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Sharyl Wee

*Southern Methodist University*, [swee@smu.edu](mailto:swee@smu.edu)

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DAILY STRESS AND NEGATIVE AFFECT AS PREDICTORS OF  
ORTHOREXIA NERVOSA SYMPTOMS AMONG COLLEGE  
STUDENTS: TESTING DIRECT AND MODERATED  
ASSOCIATIONS USING DAILY  
DIARY METHODOLOGY

Approved by:

---

Dr. Chrystyna Kouros  
Associate Professor of Psychology

---

Dr. Austin Baldwin  
Professor of Psychology

---

Dr. David Rosenfield  
Professor of Psychology

---

Dr. Jasmine Ghannadpour  
Assistant Professor of Psychiatry

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DIARY METHODOLOGY

A Dissertation Presented to the Graduate Faculty of the Dedman College  
Southern Methodist University

in

Partial Fulfillment of the Requirements

for the degree of

Doctor of Philosophy

with a

Major in Clinical Psychology

by

Sharyl Esther Wee

B.A., Psychology, The University of British Columbia, Canada  
Master of Arts, Clinical Psychology, Southern Methodist University

December 16<sup>th</sup>, 2023

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Wee, Sharyl Esther

B.A., Psychology, The University of British Columbia  
Master of Arts, Southern Methodist University

Daily Stress and Negative Affect As Predictors Of  
Orthorexia Nervosa Symptoms Among College  
Students: Testing Direct and Moderated  
Associations Using Daily  
Diary Methodology

Advisor: Dr. Chrystyna Kouros

Doctor of Philosophy degree conferred December 16, 2023

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Orthorexia Nervosa (ON) is a condition involving a pathological obsession with healthy or “clean” eating (Bratman, 1997). Prevalence estimates of ON range from 35.4% to 83% in the U.S. population (Niedzielski & Kaźmierczak-Wojtás, 2021). Starting out innocuously as a habit of eating healthier foods, ON becomes socially and physically impairing when individuals spend a large amount of time and effort planning and preparing healthy meals, eventually turning into an obsession that interferes with other domains of life (Oberle et al., 2017). Although ON is not in the DSM-5, preliminary investigation has shown that it may fall on the eating disorder spectrum – either as a precursor or a residual form (Segura-Garcia et al., 2015). Only limited cross-sectional studies have examined the psychosocial factors related to ON (McCombs & Mills, 2019). The purpose of the present study was to test the extent to which daily stress and negative affect predicted ON behavior in college students, as well as the moderating effects of perfectionism and an already healthy diet on these relations. Moreover, we also tested the predictive effect of negative appearance-focused family cultures on concurrent levels of ON

symptoms. Results from hierarchical linear modeling found that when participants experienced higher stress intensity levels than usual, they engaged in more ON behaviors on the same day. Neither perfectionism nor an already healthy diet moderated this relation. Within-person associations between negative affect and ON were not significant. Regression models found that higher negative appearance-focused comments and behaviors in families predicted higher levels of baseline ON symptoms, over and above perfectionism, obsessive-compulsive tendencies, past dieting, current/past eating disorders, and neuroticism. The findings can inform intervention and preventive work in ON, which has no empirically-tested treatment yet.

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## Chapter 1

### INTRODUCTION

Orthorexia nervosa (ON) is a condition involving a pathological obsession with healthy or “clean” eating (Bratman, 1997). ON differs from anorexia nervosa in that individuals with ON are not fixated on the number of calories contained in food, but on the quality and preparation of the food (Bratman, 1997). The goal of an ON diet has been described as to achieve a feeling of cleanliness, purity, or healthiness (Brytek-Matera, 2012). Starting out innocuously as a habit of eating healthier foods, ON can become socially and physically impairing when individuals spend an increasing amount of time and effort planning, purchasing, and preparing healthy meals, eventually turning into an all-consuming obsession that interferes with other domains of life (Oberle et al., 2017). Moreover, individuals with ON may start to avoid social situations such as eating with others and, because of their restrictive diet, may become malnourished and experience excessive weight loss (Fidan et al., 2010).

ON can be especially dangerous for the very fact that on the surface it appears like the individual is simply trying to eat healthier and live a healthier lifestyle. Eating behavior is strongly influenced by societal standards (Higgs & Thomas, 2016) and for the last several years, societal attitudes have shifted towards a greater emphasis on high-quality foods or ‘clean’ eating (Greville-Harris et al., 2020) – such as foods without additives, organic foods, “no chemicals”, and “all natural” foods. Eating pure and good food, such as organic food, has also been marketed as “better for the planet,” further rewarding such dietary choices. Indeed, intention to purchase

organic foods has been associated with feeling moral and “doing the right thing” (Arvola et al., 2008). Individuals, however, who adopt a pathological fixation with healthy eating, or “clean eating”, and obsessively focus on keeping up with their “pure” eating at the expense of their physical and social wellbeing, may continue with their lifestyle unbeknownst to their family and friends because of how it appears on the surface. Thus, ON behaviors, if unchecked, could over time develop into more serious eating disorders, although this has not been studied yet (Segura-Garcia et al., 2015).

ON has not yet been recognized as an eating disorder or an obsessive-compulsive disorder in the Diagnostic and Statistical Manual, Fifth Edition (DSM-5; American Psychiatric Association, 2013) or the International Statistical Classification of Diseases (ICD-10; World Health Organization, 1992). Diagnostic criteria for ON, however, has been published by Varga and colleagues (2013) and Dunn and Bratman (2016). Both criteria overlap in some ways as outlined below. Varga and colleagues (2013) identified nine criteria of ON and seven recommendations for differential diagnosis. The nine diagnostic criteria are: 1) A marked overconcern with the quality of food as expressed by rigid dietary habits; 2) Obsessive thoughts and compulsions related to eating, one’s health, and to the impact of food on health, which dominate one’s life; 3) The dietary habits are not part of the treatment of a diagnosed health-related problem or a medical recommendation, or if they are, they are executed excessively and rigidly; 4) There is no body image disorder; 5) The quantity of food is not important; 6) There are no fears of becoming fat; 7) The behaviors occur for 6 months or more; 8) The symptoms do not occur exclusively during episodes of another psychiatric disorder (e.g., obsessive compulsive disorder, anorexia nervosa, psychosis, hypochondria); 9) The symptoms cause health-related problems and/or impairment in social, occupational, or other significant areas of functioning. The seven

recommendations for differential diagnosis are: 1) Anorexia nervosa, bulimia nervosa, eating disorder not otherwise specified; 2) Obsessive-compulsive disorder; 3) Schizophrenia; 4) Paranoia (poisoning); 5) Hypochondria; 6) Healthy anxiety; 7) Somatization.

Dunn and Bratman's (2016) classification criteria for ON lists two main criteria. Under Criterion A, the individual must possess an obsession with healthy eating, which is defined either by a dietary theory or specific set of beliefs. Moreover, the individual shows exaggerated emotional distress when faced with food choices that they perceive as unhealthy. Criterion A may be evidenced by one or more of the following: 1) A compulsive behavior and/or mental preoccupation towards the restrictive dietary practice that the individual believes will promote optimal health; 2) When the individual violates their self-imposed dietary rule(s), they experience an exaggerated fear of disease, or feel impure, and/or experience negative physical sensations, usually accompanied by anxiety and/or shame; and/or 3) The dietary restrictions an individual places on themselves exacerbates over time, resulting in eliminating entire food groups, or involve more frequent and/or more severe "cleanses" (partial fasts) that they regard as purifying and detoxifying. Furthermore, weight loss may be seen as a result of their dietary choices, although this is not the primary goal; thus, the desire to lose weight is either absent, hidden, or superseded by their ideation to eat healthily.

Under Criterion B, the individual's compulsive behavior and preoccupation is clinically impairing as evidenced by: Malnutrition, severe weight loss or other medical complications; or interpersonal impairment or distress in social, academic, or vocational life; or their positive body image, self-worth, identity, and/or life satisfaction is dependent on complying with their "healthy" diet.

## **1.1. Prevalence of ON**

A recent review of the prevalence of ON found that due to the initial lack of official diagnostic criteria, cut-off-points, and variety diagnostic tools used, the prevalence has varied significantly across populations and countries (Niedzielski & Kaźmierczak-Wojtás, 2021). For example, prevalence ranged from 6.9% in Italy to 88.7% in Brazil in a population of dieting students. Out of 10 prevalence studies conducted in the United States, seven were from undergraduate student populations. Five of these studies used the Orthorexia 15 (ORTO-15; Donini et al., 2005) cut-off score of 40 to determine presence of ON. The prevalence ranged from 35.4% to 83%. The other two studies found a prevalence of 19.2% using the Düsseldorf Orthorexia Scale (DOS; Barthels et al., 2015), and 53.5% with the Orthorexia Self-Test (BOT; Bratman & Knight, 2000). One study with a sample of dieticians who self-reported about their ON symptoms using the ORTO-15 found a prevalence of 49.5% (Tremelling et al., 2017). The estimated prevalence rate of ON, therefore, appears to be higher than that of traditional eating disorders in the United States' population. For example, the lifetime prevalence of bulimia nervosa in adults in the U.S. is 0.3%, and the lifetime prevalence for anorexia in adults is 0.6% (Hudson et al., 2007). In adolescents, the lifetime prevalence for any eating disorder is 2.7% in the U.S. (Merikangas et al., 2010). Despite the varied rates, researchers and clinicians agree that ON causes high levels of emotional distress (e.g., guilt, shame, fear, and anxiety), poor physical health (e.g. malnutrition, weight loss, and/or other somatic consequences), and social impairment (e.g. social isolation, professional or academic impairment; Niedzielski & Kaźmierczak-Wojtás, 2021). Thus, it is imperative that more research is conducted to better understand ON, its development, maintenance, progression, and relations to other disorders.



## 1.2. ON and Traditional Eating Disorders

A contentious debate about ON has been whether to consider it a distinct eating disorder, or if it is just another presentation of a traditional eating disorder (McCombs & Mills, 2019). One study with Polish and Italian samples whose participants were clinical patients and healthy adults from the community ( $M$  age = 27.51) found that in the Italian sample, ON symptoms were significantly different from anorexia nervosa, whereas it was not significantly different from anorexia in the Polish sample (Gramaglia et al., 2017). Some clinicians and researchers posit that ON is a less severe form of anorexia nervosa or bulimia nervosa, or a precursor or risk to clinical eating disorders (Segura-Garcia et al., 2015). Indeed, there has been some evidence in patients with anorexia or bulimia nervosa showing that ON symptoms are highly prevalent (28% of the sample), and ON symptoms increase significantly post-treatment for anorexia or bulimia nervosa (53% of the sample; Segura-Garcia et al., 2015).

Segura-Garcia and colleagues (2015) posited that ON is associated with clinical improvement of anorexia or bulimia nervosa, as individuals move away from severe forms of eating disorders. This makes sense if thought about from the perspective that many sufferers of traditional eating disorders have an obsessive trait that research has shown is difficult to improve, even after eating disorders symptoms subside (Ohmann et al., 2013). From this conceptualization, these individuals start to learn to respect their bodies more and avoid restricting food or engaging in body-destroying behaviors such as bingeing and purging, but they look for a compromise that enables them to continue controlling food (Segura-Garcia et al., 2015). Hence, ON could also be considered as a different way of maintaining their eating disorder and maintaining control, while not being labeled as a “sick person who refuses food” (Segura-Garcia et al., 2015), and this ritualistic obsession requires specific treatment beyond

what traditional eating disorders treatment currently provides. Moreover, ON may represent residual symptomatology that may contribute to the high relapse rates of eating disorders (Segura-Garcia et al., 2015). Altogether, ON appears to be part of the eating disorders spectrum, and as clinicians and researchers have been moving towards a transdiagnostic approach towards mental health (e.g., Research Domain Criteria, NIMH RDoC Workgroup, 2021; Hierarchical Taxonomy of Psychopathology [HiTOP]; Kotov et al., 2017), it is important to understand the underpinnings of this spectra of eating disorder, such as its development, risk, and maintenance factors.

