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Real-time fluctuations in mindful awareness, willingness, and values clarity, and their associations with craving and dietary lapse among those seeking weight loss

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Abstract

Background: Mindful awareness, willingness and values clarity have been examined as protective factors across a wide range of problems, including overweight/obesity. However, these variables have almost exclusively been examined at the trait-level. It is possible that these variables also fluctuate within individuals in daily life, and that these intraindividual fluctuations may in turn be related to food craving and dietary lapse. The current study used ecological momentary assessment (EMA) to examine the extent to which momentary mindful awareness, willingness, and values clarity varied within-person, and were associated with craving and likelihood of dietary lapse among weight-loss seeking individuals with overweight/obesity prior to starting a weight loss program. We also examined the extent to which craving was associated with dietary lapse.

Methods: Adults with overweight/obesity (N = 126) completed one week of EMA prior to enrolling in a randomized controlled trial of behavioral weight loss treatments. They responded to EMA questions assessing dietary lapses, craving, mindful awareness, willingness, and values clarity six-times per day.

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Author Contributions

Margaret Sala, Corey Roos and Evan Forman conceptualized the study aims for the current analysis. Rebecca Crochiere curated the data. Margaret Sala conducted formal data analysis. Margaret Sala and Corey Roos wrote the original draft of the manuscript. Evan Forman, Meghan Butryn, Adrienne Juarascio, and Stephanie Manasse contributed to the parent clinical trial. Evan Forman led the parent clinical trial. All authors reviewed and edited the manuscript.

Ethical Approval and Informed Consent

The study was approved by the Drexel University Institutional Review Board (IRB Protocol # 1903007097). All participants gave informed consent before taking part in the study.

Declaration of Interest

Evan M. Forman receives royalties from Oxford Press for a published acceptance-based treatment manual, and is on the Scientific Advisory board for Tivity Health.

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Results: Mindful awareness, willingness, and values clarity demonstrated substantial within-person variability, and higher within-person mindful awareness, willingness, and values clarity were concurrently (but not prospectively) associated with lower craving and likelihood of dietary lapse. Higher craving was concurrently (but not prospectively) associated with higher likelihood of dietary lapse. Between-person, higher mindful awareness, willingness, and values clarity were associated with lower craving and likelihood of dietary lapse, and higher craving was associated with greater frequency of dietary lapses.

Conclusion: Mindful awareness, willingness, and values clarity vary substantially at the daily level, and may be important mechanisms to target to reduce craving and dietary lapses in the daily lives of individuals with overweight/obesity.

Keywords

obesity; overweight; dietary lapse; mindfulness; acceptance and commitment therapy; psychological flexibility

Mindful awareness (i.e., being aware of present moment experiences), values clarity (i.e., behaving consistently with one's values), and willingness (i.e., being willing to experience distress while pursuing goals) are processes targeted in mindfulness and acceptance-based treatments (MABTs) that have been examined as protective factors across a wide range of problems, including overweight/obesity (e.g., Brewer et al., 2018; Forman & Butryn, 2015; Forman, Hoffman, Juarascio, Butryn, & Herbert, 2013; Lillis et al., 2016). Mindful awareness, values clarity, and willingness have been almost exclusively conceptualized as trait variables (i.e., general tendencies that differ across individuals). However, it is possible that these variables are dynamic processes that fluctuate over time within the same individual. Recent research suggests that psychological variables initially conceptualized to be traits also vary substantially within-person (e.g., Kleiman et al., 2017). Thus, it is possible that, in addition to there being trait-level differences in mindful awareness, willingness, and values clarity, these constructs may also vary on a momentary basis. For example, research suggest that the extent to which one is aware of current experiences varies within a day (Killingsworth & Gilbert, 2010). Individuals may be willing to experience thoughts and feelings during some times (e.g., when feeling sad at home), but not during other times (e.g., when feeling deprived at a dinner party). It may also be that individuals think about their values as they relate to behavioral decisions in some situations (e.g., while eating at home), but not others (e.g., while eating out at a favorite restaurant in the presence of delicious foods). However, no prior studies have tested the real-time stability of mindful awareness, willingness, and values clarity.