### **1.3. Sociocultural and Psychological Risk Factors for ON**

McCombs and Mills (2019) recently conducted a systematic review of studies examining risk factors of ON. The researchers provided a narrative summary of the qualitative and quantitative studies examining sociocultural and psychological risk factors of ON that have been conducted so far and proposed six sociocultural factors pertinent to ON development: weight bias and obesity stigma; if the individual has access to organic, whole foods; higher income; access to food research/knowledge; positive reinforcement from others; and time to plan meals and complete meal preparation. Only one study (Hyrnik et al., 2016) reported effect sizes for the positive association between income and ON, which was  $OR = 2.40$ . In addition, psychological factors were summarized, and some effect sizes were available from quantitative studies. The psychological and behavioral factors examined to date include perfectionism, obsessive-compulsive tendencies, dieting/restrictive eating, drive for thinness/thin-ideal internalization, neuroticism, and current or past eating disorder (McCombs & Mills, 2019).

Higher perfectionism scores were associated with greater ON tendencies in U.S. undergraduate students with small to medium effects (Hayles et al., 2017; Oberle et al., 2017). In

a Spanish university sample, concern over mistakes (from the Frost Multidimensional Perfectionism Scale) was associated with greater ON symptoms (Barrada & Roncero, 2018). One study with Australian university students (Barnes & Caltabiano, 2017), however, did not find that any of the three types of perfectionism measured by the Hewitt -Flett Multidimensional Perfectionism Scale (HMPS; Hewitt & Flett, 1990), that is, self-oriented, other-oriented, or socially prescribed, predicted ON symptoms.

The effect sizes for the association between obsessive-compulsive traits and ON varied from medium to large. Specifically, obsessions and rituals involving food were positively associated with ON symptoms with a large effect size (Segura-Garcia et al., 2015). Similarly, obsessions and ritualistic patterns of exercise predicted ON in a sample of Italian athletes (Segura-Garcia et al., 2012), and were also positively associated with ON in a U.S. undergraduate sample (Oberle et al., 2018). Total obsessive-compulsive scores were associated with greater ON symptoms in a Spanish university sample (Barrada & Roncero, 2018) and two U.S. college samples (Bundros et al., 2016; Hayles et al., 2017).

Past dieting and restrictive eating were consistently shown to be positively associated with ON symptoms or predict greater ON symptoms in eight high quality studies in Spain (Roncero et al., 2017), Italy (Bo et al., 2014; Segura-Garcia et al., 2012), Turkey (Bagci Bosi et al., 2007), and Hungary (Varga et al., 2014); these studies were included in McComb & Mills' (2019) review. Two of these were with college-aged participants (Bo et al., 2014; Reynolds, 2018).

Only three studies have examined drive for thinness and thin-ideal internalization and ON symptoms (Brytek-Matera et al., 2017; Eriksson et al., 2008; Parra-Fernandez et al., 2018), providing preliminary evidence that there is an association between the two factors. One study

with college students in Spain (Parra-Fernandez et al., 2018) found that students with drive for thinness were more likely to also report ON symptoms.

Current or history of an eating disorder was associated with ON symptoms in five studies in McComb & Mills' (2019) review (Barnes & Caltabiano, 2017; Brytek-Matera et al., 2015; Gramaglia et al., 2017; Missbach et al., 2015; Segura-Garcia et al., 2015), providing considerable evidence of their association. Two of these studies were with a college-age sample (Barnes & Caltabiano, 2007; Brytek-Matera et al., 2015). Barnes and Caltabiano (2007) found that history of an eating disorder was the strongest predictor of ON over and above weight preoccupation and appearance orientation.

**a. Issues with Measures of ON.** Unfortunately, only 11 out of the 54 studies included in McCombs and Mills' (2019) review were deemed of high quality. Moreover, many of these studies utilized the ORTO-15 as diagnostic criteria, which has been shown to have poor psychometric properties and is inadequate at capturing the psychopathology inherent in ON (McCombs & Mills, 2019). The <40 cutoff point for scoring the ORTO-15 has been found to lack specificity in detecting individuals without ON; that is, it leads to false positives. Some researchers use the <35 points cut-off, but even then, the prevalence rates detected range from 13 to 49%. Internal reliability of the ORTO-15 is low across its different translations, from as low as .18 (Barnes & Caltabiano, 2017) and mostly below .70 (e.g., Alvarenga et al., 2012; Brytek-Matera et al., 2015; Fidan et al., 2010; Missbach et al., 2015). Above all, the biggest limitation of the ORTO-15 is that it does not measure clinical impairment caused by ON (McCombs & Mills, 2019). The scale has been the most common assessment because it was the only scale measuring ON for many years, created in 2005, whereas other scales have been created in more recent years (e.g., Bratman Orthorexia Test [Bratnman, 2017] and Düsseldorf Orthorexie Scale [Barthels et

al., 2015]). McComb and Mills (2019) emphasize a need for future research in ON to go beyond qualitative research and examine the role of childhood experiences and familial factors as psychosocial risk factors for ON. Since there is evidence that ON likely falls in the eating disorders spectrum, looking to existing literature on the psychosocial underpinnings of traditional eating disorders will inform our direction of research for ON. Daily stress, negative affect, perfectionism, and specific familial behavior have all been associated with increased eating disorder pathology; each of these is discussed in more detail below.

#### **1.4. Daily Stress and Eating Disorder Symptoms**

Stress is an individual's perception that demands exceed their ability to cope (Lazarus & Folkman, 1984). It can be both acute life events and/or everyday strains in life ("hassles"; Lazarus & Folkman, 1984). Chronic and acute stress have been examined in eating disorder populations extensively and are associated with the development of eating disorders (e.g., Rojo et al., 2006). Moreover, people with eating disorders often report more stressful life events than their healthy counterparts (Raffi et al., 2000), and they also perceive more stress in their lives (Cattanach et al., 1988). Additionally, they perceive daily hassles as more stressful than healthy controls (Crowther et al., 2001). Furthermore, eating disorder behaviors have been shown to be a coping mechanism for these individuals, as a response to daily stressors (Woods et al., 2010; Wolff et al., 2000).

Notably, it appears that this perception and/or occurrence of stress in their daily life temporally precedes eating disorder symptoms. In a group of women with anorexia nervosa, a 2-week ecological momentary assessment (EMA) showed that stress (especially media-induced stress) significantly increased the likelihood of binge eating and purging at the next assessment point (about 2.5 hours later,  $SD = 30$  minutes), and significantly increased the probability of

restrictive eating and fluid intake, purging, and laxative abuse across the day (White et al., 2016). The association between daily stress and eating disorder symptoms is especially salient with bulimia nervosa and binge eating disorder (e.g., Berge et al., 2015; Leehr et al., 2015). Several studies have shown that binge eating may serve as a coping mechanism in response to stress by acting as a distraction and an escape from the negative self-awareness of stressful events (Heatherton & Baumeister, 1991; Polivy & Herman, 1993, 1999). A more recent study found that stress preceded bulimic behaviors. In a study using ecological momentary assessment, Goldschmidt and colleagues (2014) found that stress preceded bulimic behaviors in women with bulimia nervosa. Another study found that not only did negative events occur prior to bingeing and purging, but immediately after bingeing and purging, there was a rapid increase in positive affect and decrease of negative affect (Smyth et al., 2007).

### **1.5. Negative Affect and Eating Disorder Symptoms**

Earlier research demonstrated that negative affect may be a risk factor for eating disorder symptoms (Cooley et al., 2001; Killen et al., 1996; Stice & Agras, 1998). Negative affect is defined as a state of “subjective distress and unpleasurable engagement” (Watson et al., 1988; p. 1063). Many adverse emotions fall under negative affect, such as sadness and anxiety. Theoretical models posit that eating disorder symptoms may be a form of coping with negative affect that some individuals turn to because they may not know how to use adaptive forms of coping (Haynos & Fruzzetti, 2011). The transactional model of emotion dysregulation was first proposed to apply to anorexia nervosa by Haynos and Fruzzetti (2011). This comprehensive model posits that temperamental and current emotional vulnerabilities underlying an individual with anorexia elevates emotional arousal and associated emotion dysregulation. Hence eating disorder behaviors are seen as a result of this emotion dysregulation. That is, when an individual

with temperamental vulnerabilities experiences emotional stress – that is, negative emotions related to the stress they experience – their inability to regulate that emotion results in emotion dysregulation and maladaptive coping behaviors, such as eating disorder behavior. The evidence so far seems to support this model. A recent 10-week longitudinal study with adults with binge eating disorder found that negative affect and emotion dysregulation co-occur with eating disorder psychopathology severity (Bodell et al., 2019). Negative affect, however, was the only significant correlate of eating disorder cognitions and binge eating frequency over time. The authors posited that the connection between negative affect and eating disorder symptomology is stronger than the connection between emotion regulation and eating disorder symptoms (Bodell et al., 2019).

Negative affect has also been hypothesized to increase body dissatisfaction, which then increases risk of developing eating disorders (Presnell et al., 2004), but the findings have been mixed (Stice & Whitenton, 2002). Researchers focusing on specific types of emotional states and eating disorders have found that not only do negative emotional states occur just before eating disorder symptoms, but they also predict the development of eating disorders (Vannucci et al., 2015). Moreover, eating disorder behaviors are used as an escape from negative affect in bulimia and binge eating (Heatherton & Baumeister, 1991), and restrictive eating has been linked to reduction of negative affect in individuals with anorexia nervosa (Engel et al., 2005; Lavender et al., 2013).

On a daily level, Barker and colleagues (2006), Smyth and colleagues (2007), Goldschmidt and colleagues (2014) all found that negative affect uniquely predicted bingeing and purging behavior within the same day. Specifically, negative affect was associated with an increased chance of binge eating within the same day, and in turn, binge eating predicted increased

negative affect the next day (Barker et al., 2006). Smyth and colleagues (2007) found that between-days, bingeing or purging days were associated with lower positive affect and higher negative affect, over and above stress. Within-day, decreasing positive affect, and increasing negative affect significantly preceded bingeing/purging events, while positive affect increased and negative affect decreased significantly after bingeing/purging, controlling for stress. Another EMA study with anorexia nervosa participants from clinical, community, and college campus settings (Lavender et al., 2016) found that within-day fluctuations of negative affect (i.e., affect lability) independently predicted dietary restraint (i.e., limiting food amount, fasting, food avoidance, following food or diet rules, and/or desiring an empty stomach; Romano & Lipson, 2021).

## **1.6. Perfectionism and Eating Disorder Symptoms**

Perfectionism is a personality characteristic that involves the perception or actual need to be perfect (Hewitt & Flett, 1993). Perfectionism impacts the way a person thinks, feels, and behaves and is now established as a transdiagnostic risk and maintaining factor for numerous psychological disorders such as affective disorders, anxiety disorders, obsessive-compulsive disorder, and eating disorders (see Egan et al., 2011 for a review). Importantly, perfectionism has been shown to be highly associated with the development of eating disorders (e.g., Hewitt & Flett, 2002; Limburg et al., 2017). In a recent meta-analysis, perfectionism predicted increased levels of eating pathology, and anorexia and bulimia symptoms (Limburg et al., 2017). Moreover, perfectionism has been shown as a robust characteristic of anorexia nervosa, over and above obsessive-compulsive traits (Halmi et al., 2000). In addition, perfectionism is one of the core maintaining mechanisms in the theoretical basis of the cognitive-behavioral model of bulimia nervosa - Fairburn's transdiagnostic model of eating disorders (Fairburn et al., 2003).