Real-time changes in these variables may explain fluctuations in eating behaviors that determine likelihood of success in overweight/obese individuals who are initiating weight loss, such as likelihood of dietary lapses (i.e., individual episodes of dietary nonadherence) (Forman et al., 2017). Specifically, higher momentary mindful awareness might help individuals be more aware of environmental factors (e.g., walking by the baked goods section in the grocery store) and internal experiences (e.g., negative affect, food-related thoughts, cravings) that often precede overeating (Dalen et al., 2010), as well as be more attuned to internal hunger and fullness cues (Kristeller & Wolever, 2010). Higher

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momentary willingness might help individuals tolerate temptations and loss of pleasure from caloric restriction as they pursue dietary goals, helping them from refraining eating high calorie foods despite of temptations. Higher momentary values clarity might facilitate access to intrinsic motivators of healthy behavior, thus facilitating valued choices when encountering various dietary "choice points" in daily life. Overall, real-time changes in mindful awareness, willingness, and values clarity may reduce likelihood of dietary lapse.

Mindful awareness, willingness, and values clarity may also down-regulate distressing states, such as craving for food in daily life, by reducing psychological reactivity to external cues and internal states (Kober, Buhle, Weber, Ochsner, & Wager, 2019; Westbrook et al., 2013). Craving has been identified as an important predictor of overeating (Kober & Boswell, 2018), and higher momentary craving intensity is predictive of snack consumption (Richard, Meule, Reichenberger, & Blechert, 2017). Mindful awareness may help individuals "step back" and simply notice (rather than get caught up in or swept away by) thoughts and feelings related to a craving to eat, which may in turn lower the intensity of cravings that arise in daily life. Willingness may help individuals accept the experience of a craving (rather than fighting the experience or judging oneself), which may ultimately diminish the craving. Values clarity may help individuals shift their focus to personal values in the moment (rather than the expectation of immediate reward or relief from eating), thereby potentially reducing the desire to eat (e.g., craving) in the moment.

Ecological momentary assessment (EMA) is the repeated and frequent measurement of processes and behaviors in daily life. EMA is an ideal tool for examining the relationships among mindful awareness, willingness, values clarity, craving, and dietary lapses, given that these constructs are dynamic (i.e., may fluctuate over time in one's daily life). Key advantages of EMA include the ability to measure constructs in the multiple daily contexts that they occur, reduction of recall bias, and the opportunity to explore both between- and within-person processes (Bolger & Laurenceau, 2013; Shiffman, Stone, & Hufford, 2008; Trull & Ebner-Priemer, 2013). Several studies to date have examined predictors of health behavior lapses using EMA (Carels, Douglass, Cacciapaglia, & O'Brien, 2004; Carels et al., 2002; Crochiere, Mangubat, Manasse, & Forman, 2019; Forman et al., 2017; Goldstein et al., 2018; Manasse et al., 2018; McKee, Ntoumanis, & Taylor, 2014; Schumacher et al., 2017). More recently, studies have begun use EMA to measure mindful awareness (Grégoire, Chénier, Doucerain, Lachance, & Shankland, 2020; Landmann, Cludius, Tuschen-Caffier, Moritz, & Külz, 2020; Moore, Depp, Wetherell, & Lenze, 2016; Rupp et al., 2019; Rupp et al., 2020; Shiyko, Siembor, Greene, Smyth, & Burkhalter, 2019), and, to a lesser extent, willingness, and values clarity (Grégoire et al., 2020). However, to our knowledge, no studies to date have examined mindful awareness, willingness, and values clarity as they relate to craving and dietary lapses in the moment.

The current study utilized data collected at the baseline period (i.e., prior to beginning treatment) of the first two waves of an ongoing trial evaluating MABTs for individuals with overweight or obesity. We examined several aims. First, we examined the extent to which mindful awareness, willingness, and values clarity varied within-person. We hypothesized that at least 50% of the variability in mindful awareness, willingness, and values clarity would be due to within-person factors, which is consistent with within-person variability

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of other psychological constructs (e.g., negative affect, loneliness) (Goldberg, Knoeppel, Davidson, & Flook, 2020; Kleiman et al., 2017; Peeters, Berkhof, Delespaul, Rottenberg, & Nicolson, 2006). Second, we examined the extent to which momentary mindful awareness, willingness, and values clarity were associated with momentary craving and dietary lapses. We hypothesized that higher mindful awareness, willingness, and values clarity would be related to lower craving and lower likelihood of dietary lapses, at both the within- and between-person level. Third, we examined whether momentary craving was associated with momentary dietary lapse. We hypothesized that higher momentary craving would be related to higher likelihood of dietary lapse, at both the between- and within-person level.

Methods

Participants

Participants (N = 126) were part of the first and second cohort of data collection in a randomized controlled trial (NCT04337619) evaluating Mindfulness and Acceptance Based Behavioral Therapies (MABTs) for Weight Loss. In the ongoing parent trial, three MABT components are evaluated through a Multiphase Optimization Strategy (MOST) factorial design: awareness, willingness, and values clarity. Eligibility criteria included: (1) ages 18–70; (2) overweight or obesity (BMI 27–50 kg/m^2); and (3) seeking weight loss. Exclusion criteria included: (1) inability to engage in exercise plan of program; (2) medical or psychiatric condition that posed risk to participant during weight loss; (3) initiation or titration of a weight-affecting medication within the previous three months; (4) pregnancy, planned pregnancy, or breastfeeding; (5) history of bariatric surgery; (6) having greater than 5% weight loss in the previous six months; (7) planning to move away from Philadelphia; (8) planning to, or participating, in another weight loss treatment in the next three years; (9) experiencing significant loss of control eating (i.e., 9 or more episodes with loss of control eating in the previous 3 months) (10) engaging in compensatory vomiting or other severe compensatory behaviors; and (11) no current or history of anorexia nervosa or bulimia nervosa. See Table 1 for demographic and descriptive information.

Procedure

For the parent study, as approved by Drexel University Institutional Review Board, participants are randomized to one of 8 behavioral weight loss programs each with different combinations of MABT components “switched on.” As part of all treatment conditions, participants received gold standard behavioral weight loss counseling based on the Diabetes Prevention Program (DPP) (Diabetes Prevention Program Research Group, 2002) and Look Ahead (Look AHEAD Research Group, 2006). For the purposes of this study, we collapsed data across all conditions because EMA data were collected at baseline. The baseline period is a time that, although there is some variability, many participants have already formed the intention to lose weight (Kerrigan et al., 2016; West, Harvey-Berino, Krukowski, & Skelly, 2011). In the current study, participants lost an average of 1.26 lbs or 0.57 kg (*SD* = 4.24 lbs or 1.98 kg) between baseline and week 1 of treatment.

Participants were asked to complete one week of EMA approximately four weeks before program start, with six surveys delivered to participants’ smartphones per day using Paco.

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However, some participants continued completing EMA for more than seven days. Before beginning EMA, participants had a chance to practice a sample EMA survey with the assessor and the opportunity to ask questions about any EMA items. Participants set daily start/end times (i.e., at wake-up and bedtime), and assessments were semi-random within these time intervals, so that they would be semi-equally distributed between wake and bedtimes. For example, for a participant who set a start time of 8:30 AM and a bedtime of 9:00 PM, a schedule of EMA items on one day was 8:49 AM, 10:18 AM, 12:59 PM, 3:36 PM, 6:26 PM, and 8:57 PM.

Measures

Dietary lapses.—Dietary lapses were measured with the following EMA item: *Since the last survey, have you eaten?* Response choices included: *No, I didn't eat; Yes, I ate what I intended;* and *Yes; I overate or ate a food that I didn't intend to.* Overeating or eating a food that one didn't intend to eat was coded as a lapse (Forman et al., 2017).

Craving.—Craving was measured with the following EMA item: *Since the last survey, have you experienced the temptation to overeat*? Responses were rated on a scale from 1 (*not at all*) to (5) *strongly.* Although craving has been defined as the desire for *specific* foods that one is trying to resist eating (Weingarten & Elston, 1990), we chose to examine temptation for overeating in general rather than temptations for specific foods to reduce the participant EMA burden of assessing craving for specific foods.

Mindful awareness.—Mindful awareness was measured with the following EMA item: *Over the past few hours, I have been fully aware of my present moment experience, such as my thoughts, feelings, and urge*s. Responses were rated on a scale from (1) *disagree* to (3) *agree.* This item was adapted from the Philadelphia Mindfulness Scale (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008).

Willingness.—Willingness was measured with the following EMA item: *Over the past few hours, I felt I could make healthy eating and activity decisions regardless of my thoughts, feelings, urges*. Responses were rated on a scale from (1) *disagree* to (3) *agree.* This item was adapted from the Food and Acceptance Action Questionnaire (Juarascio, Forman, Timko, Butryn, & Goodwin, 2011).