Perfectionism is also the core variable in the three-factor model of bulimia nervosa (Bardone-Cone et al., 2006) and the cognitive-interpersonal model of anorexia nervosa (Schmidt & Treasure, 2006). In non-clinical populations, similar findings have been seen with eating disorder symptomology (e.g., Brannan & Petrie, 2008; Miller-Day & Marks, 2006; Welch et al., 2009).

Perfectionism is now widely viewed as a multidimensional construct and factor analytic studies have consistently identified two-factor dimensions of perfectionism (Bieling et al., 2004; Frost et al., 1993): (1) perfectionistic concerns, which has been strongly related to maladaptive outcomes such as negative affect, stress, depression, and anxiety (Limburg et al., 2016); and (2) a more adaptive dimension, perfectionistic strivings, which has been associated with adaptive outcomes such as positive affect. Perfectionistic concerns has consistently been shown to be associated with maladaptive outcomes such as eating disorder symptoms in both anorexia and bulimia nervosa (see Bieling et al., 2004; Dunkley et al., 2006; Frost et al., 1993; Stoeber & Otto, 2006), while perfectionistic strivings (striving for very high standards) is related to positive performance outcomes and psychological states (e.g., Frost et al., 1990; Gilman & Ashby, 2003). Several studies examining perfectionistic strivings have found that it has been associated with maladaptive outcomes such as depressive symptoms, anorexia nervosa, and psychopathology (see Limburg et al., 2016 meta-analysis). One of the most frequently used measures of perfectionism with eating disorder populations, and in studies examining eating disorders or maladaptive eating behavior, is the Hewitt-Flett Multidimensional Perfectionism Scale (HMPS; Hewitt & Flett, 1991), because of the conceptual similarities that the HMPS has with a common eating disorder scale, the Eating Disorder Inventory (EDI-2; Garner et al., 1983). The HMPS measures three dimensions of perfectionism: (1) self-oriented perfectionism (SOP), where one sets high standards for oneself and thereafter harshly evaluates one's own behaviors based on

how well one meets their standards; (2) socially prescribed perfectionism (SPP), where one believes that others have unrealistically high standards for oneself; and (3) other-oriented perfectionism (OOP), in which one reflects unrealistic high standards on significant others in their lives (Hewitt & Flett, 1991). SOP and OOP have been found to fall under the perfectionistic strivings factor dimension, while SPP has been found to be in the perfectionistic concerns dimension (Limburg et al., 2017). Studies on the different dimensions of perfectionism and eating disorders have found that both high levels of SOP and SPP have been significantly associated with anorexia nervosa and anorexic attitudes and behaviors (see Bardone-Cone et al., 2007 for a review). The research on OOP is still underdeveloped (Stoeber, 2014), but two studies with university student samples have shown OOP is a “dark” form of perfectionism that may be associated with antisocial and narcissistic personality characteristics, as well as psychopathy, social dominance goals, and negatively associated with nurturance, intimacy, emotionality, agreeableness, altruism, and social development goals (Stoeber, 2014).

Emerging evidence has also suggested that there is an association between trait perfectionism and ON (McComb & Mills, 2019). Six studies have examined perfectionism and ON so far, across a variety of populations (e.g., U.S., Spain), and when using ON diagnostic assessments, trait perfectionism was associated with greater ON symptoms (Barnes & Caltabiano, 2017; Barrada & Roncero, 2018; Hayles et al., 2017; Oberle et al., 2017; Parra-Fernandez et al., 2018; Pratt et al., 2021). Five of these studies (Barrada & Roncero, 2018; Hayles et al., 2017; Oberle et al., 2017; Parra-Fernandez et al., 2018; Pratt et al., 2021) did not separate perfectionism according to its higher-order dimensions. One of these studies (Barnes & Caltabiano, 2017), did not find that perfectionism (neither SOP or SPP) was significantly related to ON. It stands to reason that when an individual feels a need to appear perfect, especially with regards to their

physical appearance, they may be more likely to experience rigid thoughts and behaviors about their diet and body and attempt to adjust their lifestyle habits accordingly (Pratt et al., 2021).

Whereas perfectionism has been directly associated with eating disorders risk, development, and maintenance, and preliminary research supports associations with ON (Barnes & Caltabiano, 2017; Barrada & Roncerco, 2018; Hayes et al., 2017; Oberle et al., 2017; Parra-Fernandez et al., 2018; Pratt et al., 2021), the mechanisms through which it plays out in an individuals' daily life is unclear. Evidence suggests that perfectionism may operate as a moderator between chronic stress (including both achievement-related and interpersonal stress) and depression over one year (Békés et al., 2015). That is, individuals with depression who were higher in perfectionism levels had a heightened vulnerability to different chronic stressors over the course of a year which impeded the improvement of their depression symptoms (Békés et al., 2015). The researchers suggest that individuals with higher levels of perfectionism are more vulnerable to certain types of stress because their self-worth is dependent on their ability to achieve high standards – whether self- or socially- imposed – and they interpret stress as a personal failure. Moreover, they utilize ineffective stress coping strategies (DiBartolo et al., 2004; Dunkley et al., 2014b; Hewitt & Flett, 1993; Sturman et al., 2009). Interestingly, even the often-viewed adaptive form of perfectionism, perfectionistic strivings, was a significant moderator in the relation between chronic stressors and depression symptoms – specifically, achievement-related stressors (Békés et al., 2015). The authors posit that perfectionistic strivings can become a maladaptive form of perfectionism (like SOP) when perfectionists are faced with achievement-related chronic stress (Békés et al., 2015).

Perfectionism also moderated the relation between body dissatisfaction and eating disorder attitudes and behaviors in a sample of undergraduate students (Welch et al., 2009). Specifically,

both self-oriented and other-oriented perfectionism measured by the HMPS exacerbated the relation between body dissatisfaction and eating disorder attitudes and behaviors. Relatedly, perfectionism has also been shown to be a moderator between alexithymia (a type of affective dysregulation and inability to self-soothe to manage emotions; Taylor & Bagby, 1997) and eating disorder development (Marsero et al., 2011) whereby higher levels of perfectionism exacerbated this relation.

Furthermore, eating disorders have been posited to be an expression of perfectionism (Limburg et al., 2017). An individual's self-evaluation may be dependent on striving to attain some sort of personal standard of control over eating, or striving to attain a perceived *socially* prescribed standard of eating. Perhaps for such individuals, ON is the best approach because "healthy eating" is socially accepted and even rewarded (Greville-Harris et al., 2020; Higgs & Thomas, 2016), whereas in traditional eating disorders, once discovered by others, is frowned upon as a disorder or the individual is seen as a "sick person." Moreover, perfectionism in the context of eating disorders is conceptualized as accomplishing a higher order goal of feeling in control (Robinson & Wade, 2021) by achieving a lower order and tangible goal (i.e., a personal/social standard that must be met, such as eating below a certain amount of food a day). Perhaps when faced with daily stress or negative affect that can feel overwhelming, individuals with perfectionism feel a lack of control, and use ON (in this context, the lower order, tangible goal) as a way to achieve a sense of control over their lives.

### **1.7. Family Comments about Weight and Shape in Eating Disorders**

Family influences have been demonstrated to play a role in the development of eating disorders. One particularly salient type of behavior in the family that has been significantly associated with eating disorders is family comments about eating, weight, shape, and/or

appearance. Individuals with anorexia (Wade et al., 2007) and bulimia nervosa (Gonçalves et al., 2016; Wade et al., 2007) reported experiencing more comments from their parents about physical appearance compared to a control group. Higher rates of comments about amount of food eaten were also significantly higher in individuals with anorexia (Machado et al., 2014; Wade et al., 2007), and bulimia nervosa (Wade et al., 2007). This has also been demonstrated in adolescents with binge-eating disorder (Pötzsch et al., 2018); adolescents with binge-eating disorder reported a significantly higher amount of weight teasing compared to adolescents who were overweight but did not suffer from binge-eating disorder (Pötzsch et al., 2018).

Researchers have called family environments with frequent comments about eating, weight, shape, and/or appearance as “appearance-focused family cultures” (Kluck, 2010). Increasing evidence has shown that various types of family behavior related to food and weight (e.g., communications about appearance, comments, and body size) are related to higher rates of eating problems in children (see Golan & Crow, 2004 for a review). Generally, a focus on appearance and attractiveness in families is associated with higher levels of disordered eating and concern with weight in daughters (e.g., Davis et al., 2004; Field et al., 2001; Laliberte et al., 1999).

Of importance are the specific family behaviors that create this appearance-focused family culture – verbal comments parents make about their child’s body size or appearance. This has been shown in various forms such as a mother or father teasing their child (MacBrayer et al., 2001), or negative comments and criticism about appearance or weight (Baker et al., 2000; Smolak et al., 1999; Vincent & McCabe, 2000). Such behaviors and encouragement to lose weight are related with significantly higher levels of eating disorders in daughters (e.g., Benedikt et al., 1998; Keel et al., 1997; Vincent & McCabe, 2000; Wertheim et al., 2002). Unfortunately, parents may not be aware of the harm of encouraging dieting and may perceive their verbal

encouragement as a caring behavior and an appropriate concern for their children's health (Kluck et al., 2010).

The Tripartite Influence Model (Thompson et al., 1999) attempts to explain the association between appearance-related family comments (e.g., weight teasing, criticisms related to food choices, etc.) and eating disorder behavior. This model proposes that there are three main sources of influence that form the basis for development of body image and eating pathology: peers, parents, and the media. The model also posits two mediating pathways connecting these three sources of influence: internalizing societal norms of appearance and heightened tendencies for appearance comparison. The model hypothesizes that these mediating pathways lead to body image issues and eating pathology (Thompson et al., 1999). Evidence with clinical and non-clinical eating disordered populations have supported the Tripartite Influence Model (Rodgers & Chabrol, 2009; Rodgers et al., 2012). Preliminary evidence points to body image dissatisfaction as a specific pathway from comments about weight/shape/eating and disordered eating (Cash & Prunzinsky, 2002; Mora-Giral et al., 2004; Shaw et al., 2004; Thompson et al., 1999). That is, children in appearance-focused family environments become more cognizant about their physical appearances and how that fits in with their family's expectations, and ultimately, society's expectations. Appearance-focused families may reinforce to children that thinness is valued (Kluck et al., 2010).

There are two main ways that family communication is associated with eating pathology: directly through verbal communication about the child's physical appearance and/or eating (food choices/diet), and indirectly by creating an appearance-focused family climate through modelling parents' own behaviors about weight/shape/food (Neumark-Sztainer et al., 2010). One such communication has been termed "fat talk" (Shannon & Mills, 2015). In the family, fat talk has

been associated with reinforcing the thin ideal and body objectification of women. For example, parents may communicate restrictive eating to their children (Kroon et al., 2010), or comment about their own weight in front of their children (Berge et al., 2015; Wansink et al., 2017).

Beyond direct communication, some studies have shown that parents' and children's body dissatisfaction levels are associated, although the mechanisms through which this is transmitted is unclear (Rodgers & Charbol, 2009). For example, mothers' and daughters' body dissatisfaction levels have been significantly associated (Elfhag & Linné, 2005; Fulkerson et al., 2002; Keery et al., 2006, Kichler & Crowther, 2001; Mckinley, 1999; Usmani & Daniluk, 1993), and some studies have shown paternal body dissatisfaction is also related to girls with eating disorders (Keel et al., 1997). There is limited evidence on the association between mothers' and daughters' self-reported dieting behavior. Keery et al. (2006) and Dixon et al. (1996) did not find a significant association between mothers' and daughters' dieting, while Fulkerson et al. (2002) did. Interestingly, Dixon and colleagues (1996) found a positive association between fathers' and daughters' dieting behavior. Moreover, maternal dieting has been associated with weight concerns and extreme weight-loss behaviors in their sons and daughters (Keery et al., 2006).