Values clarity: Values clarity was measured with the following EMA item: *Over the past few hours, I have thought about my values when making eating or activity decisions*. Responses were rated on a scale from (1) *disagree* to (3) *agree.*

Statistical Analyses

Data were analyzed using multilevel linear modeling (MLM) in SPSS, which is robust to missing data. In the current data, EMA survey occasions (Level 1) were nested within individuals (Level 2). Intraclass correlation coefficients (ICCs) were computed for each item to indicate the proportion of variance due to between- vs. within- person differences. ICCs measure the degree of dependence in the data, or strength of the nesting effect. Subtracting

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the ICC from 1 provides the proportion of variability that can be attributed to within-person differences. Therefore, lower ICCs suggest higher within-person variability.

We employed an AR1 autocorrelation given the dependence within the nested data. We conducted random intercept and fixed predictor models. Because the momentary craving variable was skewed, we used a generalized linear mixed model (GLMM) based on a gamma distribution with log link for the analyses with craving as the outcome variable (Atkins & Gallop, 2007). For the lapse analyses, we used a GLMM based on a binomial distribution with logit link due to the dichotomous nature of the dietary lapse occurrence.

We included between- and within-subject predictors. All between-subject variables were grand-mean centered, and all within-subject effects were centered within person. Therefore, within-person variables reflect the degree to which an individual's momentary value of a variable (i.e., mindful awareness, willingness, values clarity) differs from that individuals' average level across the EMA surveys. Between-person variables reflect the degree to which an individual's average level of a variable across the EMA surveys differs from the total sample mean of the variable. For analyses with craving and dietary lapses as the outcomes, we considered both concurrent and lagged associations given our conceptualization that mindful awareness, willingness, and values clarity may influence craving and lapses both (1) *within the same time window in a given day* (e.g., mindful awareness influencing a contemporaneous overeating lapse between 4pm and 6pm); and (2) *in subsequent and adjacent time windows in a given day* (e.g., willingness to experience distress between 10am and noon increasing the likelihood of a subsequent overeating lapse between noon and 2pm). For the lagged associations, craving and dietary lapse at time t were predicted by mindful awareness/willingness/values clarity at time t-1, controlling for the outcome variable at time t-1. Lagged associations were created within day, with no variable carried over from the previous day. We computed effect sizes by transforming the *t* statistic into a Cohen's *d* effect size (Wilson, 2011).

Results

Descriptive Statistics

Over the 1-week EMA period, EMA compliance averaged 89.81% (*SD* = 13.08%, *Range* = 29 – 100%). Participants reported an average of 5.48 (*SD* = 5.13) dietary lapses. See Table 1 for demographic and descriptive information. ICCs (i.e., proportion of between person variability) were as follows: mindful awareness: .47, willingness: .33, values clarity: .50, craving: .28, and dietary lapse: .08.

Mindful Awareness, Willingness, and Values Clarity Predicting Craving and Dietary Lapses

Tables 2 and 3 provide results from models with craving and dietary lapses as the outcome, respectively.

Mindful awareness.

Consistent with our hypotheses, within-person, higher mindful awareness was concurrently associated with lower craving (*d* = −.06, *p* = .007) and lower likelihood of dietary lapse (*d* =

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−.18, $p < .001$). Between-person, higher aggregate mindful awareness over the one-week period was associated with lower aggregate craving ($d = -.56$, $p = .003$) and a lower proportion of surveys with dietary lapses ($d = -.46$, $p = .02$) over the one-week period. Mindful awareness was not prospectively associated with craving or likelihood of dietary lapse (*ps* > .68).

Willingness.

Consistent with our hypotheses, within-person, higher willingness was concurrently associated with lower craving ($d = -.62$, $p < .001$) and lower likelihood of dietary lapse ($d = -.60$, $p < .001$). Between-person, higher aggregate willingness over the one-week period was associated with lower aggregate craving ($d = -1.00$, $p < .001$) and a lower proportion of surveys with dietary lapses ($d = -1.07$, $p < .001$) over the one-week period. Willingness was not prospectively associated with craving or likelihood of dietary lapse (*ps* > .21).

Values clarity.