Drawing from nutrition and obesity literature, parents have been shown to play a pivotal role in modelling (promoting and preventing) food consumption behavior to their children (see Yee et al., 2017 for a review of parental practices on food consumption behaviors). It stands to reason those unhealthy behaviors in the family environment surrounding food, such as seeing your parent diet frequently, or parents who enforce diets on their children, may play a role in these children's food choices as adults.

Furthermore, intervention research in eating disorders have shown that one of the most effective types of treatment, which is now known as the gold standard treatment of traditional eating disorders, is Family-Based Treatment (Treasure & Schmidt, 2013). This treatment focuses on partnering with the individuals' immediate family, to aid in their recovery from eating disorders. Parents are coached on how to overcome challenges with mealtimes and food, and how to talk about food, meals, and body image in an adaptive manner (Lock & Le Grange, 2015). The high involvement of the family for the individual's recovery lends credence to the family environment playing a major role in the eating disorders spectra (Treasure & Schmidt, 2013).

Although appearance-focused family cultures have been known to contribute to the development of traditional eating disorders such as anorexia nervosa and to eating disorder-related factors such as body dissatisfaction, we do not yet know whether it contributes to the development of ON. From the extant literature on appearance-focused family cultures and traditional eating disorders, the Tripartite Influence Model, nutrition and obesity research, and eating disorders intervention research, it would make sense that individuals who develop ON may have had similar experiences in their family environments because the family climate seems to be a significant factor in molding children's view of society's expectations with regards to shape, weight, and diet.

## **1.8. Present Study**

Although there has been a scarcity of research on the relatively new phenomena of orthorexia nervosa, extensive previous research, and theoretical models of clinical eating disorders, as well as recent research that points to ON falling under the eating disorders spectrum, suggest that perfectionism, the family environment, daily stress, and daily negative affect are potential target



risks factors involved in ON, as well. The purpose of this study, thus, was to identify between- and within-person risk factors for ON symptoms in a college sample.

**a. Research Aim 1.** Our first aim was to test daily stressors and negative affect as predictors of ON behavior in daily life. We expected that there would be a positive within-person association between daily stress and orthorexia symptoms on the same day (Hypothesis 1), as well as a positive, within-person association between negative affect and orthorexia symptoms on the same day (Hypothesis 2). That is, we expected participants to report higher levels of ON-related behavior on days with higher-than-usual daily stress intensity or daily negative affect on the same day. Moreover, we examined if the association between daily stress (Hypothesis 3) and negative affect (Hypothesis 4) was moderated by an already healthy diet. We expected that having a healthy diet would exacerbate the association between daily stress (Hypothesis 3) and negative affect (Hypothesis 4) and ON behaviors, such that at higher levels of a healthy diet, the association between daily stress/negative affect and orthorexia nervosa symptoms would be stronger, and at lower levels of a healthy diet, the association between daily stress/negative affect and orthorexia nervosa symptoms would be weaker. In addition, we expected that previous day stress (Hypothesis 5) and negative affect (Hypothesis 6) would significantly predict next-day ON-related behavior, controlling for the previous day's ON behavior.

**b. Research Aim 2.** Our second aim was to test the extent to which perfectionism moderated relations between daily stress and ON behaviors and relations between daily negative affect and ON behaviors. We expected that higher levels of perfectionism would exacerbate the association between same day stress and ON behavior (Hypothesis 7) as well as the association between same day negative affect and ON behavior (Hypothesis 8), such that at higher levels of perfectionism, the association between daily stress/negative affect and orthorexia nervosa

symptoms would be stronger, and at lower levels of perfectionism, the association between daily stress/negative affect and ON symptoms would be weaker. Moreover, we expected that higher levels of perfectionism would significantly exacerbate the relation between previous day stress (Hypothesis 9) or negative affect (Hypothesis 10) and next day ON symptoms. That is, at higher levels of perfectionism, the association between previous day stress and next day ON symptoms would be stronger, and at lower levels of perfectionism, the association between previous day stress and next day ON would be weaker.

**c. Research Aim 3.** Our third aim was to test the extent to which negative appearance-focused family culture predicts ON symptoms, over and above perfectionism, obsessive-compulsive tendencies, past dieting, current or past eating disorders, and neuroticism. We expected that, controlling for these other known risk factors of ON and eating pathology (McComb & Mills, 2019), emerging adults who reported higher levels of negative appearance-focused comments and behaviors in their family when they were children would endorse higher levels of orthorexia symptoms, impairments, and emotions (i.e., the total score on the Orthorexia Nervosa Inventory; Oberle et al., 2021) (Hypothesis 11). To date, risk factors for ON that have been consistently demonstrated in at least four quantitative studies include perfectionism, obsessive compulsive tendencies, history of dieting/restrictive eating, and current or history of eating disorders (McComb & Mills, 2019). We included neuroticism as a risk factor even though only one study has demonstrated its association with ON symptoms (Gleaves et al., 2013) because neuroticism has been shown to exacerbate the relation between daily stress and negative affect in multiple studies (e.g., (Bolger & Schilling, 1991; Komulainen et al., 2014; Marco & Suls, 1993; Mroczek & Almeida, 2004; Sliwinski et al., 2009; Suls, Green, & Hillis, 1998; Zautra et al., 2005).

Although drive for thinness was identified as a risk factor in McComb & Mills' (2019) review, it has only been tested in three quantitative studies. Moreover, drive for thinness is highly correlated with current and past eating disorder behavior (e.g., Krug et al., 2020), both of which are more consistently related to ON symptoms. Therefore, we did not include drive for thinness as a risk factor but instead included eating disorder history.

**d. Supplemental Exploratory Research Aims.** As a supplemental, exploratory aim, we also tested the different domains of perfectionism (self-oriented perfectionism and socially-prescribed perfectionism) as separate moderators to test the extent to which they differentially moderate associations. We expected that both SOP and SPP would exacerbate the relation between daily total stress and ON symptoms on the same day, such that at higher levels of SOP or SPP, the association between daily stress/negative affect and ON symptoms would be stronger on the same day, and at lower levels of SOP or SPP, the association between daily stress/negative affect and ON symptoms would be weaker on the same day. Likewise, we expected the same moderating effect when examining next-day associations. We did not examine OOP as a moderator because research so far has shown that OOP is associated with antisocial, narcissistic, and psychopathy traits (Stoeber, 2014), and not eating pathology; therefore, OOP was less relevant to the present study aims. Moreover, another supplemental exploratory aim was to examine whether type of day (weekend or weekday) significantly moderated the relation between daily stress or negative affect and ON symptoms. Individuals with binge eating disorders have significantly more binge eating episodes on weekdays compared to weekends (Schreiber-Gregory et al., 2013), although the reason why is unclear. We do not know if ON symptoms also differ between weekdays and weekends. Hence, we wanted to test the possibility that the type of day can significantly moderate the strength of the relation between daily stress or

negative affect and ON symptoms. No a priori hypotheses were made regarding the extent to which type of day (weekend vs. weekday) would moderate the within-person relation between daily stress/negative affect and ON symptoms on the same day.

A final supplemental exploratory aim was to examine baseline eating pathology measured by the Eating Disorder Diagnostic Scale (EDDS; Stice et al., 2000) as a moderator of the relation between daily stress or negative affect and ON symptoms because current levels of eating pathology has been associated with ON symptoms in several studies (Barnes & Caltabiano, 2017; Brytek-Matera et al., 2015; Gramaglia et al., 2017; Missbach et al., 2015; Segura-Garcia et al., 2015). We expected that higher current levels of eating pathology would exacerbate the relation between daily stress or negative and affect and ON symptoms on the same day, such that at higher levels of current eating pathology, the relation between daily stress/negative affect and ON symptoms would be stronger on the same day, and at lower levels of current eating pathology, the relation between daily stress/negative affect and ON symptoms would be weaker on the same day. Likewise, we expected the same moderating effect when examining next-day associations. The rationale for this hypothesis is based on research showing that eating disorder behaviors such as binge eating may be coping behaviors to stress (Heatherton & Baumeister, 1991; Polivy & Herman, 1993, 1999) and theoretical models of eating pathology posit that eating disorder symptoms are a coping behavior to stress and negative affect (Haynos & Fruzzetti, 2011). Hence, individuals with an existing baseline eating pathology may turn to eating disorder coping behaviors like ON in response to stress and negative affect.

**e. Additional Variables Assessed.** The present study also measured eating disorder attitudes (measured by the EAT-26), depression and anxiety, and trauma history to be used in future secondary data analysis projects that are not part of the researcher's (S. Wee) dissertation aims

and hypothesis. Stress has been found to predict an increase in eating high caloric foods, foods high in salt/fat/sugar content, increased snacking) in college students (de Oliveira Penaforte et al., 2016) and it may be worthwhile to examine if stress predicts unhealthy eating behavior in some individuals rather than ON symptoms. We measured eating disorder attitudes because they have been related to ON symptoms (e.g., Reynolds, 2018; Roncero et al., 2017; Segura-Garcia et al., 2012) and other eating disorder symptoms (e.g., Gleaves et al., 2014), even when the individual does not meet the diagnostic criteria for an eating disorder. Additionally, depression and anxiety are often comorbid with eating disorders (Hudson et al., 2007; Swinbourne & Touyz, 2007), and therefore would also us to examine the extent to which individuals with higher levels of depression and anxiety also engage in higher levels of ON behavior. Finally, a history of trauma has been significantly associated with eating disorders (Brewerton, 2015; Groth et al., 2020), however, we do not know if this is the case with ON yet. Measuring trauma history will allow us to examine if trauma history is significantly associated with ON.

**f. Summary.** Altogether, our study aimed to extend the current literature on orthorexia nervosa by examining psychosocial factors in the family environment and the individual that may be risk factors for ON symptoms. We also aimed to go beyond direct main effect studies that have been conducted so far relating perfectionism and ON by examining the moderating effect of perfectionism on daily stress and/or negative affect and orthorexia symptoms. Examining daily contributors to orthorexia nervosa symptoms will inform interventions for ON, which currently have not been established. Regardless of whether ON is a precursor to more severe eating disorders, a residual symptom of traditional eating disorders, or its own distinct form of eating pathology, it is important to establish targeted interventions that can help alleviate ON symptoms given its associations with negative health and well-being outcomes (Brtytek-

Matera, 2012; Dunn et al., 2016; Segura-Garcia et al., 2015). Moreover, identifying possible family-level risk factors of orthorexia nervosa can inform current family-based treatments for eating disorders, and preventative efforts, such as public service campaigns educating parents about the adverse impacts of comments about dieting, weight, and shape in the family.

## Chapter 2

### METHOD

#### **2.1. Participants**

Participants ( $N = 178$ ) were recruited from the undergraduate psychology pool (Sona System) and awarded for their participation with undergraduate psychology course credits. Eligibility criteria for these participants were emerging adults 18-years-old and older who had access to a smartphone and were a higher education student (undergraduate level). The present study's baseline survey included two types of validity indicators to screen participants' responses and ensure that their responses were of decent quality (e.g., Aust et al., 2013; Chmielewski & Kucker, 2020). We included three attention check items (e.g., Please select "strongly agree") and calculated response time in seconds per item. Participants who failed two out of three of the attention check items in the baseline surveys were excluded from the study. We followed recommendations from psychometric experts who recommended not being overly stringent (e.g., dropping participants who failed 10% of the attention check items) because it may lead to biased/unrepresentative samples, and to include multiple types of validity indicators because each of them tap into related aspects of low-quality responding in questionnaires. One participant failed all three items and two participants failed two attention check items. An additional 11 participants were excluded for failing time checks on the baseline survey (taking less than 1-sec per question). Finally, 21 participants did not complete any daily diary entries and one participant only completed one daily diary record. Thus, the final sample size for this study was 142.