Consistent with our hypotheses, within-person, higher values clarity was concurrently associated with lower craving ($d = -.24$, $p < .001$) and lower likelihood of dietary lapse ($d = -.38$, $p < .001$). Between-person, higher aggregate values clarity over the one-week period was associated lower aggregate craving ($d = -.39$, $p < .001$) and with a lower proportion of surveys with dietary lapses over the one-week period ($d = .58$, $p < .001$). Higher within-person values clarity was prospectively associated with higher craving (i.e., a direction opposite that hypothesized) ($d = .11$, $p = .001$) and not significantly associated with likelihood of dietary lapse ($p = .57$).

Craving Predicting Dietary Lapses

Consistent with our hypothesis, within-person, higher craving was concurrently associated with a higher likelihood of dietary lapse within the same time measurement window ($b = 1.54$, *SE* = .05, *95% CI* = 1.44 – 1.65, $d = .68$, $p < .001$). Between-person, higher craving was associated with a higher proportion of surveys with dietary lapses over the one-week period ($b = .86$, *SE* = .14, *95%* CI = .59 – 1.13, $d = 1.20$, $p < .001$). Higher within-person craving was not prospectively associated with likelihood of dietary lapse at the next measurement window ($b = .08$, *SE* = .05, *95% CI* = −.02 – .18, $p = .12$).

Sensitivity Analyses

For sensitivity analyses, we computed all models with only 7 days of EMA data of each participant (i.e., not including any assessment reports beyond the required 7 days). These analyses also yielded the same pattern of results from the analyses reported above, which included EMA assessment points beyond the required 7 days.

Discussion

This study is the first to our knowledge to examine how mindful awareness, willingness, and values clarity are associated with craving and dietary lapse in the daily lives of individuals with obesity or overweight. We found that mindful awareness, willingness, and values clarity demonstrated substantial within-person variability. We also found that mindful awareness,

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willingness, and values clarity were concurrently associated with craving and dietary lapse at both the within- and between-person level. Finally, craving was concurrently associated with higher likelihood of dietary lapse, at both the within- and between-person level. However, mindful awareness, willingness, and values clarity were not prospectively associated with craving or dietary lapse (with the exception of higher values clarity being prospectively associated with higher craving), and craving was not prospectively associated with dietary lapse.

In regard to intraindividual variability, 53% of the total variability for mindful awareness, 67% of the total variability for willingness, and 50% of the total variability for values clarity was due to within-person variability. These findings are consistent with findings that ICCs for mindfulness are .40 (Goldberg et al., 2020). To put these findings into context, within-person variability for mindful awareness, willingness, and values clarity is similar to other psychological constructs typically examined on a momentary basis, such as self-induced loneliness (ICC = .49; Kleiman et al., 2017), suicidal ideation (ICC = .53-.67; Kleiman et al., 2017), and negative affect (ICC = .56; Peeters et al., 2006). Overall, our results indicate that mindful awareness, willingness, and values clarity vary within-person to a similar or greater extent than other psychological constructs typically examined using EMA, and should therefore also be studied at a state level. Assessing mindful awareness, willingness, and values clarity only at a trait level fails to capture variation that occurs within-person. Additionally, fluctuations of these states at the daily level suggest that these dynamic processes could be targeted in daily life.

Higher mindful awareness was associated with lower concurrent craving and likelihood of dietary lapse, with small size effects. Higher levels of mindful awareness may enable individuals to “step back” and observe momentary craving as it arises and then passes, and/or flexibility redirect attention to present-moment activities, rather than automatically getting caught up in cravings. Higher mindful awareness may also increase awareness of various external and internal triggers that may increase craving and risk for dietary lapse (Brewer et al., 2018). Finally, higher mindful awareness may help individuals notice the emotional and physical consequences of dietary lapses over time (Brewer et al., 2018). Of course, because these findings were concurrent, the reverse possibility is also possible (i.e., that lapsing may promote lower mindful awareness). Higher mindful awareness was not prospectively associated with craving or dietary lapse, suggesting that mindful awareness is not predictive of craving or dietary lapse at a subsequent time-point. Alternatively, it could be that the timeline of the effects does not match the timeline of our EMA assessments. Specifically, the temporality of the effects may be of shorter duration than the spacing between our EMA assessments. For example, it could be that the effects of mindful awareness on craving and dietary lapse occur within an hour, but do not last 3–4 hours (which was the spacing between EMA surveys in the current study). Of course, this is just a hypothesis, as no research to date has been conducted to determine the timing of the effects of variables such as mindful awareness, willingness, and values clarity on craving and dietary lapse. Future research should be conducted with shorter EMA intervals (e.g., 30–60 minutes).