The mean age of participants was 20.41 years ( $SD = 1.62$ ). The majority of the sample identified as female (76.8%) and 23.2% identified as male. The majority of the sample was freshmen (41.5%), 35.9% were sophomores, 12% were juniors, and 10.6% were seniors. The sample was primarily White (74.6%); 12.7% were Asian, 5.6% were Black/African American, 1.4% were American Indian/Alaskan Native, 0.7% was Native Hawaiian/Other Pacific Islander, and 4.9% of the sample identified as another race other than the ones listed above. 16.9% of the sample identified as Hispanic/Latino/Spanish in origin. Only 7.7% of the sample were college athletes. Demographic information for participants are located in Table 1.

## **2.2. Procedures**

Approval from the university's Institutional Review Board (IRB Protocol Number 22-009) was obtained prior to beginning data collection. Data were collected between February and May 2022. This study was completed virtually through use of HIPAA-compliant Zoom and Qualtrics. Participants signed up for the study in the Sona System and then reviewed and signed the informed consent form and completed the baseline survey on Qualtrics. At the end of the baseline survey, participants were able to select a time for their 30-minute Zoom video call with the present study's researcher. During the Zoom meeting, participants were shown how to download the experience-sampling software application onto their smartphones, and how to complete the daily diary check-ins on the application (described below). The participant completed a practice report on the smartphone application together with the researcher during the Zoom meeting.

## **2.3. Daily Diary Protocol**

Beginning the day after their Zoom meeting with the researcher, participants were instructed to start logging their 14-day daily diary once per day, which was delivered via the Smartphone



Ecological Momentary Assessment 3 application (SEMA3; Koval et al., 2019) to their smartphone. The 14-day time period was chosen because past daily diary studies examining eating behavior in the college population have utilized this time period to be able to detect day-to-day variability (e.g., Braker et al., 2006; Mason et al., 2016). Participants were only assessed once a day, at the end of the day, to reduce participant burden. In addition, previous daily diary studies examining eating behavior in college adults have detected significant variability utilizing a once per day assessment of negative affect and disordered eating behavior (e.g., Mason et al., 2016), self-compassion and eating behavior (Kelly & Stephen, 2016), and negative affect and positive affect and food consumption (White et al., 2013).

SEMA3 is an open-sourced software that has been created for researchers who are using experiencing sampling protocols. Notifications to complete their daily diary were sent at 8:00PM each day, and again at 10:30PM if the participant did not complete their report for that day yet. Instructions informed participants to complete the brief daily diary before they went to bed that day. Participants had up to three hours to complete their report. Once participants completed their survey for the day, the participants received a notification that their data had been uploaded. The researcher (S. Wee) had access to participant data in real-time via the SEMA3 website. All data was associated with a deidentified participant ID. Only the researcher (S. Wee) had access to the list linking ID numbers to participant names and emails to contact participants, issue reminders, and assign SONA credits at study completion. Researchers monitored participants' dairies daily and sent participants a reminder text and email if the participants had missed one day of reporting. Participant responses were downloaded and exported to an IBM SPSS (v. 25; 2017) dataset. A list of resources to counseling services and eating disorder services on-campus and off-campus was provided to all participants on the final day of the 14-day daily diary period.

## 2.4. Baseline Measures

**a. Demographic Information.** Participant demographic information was collected using a demographic form (see Appendix A) created for this study. The form included questions about the participants' age, race, ethnicity, gender, year in university, family structure (e.g., lived with both biological parents, gender identity of parents, number of siblings, any other family members in the home such as grandparents), food allergies, medical/religious dietary restrictions, whether they are a college athlete or not, whether they have ever been on a diet that was not medically/religiously prescribed before, and whether they have ever been diagnosed with an eating disorder.

**b. Orthorexia Nervosa.** The Orthorexia Nervosa Inventory (ONI; Oberle et al., 2021) is a 24-item self-report questionnaire measuring ON symptomology. Unlike other existing ON measures, the ONI includes items that measure the physical impairment of ON, which is one of the consensus diagnostic criteria for ON (Dunn & Bratman, 2016). Individuals respond to statements presented to them using a four-point Likert scale with the following response options: “not at all true” (1), “slightly true” (2), “mainly true (3), and “very true” (4). An example statement is “Over time, my diet has come to include elimination of entire food groups that I believe are unhealthy.” No timeframe for the questions is given. Items are summed and higher scores indicate more severe orthorexic behavior. The highest score an individual can receive is 96. A score of 72 or higher indicates presence or high risk for ON. With a U.S. sample recruited from undergraduate college campus and the community, the ONI demonstrated good internal consistency (Cronbach's  $\alpha = .88 - .90$ ) and 2-week test-retest reliability ( $r = .86 - .87$ ). In this study, the ONI demonstrated good reliability (Cronbach's  $\alpha = .95$ ).

The Düsseldorf Orthorexia Scale (DOS; Barthels et al., 2015) is a 10-item self-report questionnaire measuring orthorexic eating behavior. Individuals respond to statements presented to them using a four-point Likert scale from “this does not apply to me” (1 point) to “this applies to me” (4 points). Higher scores indicate more severe orthorexic behavior. The highest score an individual can receive is 40. A score of 30 or higher indicates presence of ON, while a score between 25 to 29 indicates risk of ON. The DOS was originally created in German. The German version of the scale showed high internal consistency (Cronbach’s  $\alpha = .84$ ), and high test-retest reliability ( $r = .67-.48, p = .001$ ) between three time points, each 30-days apart. A recent study translated the DOS into English (E-DOS), used a back-translation process, and then evaluated the English DOS with a U.S undergraduate student sample (Chard et al., 2019). The E-DOS showed high internal consistency (Cronbach’s  $\alpha = .88$ ). The test also showed good construct validity ( $r = .76, p = .001$ ) with the Eating Habits Questionnaire (EHQ; Gleaves et al., 2013), an assessment of cognitions, behaviors, and feelings related to extreme focus on healthy eating. The E-DOS showed excellent reliability in the present study (Cronbach’s  $\alpha = .90$ ).

In the present study, the ONI and E-DOS were highly correlated,  $r = .86, p < .001$ . A composite total baseline ON symptoms score was calculated by standardizing and summing the scores of the two measures.

**c. Healthy Eating Behavior.** The Healthy Eating Assessment (HEA; Government of Northwest Territories, 2017) is a 10-item food frequency instrument designed to measure dietary patterns in an individual. Respondents indicated on a 5-point scale how often they ate certain foods in a day. An example item from the HEA is, “How many times a day did you eat fast/fried food/or packaged snacks high in fat/salt/or sugar?” (reverse-scored). The original questionnaire, known as the Starting The Conversation Scale (STC; Paxton et al., 2011), was designed for non-

dietitians to measure dietary patterns in a brief and effective way for assessment and counseling. The Government of Northwest Territories added two items to this questionnaire to create the HEA. The original eight items were significantly correlated with other measures of diet and health, such as fat screeners, and percentage of calories from fat. It also showed sensitivity to changes during an intervention (Paxton et al., 2011). Paxton and colleagues (2011) stated that they did not calculate measures of scale reliability for the STC because the eight items in the STC measured distinctly different aspects of eating behavior and were not expected to intercorrelate significantly. The authors of the HEA also did not calculate scale reliability.

**d. Perfectionism.** The Hewitt-Flett Multidimensional Perfectionism Scale (HMPS; Hewitt & Flett, 1991) is a 45-item scale that consists of three trait dimensions of perfectionism: self-oriented perfectionism (SOP), other-oriented perfectionism (OOP), and socially-prescribed perfectionism (SPP). Respondents used a 7-point Likert-type rating ranging from “strongly disagree” (1) to “strongly agree” (7) to rate their agreement to statements. An example statement under the self-oriented perfectionism dimension is “one of my goals is to be perfect in everything I do.” An example statement that falls under the socially-prescribed perfectionism dimension is, “my family expects me to be perfect.” No timeframe is given for this scale. Scores for each item are summed for the total score, and for each of the trait dimension scales. Higher scores indicate higher levels of perfectionism. The HMPS has been shown to have a good internal consistency, with Cronbach’s  $\alpha = .88, .74$ , and  $.81$  for the three subscales, respectively (Hewitt & Flett, 1991). The test-retest reliability was  $.88, .85$ , and  $.75$  over three months for the three respective subscales in an undergraduate student sample (Hewitt & Flett, 1991). The present study utilized the total score, as well as scores from the SCP and SOP scales. The reliability of the SCP scale

(Cronbach's  $\alpha = .80$ ), SOP scale (Cronbach's  $\alpha = .83$ ), and total scale (Cronbach's  $\alpha = .86$ ) were good in this study.

**e. Appearance-Focused Family Environment.** Several measures assessed appearance-focused family environment. The Parental Comments Scale (PCS; Rodgers et al., 2009a) assesses an individual's perception of the lifetime frequency of messages they received from their parents about weight/shape. The self-report measure contains a total of 18 items; five items measure positive messages, and thirteen items measure negative messages. Participants rate the frequency with which they recall their parents having made a number of statements on a 5-point Likert scale from "Never" (1-point) to "Always" (5-points). An example item is "My father said to me: 'You look like you've put on weight; you should watch what you eat'" (paternal negative comment). In the present study, participants completed separate reports of their mother (or mother-figure) and their father (or father-figure/second-parent figure). Participants were asked to indicate if they had a father-figure/second-parent figure to report on before proceeding on to the second-parent report of the PCS. Eight participants did not answer questions on the PCS about their father or second-parent figure because they indicated they had no other parent figure. Scores are calculated separately for the positive comments and negative comments scales. Higher scores indicate higher frequency of each type of comment (positive or negative).

The internal reliability of the negative comments subscale in an Australian undergraduate sample ( $M$  age = 19.58,  $SD = 1.02$ ) ranged from Cronbach's  $\alpha = .87$  to .91, and .84 to .85 for the positive comments subscale (Rodgers et al., 2009b). In the present study, the PCS demonstrated good reliability for both positive and negative scales, and for both parents (Cronbach's  $\alpha = .84$  to .91). Although participants completed the full PCS questionnaire, the present study only utilized the negative scale in accordance with research aim 3 where our aim was to examine how

negative appearance-focused comments in the family may be associated with ON symptoms. A parent-composite PCS negative comments score was created by using the average rating of participants' reports of their mothers' and fathers' negative comments ( $r = .54, p < .001$ ). A paired samples t-test demonstrated that participants' mean reports of their mothers' and fathers' negative comments differed significantly,  $t(129) = 5.52, p < .001$ , where participants reported that their mothers ( $M = 25.77, SD = 12.05$ ) made significantly more negative appearance-focused comments than fathers ( $M = 20.56, SD = 10.17$ ).

The Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al., 1986) assesses restrained, emotional, and external eating in an individual. It was originally constructed as a self-report scale of eating behavior; however, it has since been adapted to other versions in which others report about an individual's eating behavior (e.g., the DEBQ parent version where parents report on their child's eating behavior). As such, we used the DEBQ and adapted it to a child's report on their parents' eating behaviors. The restraint scale of the DEBQ was used, consisting of 10 items rated on a 5-point Likert-type scale ranging from "Never" (1) to "Very Often" (5). An example item is, "When your parent(s) put on weight, did/do they eat less than they usually did/do before?" Items were summed, and higher scores indicate higher frequency of parents' restrained eating behavior. The internal consistency of the scale was  $\alpha = .95$  in a Dutch adult sample, and  $\alpha = .94$  in a U.S. college sample (Nolan et al., 2010). The DEBQ demonstrated good reliability in the present study (Cronbach's  $\alpha = .95$ ).

The Family Fat Talk Questionnaire (FFTQ; MacDonald et al., 2015) is a 16-item, 2-factor measure of self-critical, body-related communication within the family. Eight items on the scale measure fat talk exhibited by the family (e.g., "When I'm with my family members, I hear them complain that they are fat."). The other eight items measure the individual's own fat talk in a

family context, such as “When I’m with my family, I complain that I’m not in shape.” Items are rated on a 5-point Likert scale from “Never” (1) to “Always” (5). Scores on items are summed for each subscale to give the subscale scores, and a total sum is also calculated to represent general family fat talk in the family (both family and self-critical). Higher scores indicate higher frequency of fat talk occurring in the family. The scale has shown excellent internal consistency (Self subscale  $\alpha = .88$ , Family subscale  $\alpha = .90$ ) in an undergraduate female U.S sample (MacDonald et al., 2015). The temporal stability of the FFTQ scores has been shown to be 2 weeks (MacDonald et al., 2015). For the purposes of this study, we focused only on the family subscale but we collected data using the whole questionnaire. The FFTQ family subscale showed good reliability in the present study (Cronbach’s  $\alpha = .93$ ).

The correlations between the parent-composite PCS negative subscale, DEBQ, and FFTQ were calculated. The three scales were significantly correlated with each other ( $r = .59-.62$ ,  $p < .001$ ); therefore, a composite *negative appearance-focused family culture* score was calculated by standardizing the scores of the three measures, and then summing them. The composite negative appearance-focused family culture score showed good reliability in this sample (Cronbach’s  $\alpha = .82$ ).

**f. Neuroticism.** The Big Five Inventory (BFI; John & Srivastava, 1999) neuroticism subscale is an 8-item self-report scale measuring the personality trait of neuroticism. Participants respond to statements such as, “I see myself as someone who is depressed, blue,” using a 5-point Likert scale from “disagree strongly” (1) to “agree strongly” (5). The BFI neuroticism subscale has been shown to have high internal consistency in a US college sample ( $\alpha = .82$ ; Arterberry et al., 2015). In this current study, the BFI neuroticism scale demonstrated good reliability (Cronbach’s  $\alpha = .84$ ).

**g. Obsessive-Compulsive Symptoms.** The Obsessive-Compulsive Inventory Revised (OCI-R; Foa et al., 2002) is an 18-item self-report questionnaire that measures obsessive-compulsive disorder symptoms in the past month. Participants responded using a 5-point Likert scale, ranging from “not at all” (0) to “extremely” (4). An example item is “I feel I have to repeat certain numbers.” The OCI-R has shown high internal consistency in a college sample ( $\alpha = .88$ ; Hajcak et al., 2004). In this study, the OCI-R demonstrated good reliability (Cronbach’s  $\alpha = .92$ ).

**h. Current Eating Disorder.** The EDDS is a 22-item self-report questionnaire for diagnosing anorexia nervosa, bulimia nervosa, and binge-eating disorder. Participants rated their level of symptoms and feelings to four questions over the past 3 months, using a 7-point Likert-like scale ranging from “Not at all” (0) to “Extremely (6). An example question is, “Over the past 3 months, have you had a definite fear that you might gain weight or become fat?” Participants also answered yes/no to eight questions. An example of such a question is, “During the past 6 months, have there been times when you felt you have eaten what other people would regard as an unusually large amount of food (e.g., a quart of ice cream) given the circumstances?” Respondents also rated how many days per week on average and how many times per week on average over the past 3-6 months they have experienced different symptoms (e.g., “How many days per week on average over the past 6 months have you eaten an unusually large amount of food and experienced a loss of control?”). Lastly, respondents reported their current weight and height, how many menstrual periods they have missed (if biologically female), and if they have been taking birth control pills in the last 3 months. The EDDS has demonstrated good internal consistency in an undergraduate student sample ( $\alpha = .87$ ; Krabbenborg et al., 2012). In the present study, the EDDS demonstrated good reliability for both



the symptoms total score (Cronbach's  $\alpha = .82$ ) and standardized symptoms score (Cronbach's  $\alpha = .82$ ). In our main analyses, we used the symptoms total score.

## **2.5. Baseline Measures for Secondary Analyses (Outside of Dissertation Aims)**

**a. Eating Disorders Attitudes.** The Eating Attitudes Test (EAT-26; Garner et al., 1982) is a self-report measure of eating disorders symptoms and concerns. Respondents rated 26 statements using the following scale: “Always” (3), “Usually” (2), “Often” (1), “Sometimes” (0), “Rarely” (0), “Never” (0). There were also five behavioral questions that respondents answered indicating how often they have engaged in actions such as bingeing and vomiting, with response options: “Never”, “Once a month or less”, “2-3 times a month”, “Once a week”, “2-6 times a week,” and “Once a day or more.” The behavioral questions, however, are not included in the total score. The EAT-26 has shown to be psychometrically sound, correlating highly with the original EAT-40 scale ( $r = .98$ ; Garner et al., 1982). The internal consistency of the EAT-26 has been shown to be high in a U.S. undergraduate sample ( $M$  age = 19.90,  $SD = 2.72$ ) (Cronbach's  $\alpha = .91$ ; Thome & Espelage, 2004). In the present study, the EAT-26 demonstrated good reliability (Cronbach's  $\alpha = .93$ ).

**b. Depression and Anxiety.** The Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007) General Depression scale is a 20-item self-report measure that assesses overall depression symptoms. Respondents indicate on a 5-point scale ranging from ‘not at all’ (0) to “extremely” (4) the extent to which they had experienced each symptom over the past 2 weeks. An example item is, “I felt depressed.” The internal consistency of the IDAS General Depression scale has been shown to be high in a college sample ( $\alpha = .89$ ; Watson et al., 2007). The IDAS General Depression scale demonstrated good reliability in the present study (Cronbach's  $\alpha = .93$ ).

**c. Trauma History.** Trauma history was measured because history of trauma has been demonstrated to be a significant risk factor for eating disorders (Brewerton, 2007). The Trauma History Screen (THS; Carlson et al., 2011) is a brief 19-item self-report that assesses a person's exposure to stressors/events that have been associated with persisting posttraumatic distress. Participants first state the number of times a list of 14 events have happened to them before, for example, "Hit or kicked hard enough to injure – as an adult." Then they answer several Yes/No questions about events that they endorsed had happened to them. For example, "Did any of these things really bother you emotionally?" In a US college sample, the THS demonstrated high test-retest reliability over two months ( $r = .93$ ) and construct validity between existing longer trauma screeners ( $r = .73$ ; Carlson et al., 2011).

## **2.6. Daily Diary Measures (see Appendix B)**

**a. Daily Stress.** Daily stress was measured using a 17-item negative events checklist. The participants indicated which events occurred to them at least once that day (Stone & Neale, 1984). The participants also indicated how stressful each event was on a 7-point Likert-type scale from "Not at all stressful (1)" to "Very stressful" (7). An example event is "let down by friend, family member, or partner." These event checklists have been used in daily diary research studies with college students (e.g., Dasch et al., 2008; Gunthert et al., 1999; O'Neill et al., 2004; Tolpin et al., 2006). In the present study, a *daily stress intensity* score was calculated from summing the participants' ratings of how stressful each event was that day.

**b. Negative Affect.** The Positive and Negative Affect Schedule expanded version (PANAS-X; Watson & Clark, 1994) is a measure of 11 specific affects (Fear, Sadness, Guilt, Hostility, Shyness, Fatigue, Surprise, Joviality, Self-Assurance, Attentiveness, and Serenity) and consists of two higher order scales (positive affect and negative affect) and seven separate specific affect

scales (lower order scales). The present study utilized an 7-item modified version of the higher order negative affect scale as a measure of daily negative affect. We combined similar words from the original 10-item scale into single items. For example, items 1 and 2 from the original scale were combined into one item, “Afraid/Scared.” We retained the items, “Nervous”, “Jittery”, “Irritable”, and “Hostile” as their original single-item forms because they seemed distinct from each other. Subjects rated to what extent they felt a certain way, for example “Guilty/Ashamed”, in the past day, using a 5-point Likert scale ranging from “very slightly/not at all” (1) to “extremely” (5). The original 10-item negative affect scale has demonstrated good internal consistency. In a college sample using the 24-hour timeframe, the Cronbach’s  $\alpha$  was .87. The PANAS-X has also shown good convergent validity with measures of neuroticism (Eysenck Personality Questionnaire) and negative emotionality (General Temperament Survey) with correlations ranging from .91 to .93 (Watson & Clark, 1994). The modified PANAS negative affect scale used in the present study had acceptable between-person ( $\alpha = .84$ ) and within-person ( $\alpha = .76$ ) reliabilities (Cranford et al., 2006).

**c. Orthorexic Symptoms.** To the best of our knowledge, there has not been a daily measure of ON symptoms created to date. Therefore, we decided to combine and adapt select questions from the two psychometrically sound ON diagnostic measures, the ONI (Oberle et al., 2021) and the E-DOS (Chard et al., 2019). The daily orthorexic symptoms scale consisted of 23 items. Participants rated how much they agreed with a list of statements on a 5-item Likert-type scale ranging from “not at all” (0) to “extremely” (4). The scores to each item were summed to a create a total score, where higher scores indicate higher levels of orthorexic symptoms. The daily orthorexia symptoms scale demonstrated high between-person ( $\alpha = .93$ ) and within-person ( $\alpha = .84$ ) reliability (Cranford et al., 2006).

Four of the items may overlap with negative affect. For example, “I felt guilt and self-loathing for straying from my healthy diet today.” Therefore, we calculated a second version of the total daily ON behavior score with these four items removed to conduct supplemental sensitivity analyses. The daily orthorexia symptoms scale without the four negative affect items included demonstrated high between-person ( $\alpha = .92$ ) and within-person ( $\alpha = .85$ ) reliability.

**d. Daily Positive Affect.** Average positive affect that day was included as a control variable in our models testing daily stress and negative affect as predictors. Positive affect has been associated with some eating disorder symptoms, such as bingeing and purging (Smyth et al., 2007), therefore controlled for positive affect in order to test for unique predictive effect of negative affect (compared to low positive affect) on ON symptoms. The Joviality scale from the PANAS-X was used to measure positive affect. This scale contains eight items and has been shown to have good internal consistency in a sample of college students in the US ( $\alpha = .94$ ; Watson & Clark, 1994). In the present study we combined similar items into one question (for a total of three questions) to reduce participant burden. Participants indicated to what extent they felt (1) “happy, joyful, (2) delighted, or cheerful”; (3) “excited or enthusiastic”; and (4) “lively or energetic” in the past day, using a 5-point Likert scale ranging from “very slightly/not at all” (1) to “extremely” (5). In the present study, the PANAS joviality scale between-person ( $\alpha = .86$ ) and within-person ( $\alpha = .86$ ) reliabilities were high (Cranford et al., 2006).

## **2.7. Pre-registered Analysis Plan and Power**

**a. Preliminary Analyses.** Prior to beginning data analyses, the analysis plan was preregistered on the Open Science Framework (Center for Open Science, 2021; <https://osf.io/3g2nz/>). For our preliminary analyses, we first examined the three attention check questions and time checks in the baseline survey. Moreover, we also checked for participants

who did not complete any daily diary records (i.e., dropped from the study after completing the baseline survey). As described in the Participants section of this manuscript, some of the participants were excluded due to failing attention checks, time checks, and/or not completing any daily diary records. Missing data analyses on demographic information such as age, gender, year in college, family structure, number of siblings, non-religious/medical diet, college athlete status, did not reveal any significant differences between those who failed attention/time checks or did not complete any daily diary records and those included in the final sample (Table 2).