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Higher willingness was associated with lower concurrent craving and a lower likelihood of a concurrent dietary lapse, with medium size effects. Higher willingness involves accepting any internal experiences that will inevitably arise during weight control efforts, which may help individuals to not lapse regardless of what their internal experiences may be pulling them to do. That is, higher willingness may help individuals tolerate hunger, negative emotions (Forman, Butryn, et al., 2013; Lillis et al., 2016), and loss of pleasure that may result from not eating highly caloric foods (Forman et al., 2016). In contrast to our significant concurrent findings, higher willingness was not prospectively associated with craving or dietary lapse.

Higher values clarity was associated with lower concurrent craving (with a small size effect) and a lower likelihood of a concurrent dietary lapse (with a small-medium size effect). Higher values clarity in the moment may involve bringing to mind meaningful reasons to engage in weight control behaviors. However, surprisingly, higher within-person values clarity prospectively predicted higher craving. Future research should be conducted to determine why this may have been the case. However, current findings suggested that although higher values clarity prospectively predicted higher craving, it did not prospectively predict higher likelihood of dietary lapse.

Overall, these findings suggest that intervening on momentary mindful awareness, willingness, and values clarity could be a useful strategy for reducing craving and dietary lapses among individuals with obesity or overweight. Indeed, MABTs have been established as efficacious interventions for obesity, and are capable of producing weight loss of approximately 12–14% of initial body weight after a one-year intervention (Butryn et al., 2017; Butryn et al., in press; Forman, Butryn, et al., 2013; Forman et al., 2016; Lillis et al., 2016). Furthermore, a recent meta-analysis suggests that MABTs may be particularly effective for weight loss maintenance (Carrière, Khoury, Günak, & Knäuper, 2018). Of note, the current trial from which these data were collected is examining the independence efficacy of distinct components of MABTs for weight loss, and will be able to elucidate the extent to which MABTs can intervene on mindful awareness, willingness, values clarity, craving, and lapses.

Strengths of this study include the use of EMA and our analytic approach, which enabled us to understand within- and between-subject associations among mindful awareness, willingness, values clarity, craving, and dietary lapses, both concurrently and prospectively. There were also several limitations to this study. First, participants completed the EMA prior to starting the weight loss program, and were therefore in an unknown state of restriction (i.e., it was not clear whether they were intending to not overeat). Furthermore, this is a highly motivated, treatment-seeking sample. Caution should be taken in generalizing these findings to individuals with overweight or obesity who are not motivated to lose weight, not seeking treatment, are currently completing a weight loss intervention, or who have already completed a weight loss intervention. Second, there are limitations in our measurement of mindful awareness, willingness, and values clarity. We used single items measures that have not been previously validated. With single item measures, we were also unable to assess internal consistency. Relatedly, our willingness item had an eating behavior embedded within the item. Additionally, it may have been difficult for participants

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to respond to questions regarding mindful awareness, willingness, and values clarity without first undergoing a third-wave intervention. Participants' understanding of the questions may change after receiving a third-wave intervention. Relatedly, we did not collect trait measures that paralleled all state measures, and therefore we could not calculate the extent to which state measures were associated with trait measures. Third, for the concurrent findings, we are unable to conclude the direction of causality. For example, craving in the moment may reduce mindful awareness, willingness, and values clarity - and not the other way around. It is possible that participants may have answered questions related to mindful awareness, willingness, and values clarity by examining their actual engagement in behaviors (e.g., stating they were not willing to make healthy eating decisions because they had recently lapsed). Fourth, we collected EMA data only during a one-week period prior to when individuals were about to begin a weight loss intervention. One week is a relatively short period of time and the average number of dietary lapses was relatively low during this period. EMA data collected over a longer period with a higher number of lapse data points may yield different results. Fifth, we assessed lapses using self-report, which can be influenced by biases such as social desirability bias. However, there is a low chance of social desirability bias because participants' EMA data were not monitored. Furthermore, there is limited evidence suggesting reactivity in EMA (Trull & Ebner-Priemer, 2013). Finally, our use of semi-random assessments reduced expectancy biases (since participants did not know when assessments would occur). Relatedly, the lapse assessment was not objective (e.g., it did not record the actual amount or type of food). Sixth, the study was conducted in a predominantly white, female, middle aged sample, and we excluded individuals with severe psychiatric conditions and eating disorders. It is possible that these results would not generalize to other samples. Relatedly, we did not analyze how co-morbid psychopathology (e.g., substance use, mood and anxiety disorders) may moderate these results.