Next, we examined distributional assumptions and outliers were identified. Descriptive statistics and bivariate correlations between the baseline measures and the average levels of all the daily diary measures (averaged across 14-days) were calculated. Finally, we tested for any significant sex differences in baseline and average daily diary measures to determine if we would need to add this as a variable in our main analyses models.

**b. Preliminary Model Building.** We tested a series of preliminary multilevel models (diary reports nested within individuals). The first preliminary model was an empty model (i.e., no predictors) to calculate the ICC for our dependent variable, daily ON symptoms:

Level 1 (within-person)

$$\text{Daily ON Symptoms} = \beta_0 + R$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + U_0$$

For the Level 1 errors, we utilized the AR(1) error covariance structure, which is typically used for daily diary studies (Nezlek, 2012). AR(1) assumes that the covariances between the errors decrease proportionately as the assessments get farther apart; that is, the further apart assessments are, the less correlated the errors are. It also assumes homogeneous variances across

the different time points. This was a reasonable assumption to make in our study because our study did not involve any interventions, thus there was no reason to assume symptoms should have different variances on different days.

Next, we added reporting day (diary day 1 = 0) to test whether ON behaviors systematically changed during the reporting period.

Level 1 (within-person)

$$\text{Daily ON Symptoms} = \beta_0 + \beta_1 (\text{Day}) + R$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + U_0$$

$$\beta_1 = \gamma_{10} + U_1$$

where  $\gamma_{00}$  is the average ON symptoms when day = 0 (i.e., first reporting day) and  $\gamma_{10}$  represents whether ON symptoms systematically changed (i.e., linearly increased or decreased) during the reporting period. Based on recommendations from Bolger & Laurenceau (2013), we planned to retain Day as a predictor in models, regardless of whether it was a significant predictor in this model.

For the Level 2 random effects, we utilized the Unstructured error covariance structure, because we could not make any assumptions about the error covariance matrix between-person.

Next, we tested if ON behaviors systematically differed on weekends vs. weekday by adding a dichotomous *Type of Day* variable to Level 1. Type of day was coded such that 1 = weekend and 0 = weekday.

Level 1 (within-person)

$$\text{Daily ON Symptoms} = \beta_0 + \beta_1 (\text{Day}) + \beta_2 (\text{Type of Day}) + R$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + U_0$$

$$\beta_1 = \gamma_{10} + U_1$$

$$\beta_2 = \gamma_{20} + U_2$$

where  $\gamma_{00}$  is the average ON symptoms when day = 0 and type of day = 0, and  $\gamma_{10}$  tests whether reporting day predicts ON symptoms that day. The parameter  $\gamma_{20}$  tests the mean difference in ON symptoms for weekdays vs. weekends. If  $\gamma_{20}$  was not significant, we planned to drop this variable from the next models.

**c. Research Aim 1.** Our first aim was to test daily stressors and negative affect as predictors of ON behavior in daily life (Hypothesis 1 and 2). To test Hypothesis 1 and 2, we used hierarchical linear modeling (HLM) using SPSS Statistics 25. The daily diary data were centered according to recommendations for longitudinal analyses (Bolger & Laurenceau, 2013) to tease apart within- from between-person associations. Two sets of HLM analyses (same-day and next-day analyses) were conducted to test the extent to which within-person fluctuations in daily stress and negative affect predicted ON behavior the same day and on the next day. Since past diary studies with college students and disordered eating established a temporal order to support stress predicting subsequent eating behavior (e.g., , Freeman & Gil, 2004), we only tested daily stress and negative affect as predictors of ON behaviors the next day in our next-day analyses (as opposed to testing for bidirectional associations).

In our study, daily assessments (level 1) were nested within participants (level 2). To disentangle within- from between-person associations, Level 1 predictors (daily diary assessments of stress and negative affect) were person mean centered, and the average level across the 14 days was added as a predictor of the intercept at level 2 (grand-mean centered). Any other continuous level 2 predictors were also grand-mean centered (Hofmann & Gavin,

1998). Thus, the level 1 predictors represented within-person fluctuations, or the extent to which stress, for example, was higher or lower than usual that day. A time variable (day) was centered such that the first daily diary day = 0. The dependent variable in this model was level of ON symptoms (a composite score of all the ON behaviors). Daily stress and negative affect were tested in the same model to test the unique predictive association of each, over and above the other variable. At level 1, models included daily positive affect as a covariate. At level 2, if preliminary analyses show that sex and past/current history of eating disorder diagnosis were significantly associated with ON or key predictor variables, these were included as predictors of the intercept to control for baseline differences. The HLM model (without Type of Day) is included below:

Level 1 (within-person)

$$\text{Daily ON Symptoms} = \beta_0 + \beta_1 (\text{Day}) + \beta_2 (\text{Daily Stress person-mean centered}) + \beta_3 (\text{Daily Negative Affect person-mean centered}) + \beta_4 (\text{Daily Positive Affect person-mean centered}) + R$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + \gamma_{01} (\text{Stress person mean}) + \gamma_{02} (\text{Negative Affect person mean}) + \gamma_{03} (\text{Positive Affect person mean}) + \gamma_{04} (\text{sex; current/past history of ED}) + U_0$$

$$\beta_1 = \gamma_{10} + U_1$$

$$\beta_2 = \gamma_{20} + U_2$$

$$\beta_3 = \gamma_{30} + U_3$$

$$\beta_4 = \gamma_{40} + U_4$$

where  $\gamma_{01}$  and  $\gamma_{02}$  represent the between-person associations between stress and negative affect, respectively, on the average level of ON symptoms across days. That is, these test the



extent to which people who, on average, have higher levels of stress/negative affect also have higher levels of ON symptoms, on average. The parameter  $\gamma_{20}$  tests Hypothesis 1, within-person fluctuations in stress predicting ON symptoms that day, and  $\gamma_{30}$  tests Hypothesis 2, within-person fluctuations in negative affect predicting ON symptoms that day. Random effects will be modeled if possible, however, if the random effects do not converge in SPSS, we planned to remove some of the random effects from our model, starting with the random effects from covariates first (i.e., random effect for day and daily positive affect).

We also examined the extent to which a baseline healthy diet significantly moderated the relation between daily stress (Hypothesis 3) or negative affect (Hypothesis 4) and ON symptoms. Building on the models from Hypothesis 1 and 2, participants' healthy diet score was added as a moderator to Level 2 (grand-mean centered [GMC]). The modified HLM is below:

Level 1 (within-person)

$$\begin{aligned} \text{Daily ON Symptoms} = & \beta_0 + \beta_1 (\text{Day}) + \beta_2 (\text{Daily Stress person-mean centered}) + \beta_3 \\ & (\text{Daily Negative Affect person-mean centered}) + \beta_4 (\text{Daily Positive Affect person-mean centered}) \\ & + R \end{aligned}$$

Level 2 (between-person)

$$\begin{aligned} \beta_0 = & \gamma_{00} + \gamma_{01} (\text{Stress person mean}) + \gamma_{02} (\text{Negative Affect person mean}) + \gamma_{03} (\text{Positive} \\ & \text{Affect person mean}) + \gamma_{04} (\text{sex/current/past history of ED}) + \gamma_{05} (\text{Healthy Diet}_{\text{GMC}}) + U_0 \end{aligned}$$

$$\beta_1 = \gamma_{10} + U_1$$

$$\beta_2 = \gamma_{20} + \gamma_{21} (\text{Healthy Diet}_{\text{GMC}}) + U_2$$

$$\beta_3 = \gamma_{30} + \gamma_{31} (\text{Healthy Diet}_{\text{GMC}}) + U_3$$

$$\beta_4 = \gamma_{40} + U_4$$

where  $\gamma_{21}$  represents the cross-level interaction between daily stress and baseline healthy diet on ON symptoms. The parameter  $\gamma_{31}$  represents the cross-level interaction between negative affect and healthy diet on ON symptoms. The parameter  $\gamma_{05}$  tests the main effect of healthy diet on ON symptoms. We planned to probe significant interactions using Preacher and colleagues' (2003) online interaction calculator for multilevel models to calculate simple slopes and regions of significance.

Next, we examined whether previous day stress (Hypothesis 5) and negative affect (Hypothesis 6) significantly predicted next-day ON-related behavior, controlling for the previous day's ON-behavior. The HLM model is included below:

Level 1 (within-person)

$$\text{Daily ON Symptoms}_{t+1} = \beta_0 + \beta_1 (\text{Day})_t + \beta_2 (\text{Daily Stress person-mean centered})_t + \beta_3 (\text{Daily Negative Affect person-mean centered})_t + \beta_4 (\text{ON Symptoms})_t + \beta_5 (\text{Daily Positive Affect person-mean centered})_t + R$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + \gamma_{01} (\text{Stress person mean}) + \gamma_{02} (\text{Negative Affect person mean}) + \gamma_{03} (\text{Positive Affect person mean}) + \gamma_{04} (\text{sex/current/past ED}) + U_0$$

$$\beta_1 = \gamma_{10} + U_1$$

$$\beta_2 = \gamma_{20} + U_2$$

$$\beta_3 = \gamma_{30} + U_3$$

$$\beta_4 = \gamma_{40} + U_4$$

$$\beta_5 = \gamma_{50} + U_5$$

Where  $t+1$  represents next day ON symptoms. Therefore,  $\beta_4$  controls for ON behavior on the previous day, which was entered grand-mean centered and was not partitioned in a within- and

between-person variable like the other Level 1 predictors. The parameter  $\gamma_{20}$  tests Hypothesis 5 (within-person fluctuations in previous day stress predicting ON symptoms the next day) and  $\gamma_{30}$  tests Hypothesis 6 (within-person fluctuations in previous day negative affect predicting ON symptoms the next day).

**d. Research Aim 2.** Our second aim was to test the extent to which perfectionism moderated the relation between daily stress and ON behaviors (Hypothesis 7) and the relation between daily negative affect and ON behaviors (Hypothesis 8). Building on the model from Hypotheses 1 and 2, perfectionism was added as a moderator to Level 2 (grand-mean centered [GMC]). The modified HLM is below:

Level 1 (within-person)

Daily ON Symptoms =  $\beta_0 + \beta_1 (\text{Day}) + \beta_2 (\text{Daily Stress person-mean centered}) + \beta_3 (\text{Daily Negative Affect person-mean centered}) + \beta_4 (\text{Daily Positive Affect person-mean centered}) + R$

Level 2 (between-person)

$\beta_0 = \gamma_{00} + \gamma_{01} (\text{Stress person mean}) + \gamma_{02} (\text{Negative Affect person mean}) + \gamma_{03} (\text{Positive Affect person mean}) + \gamma_{04} (\text{sex/Current/past history of ED}) + \gamma_{05} (\text{Perfectionism}_{\text{GMC}}) + U_0$

$\beta_1 = \gamma_{10} + U_1$

$\beta_2 = \gamma_{20} + \gamma_{21} (\text{Perfectionism}_{\text{GMC}}) + U_2$

$\beta_3 = \gamma_{30} + \gamma_{31} (\text{Perfectionism}_{\text{GMC}}) + U_3$

$\beta_4 = \gamma_{40} + U_4$

where  $\gamma_{21}$  represents the cross-level interaction between daily stress and perfectionism on ON symptoms. The parameter  $\gamma_{31}$  represents the cross-level interaction between negative affect and perfectionism on ON symptoms. The parameter  $\gamma_{05}$  tests the main effect of perfectionism on ON symptoms.