Overall, our findings suggest that mindful awareness, willingness, and values clarity vary on a momentary basis, and should thus be also studied at the state level. Given that these constructs are dynamic, they may be targeted to reduce craving and dietary lapses in the daily lives of individuals with overweight/obesity. Future research is needed to examine whether interventions can increase mindful awareness, willingness, and values clarity, at both the intra- and inter-individual level, and whether these increases are in turn related to better outcomes during the process of losing weight.

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- Mindful awareness, willingness, and values clarity vary on a momentary basis
- These constructs vary the same as other psychological constructs measured with EMA
- Real-time increases in these variables are associated with lower craving
- Real-time increases in these variables are associated with lower risk for dietary lapse

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Table 1.

Demographic information. (N = 126).

	Mean (*SD*) or *n* (%)	**Range**
Sex		
Male	21 (16.7%)	
Female	105 (83.3%)	
Age	51.8 (11.8)	21 – 70
BMI	35.5 (5.1)	27.2 – 49.4
Race		
White	87 (69.0%)	
Black	33 (26.2%)	
Asian	3 (2.4%)	
Other	3 (2.4%)	
Ethnicity		
Hispanic	4 (6.6%)	
Non-Hispanic	57 (93.4%)	
Mindful awareness	2.63 (.61)	1.00 – 3.00
Willingness	2.59 (.64)	1.00 – 3.00
Values clarity	2.34 (.75)	1.00 – 3.00
Craving	1.90 (1.2)	1.00 – 5.00
Dietary lapses	5.48 (5.13)	0.00 – 28.00

Note: Mindful awareness, willingness, and values clarity were rated on a scale of 1–3. Craving was rated on a scale of 1–5. Dietary lapses reflect the frequency of reported dietary lapses during the EMA period.

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Table 2.

Summary of parameters from concurrent and lagged univariate models testing predictors of craving.

Predictor	***B***	***SE***	***95% CI***	***d***	***p***
Awareness					
Within-person effect (concurrent model)	-.04	.01	[−.06, −.01]	−.06	**.007**
Within-person effect (lagged model)	-.01	.02	[−.04, .03]	-.01	.73
Between-person effect	-.19	.06	[−.32, −.07]	-.56	**.003**
Willingness					
Within-person effect (concurrent model)	−.28	.01	[−.30, −.26]	−.62	**<.001**
Within-person effect (lagged model)	.01	.02	[−.02, .04]	.02	.51
Between-person effect	-.36	.07	[−.49, −.23]	-1.00	**<.001**
Values Clarity					
Within-person effect (concurrent model)	−.11	.01	[−.13, −.09]	−.24	**<.001**
Within-person effect (lagged model)	.05	.02	[. 02, .08]	.11	**.001**
Between-person effect	-.10	.05	[−.20,.−.01]	-.39	**.04**

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Table 3.

Summary of parameters from concurrent and lagged univariate models testing predictors of dietary lapse.

Predictor	***b***	***SE***	***95% CI***	***d***	***p***
Awareness					
Within-person effect (concurrent model)	−.59	.08	[−.74, −.43]	−.18	**<.001**
Within-person effect (lagged model)	.04	.10	[−.16, .25]	.01	.68
Between-person effect	−.50	.22	[−.94, −.07]	-.46	**.02**
Willingness					
Within-person effect (concurrent model)	−1.92	.08	[−2.08, −1.76]	−.60	**<.001**
Within-person effect (lagged model)	−.12	.10	[−.32, .07]	-.04	.21
Between-person effect	-1.35	.24	[−1.82 ,−.88]	-1.07	**<.001**
Values Clarity					
Within-person effect (concurrent model)	−1.18	.08	[−1.34, −1.02]	−.38	**<.001**
Within-person effect (lagged model)	.06	.10	[−.14, .25]	.02	.57
Between-person effect	−.51	.17	[−.85, −.17]	-.58	**.004**

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