We also examined if perfectionism moderated the relation between previous day stress (Hypothesis 9) or negative affect (Hypothesis 10) and ON symptoms the next day. Building on the model for Hypothesis 7 and 8, perfectionism was added as moderator to Level 2 (grand-mean centered [GMC]). The HLM model is as follows:

Level 1 (within-person)

Daily ON Symptoms<sub>t+1</sub> =  $\beta_0$  +  $\beta_1$  (Day) +  $\beta_2$  (Daily Stress person-mean-centered)<sub>t</sub> +  $\beta_3$  (Daily Negative Affect person-mean centered)<sub>t</sub> +  $\beta_4$  (ON Symptoms)<sub>t</sub> +  $\beta_5$  (Daily Positive Affect person-mean centered)<sub>t</sub> + R

Level 2 (between-person)

$\beta_0 = \gamma_{00} + \gamma_{01}$  (Stress person mean) +  $\gamma_{02}$  (Negative Affect person mean) +  $\gamma_{03}$  (Positive Affect person mean) +  $\gamma_{04}$  (sex/current/past history of ED) +  $\gamma_{05}$  (Perfectionism<sub>GMC</sub>) +  $U_0$

$\beta_1 = \gamma_{10} + U_1$

$\beta_2 = \gamma_{20} + \gamma_{21}$  (Perfectionism<sub>GMC</sub>) +  $U_2$

$\beta_3 = \gamma_{30} + \gamma_{31}$  (Perfectionism<sub>GMC</sub>) +  $U_3$

$\beta_4 = \gamma_{40} + U_4$

$\beta_5 = \gamma_{50} + U_5$

where  $\gamma_{21}$  represents the cross-level interaction between previous day daily stress and perfectionism on next day ON symptoms, and the parameter  $\gamma_{31}$  represents the cross-level interaction between previous day negative affect and perfectionism on next day ON symptoms.

**e. Research Aim 3.** Our third aim was to test the extent to which negative appearance-focused family culture predicts ON symptoms, over and above perfectionism, obsessive-compulsive tendencies, past dieting, current or past eating disorders, and neuroticism (Hypothesis 11), using data from the baseline survey. For this aim, we utilized multiple regression. The predictor in this model was the composite score of negative appearance-related family behavior and the outcome was the composite score of the ONI and E-DOS at baseline. The model controlled for perfectionism, obsessive-compulsive tendencies, past dieting, current or past eating disorders, and neuroticism.

**f. Exploratory Analyses.** We also tested whether the different domains of perfectionism (SOP and SPP) moderated the relation between daily stress and ON symptoms. Building on the models for Hypothesis 7 and 8, we tested SOP and SPP in the model as moderators and examined which type of perfectionism significantly moderated the relation between daily stress and ON symptoms, over and above the other.

In addition, we examined whether the type of day (weekend or a weekday) moderated the within-person relation between daily stress or negative affect and ON symptoms on the same day. We ran two different models to test the two-way interaction between type of day and (a) daily stress and (b) negative affect. The HLM model was as follows:

Level 1 (within-person)

$$\text{Daily ON Symptoms} = \beta_0 + \beta_1 (\text{Type of Day}) + \beta_2 (\text{Daily Stress person-mean centered}) + \beta_3 (\text{Daily Negative Affect person-mean centered}) + \beta_4 (\text{Daily Positive Affect person-mean centered}) + \beta_5 (\text{Type of Day})(\text{Daily Stress/Negative Affect}) + R$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + \gamma_{01} (\text{Stress mean}) + \gamma_{02} (\text{Negative Affect mean}) + \gamma_{03} (\text{Positive Affect mean}) + \gamma_{04}(\text{sex/Current/past history of ED}) + U_0$$

$$\beta_1 = \gamma_{10} + U_1$$

$$\beta_2 = \gamma_{20} + U_2$$

$$\beta_3 = \gamma_{30} + U_3$$

$$\beta_4 = \gamma_{40} + U_4$$

$$\beta_5 = \gamma_{50} + U_5$$

$$\beta_4 = \gamma_{40} + U_4$$

Finally, we also examined baseline eating pathology measured by the EDDS as a moderator of the relation between daily stress or negative affect and ON symptoms on the same day and on the next day. Building on models for Hypotheses 1 and 2, we added baseline eating pathology (grand mean centered [GMC]) to Level 2 as follows:

Level 1 (within-person)

$$\text{Daily ON Symptoms} = \beta_0 + \beta_1 (\text{Day}) + \beta_2 (\text{Daily Stress person-mean centered}) + \beta_3 (\text{Daily Negative Affect person-mean centered}) + \beta_4 (\text{Daily Positive Affect person-mean centered})$$

Level 2 (between-person)

$$\beta_0 = \gamma_{00} + \gamma_{01} (\text{Stress person mean}) + \gamma_{02} (\text{Negative Affect person mean}) + \gamma_{03} (\text{Positive Affect person mean}) + \gamma_{04}(\text{sex/Current/past history of ED}) + \gamma_{05}(\text{Baseline Eating Pathology}) + u_0$$

$$\beta_1 = \gamma_{10} + U_1$$

$$\beta_2 = \gamma_{20} + \gamma_{21} (\text{Baseline Eating Pathology}_{\text{GMC}}) + U_2$$

$$\beta_3 = \gamma_{30} + \gamma_{31} (\text{Baseline Eating Pathology}_{\text{GMC}}) + U_3$$

$$\beta_4 = \gamma_{40} + U_4$$

where  $\gamma_{21}$  represented the cross-level interaction between daily stress and baseline eating pathology on ON symptoms. The parameter  $\gamma_{31}$  represents the cross-level interaction between negative affect and baseline eating pathology on ON symptoms. The parameter  $\gamma_{05}$  tested the main effect of baseline eating pathology on ON symptoms.

Building on the model for Research Questions 7 and 8, baseline eating pathology was also added as a moderator to Level 2 (grand-mean centered [GMC]). The HLM model is as follows:

Level 1 (within-person)

Daily ON Symptoms<sub>t+1</sub> =  $\beta_0 + \beta_1$  (Day) +  $\beta_2$  (Daily Stress person-mean-centered)<sub>t</sub> +  $\beta_3$  (Daily Negative Affect person-mean centered)<sub>t</sub> +  $\beta_4$ (ON Symptoms)<sub>t</sub> +  $\beta_5$ (Daily Positive Affect person-mean centered)<sub>t</sub> + R

Level 2 (between-person)

$\beta_0 = \gamma_{00} + \gamma_{01}$  (Stress person mean) +  $\gamma_{02}$  (Negative Affect person mean) +  $\gamma_{03}$  (Positive Affect person mean) +  $\gamma_{04}$ (sex/current/past history of ED) +  $\gamma_{05}$ (Baseline Eating Pathology<sub>GMC</sub>) +  $U_0$

$\beta_1 = \gamma_{10} + U_1$

$\beta_2 = \gamma_{20} + \gamma_{21}$  (Baseline Eating Pathology<sub>GMC</sub>) +  $U_2$

$\beta_3 = \gamma_{30} + \gamma_{31}$  (Baseline Eating Pathology<sub>GMC</sub>) +  $U_3$

$\beta_4 = \gamma_{40} + U_4$

$\beta_5 = \gamma_{50} + U_5$

where  $\gamma_{21}$  represented the cross-level interaction between previous day daily stress and baseline eating pathology on next day ON symptoms. The parameter  $\gamma_{31}$  represented the cross-level interaction between previous day negative affect and baseline eating pathology on next day ON symptoms.

## 2.8. Power

Previous studies using multilevel modeling examining disordered eating behavior, assuming 14 repeated measures and a small effect size for direct effects had a sample size of 66 (Barker et al., 2006), with intra-class correlations (ICC) ranging from .02 to .60, and a sample size of 124 (Katan & Kelly, 2021), with ICCs in the range of .07 to .61 for the outcome variables. Arend and Schäfer's (2019) statistical power simulation study for two-level multilevel models showed that, with 14 repeated assessments and assuming an intra-class correlation of .10 for the outcome variable (i.e, small), a sample size of at least 100 was needed to detect a small direct effect of .11 (standardized regression coefficient) at Level 1. Assuming an intra-class correlation of .30 for the outcome variable (i.e, medium), a sample size of at least 100 was also sufficient to detect a large effect size of .78 for a cross-level interaction. Thus, we aimed to collect a minimum sample size of 100.

Our final analytic sample was 142. A sensitivity analysis revealed that for a sample size of 150, 14 repeated assessments, and a medium ICC of .31 for our daily ON composite, the minimum detectable effect size for a Level 1 direct effect was .10 to achieve power  $\geq .80$ . For a cross-level interaction, the minimum detectable effect size was .28. Thus, our study was powered to detect a small direct effect for Research Hypotheses 1, 2, 5 and 6 and to detect a medium cross-level interaction effect for Research Hypotheses 3, 4, and 7 to 10.

For research question 11, a power analysis using the program G\*Power (Faul et al., 2009) for a linear multiple regression [fixed model,  $R^2$  increase] showed that a minimum sample size of 647 was needed to achieve a power of .80 and a small effect size of  $f^2 = .02$  for the interaction, assuming that there were a total of five predictors in the model and all five of them were significant. For a medium effect size of  $f^2 = .15$  for the interaction, a minimum sample size of 92



was needed. A minimum sample size of 43 was needed for a large effect size of  $f^2=.30$  for the interaction. A sensitivity analyses revealed that with a sample of 142 and a power of .80, the minimum detectable effect size for Research Hypothesis 11 was  $f^2= 0.095$  (small to medium effect size).

## Chapter 3

## RESULTS

### 3.1. Preliminary Analyses

Normality and distributional assumptions were tested. Results of the Q-Q plots indicated the baseline ON composite, OCDIR, and EDDS symptoms were not normally distributed and were positively skewed. Skewness statistics for the ON composite, OCDIR, and EDDS symptoms, however, were within acceptable range (i.e.,  $< 2$ ; Hair et al., 1998); therefore, we did not transform these variables. Six outliers ( $\geq 3.29$  *SD* from the mean; Tabachnick & Fidell, 2012) were identified on the ONI, EDDS (total symptoms score), and OCDI-R. On the ONI, the outliers scores were 76 and 78. A score of 72 or higher on the ONI indicates presence or high risk for ON. We decided against excluding this data because our study aim was to observe the presence of ON in a college-aged population. On the EDDS, the outlier score was 82. The clinical cutoff score that indicates possible presence of an eating disorder is 16.5. Upon closer examination, the participant's eating disorder diagnosis as identified by the EDDS was subthreshold anorexia nervosa (according to the DSM-IV criteria). Moreover, the participant reported scores of more than 4 on items 1 to 4 of the EDDS, which are indicative of body image disturbance, intense fear of gaining weight/becoming fat, and undue influence of weight and shape on their self-evaluation. Additionally, this participant indicated an eating disorder diagnosis within the past 6 months. We decided to retain this participant's data in our sample

because our study aims were to examine orthorexia nervosa knowing that there is a possibility of ON being an eating disorder on its own or overlapping with traditional eating disorders. On the

OCDI-R, one outlier score of 84 was identified; scores of 21 and above on the OCDI-R indicate possible presence of OCD. We decided against excluding this data because one of our study aims is to examine the possible overlap between OCD and ON.

The majority of the sample did not report ever having been diagnosed with an eating disorder on the demographic questionnaire (87.3%), whereas 18 participants (12.7%) reported that they had been diagnosed with an eating disorder before. Out of these 18 participants, only four of them reported that this eating disorder diagnosis had been given in the past 6 months. Only two participants in the sample (1.4%) met the ONI cut-off for presence of and/or risk of orthorexia nervosa (i.e., score  $\geq 72$ ), whereas eight participants (5.6%) met the E-DOS cut-off (i.e., score  $\geq 30$ ) for an ON diagnosis. In addition, nine participants (6.3%) met the cut-off for being at risk for ON (score between 25-29).

For the daily diary variables, Q-Q plots indicated that daily average ON symptoms (and the daily average ON symptoms without negative affect items) as well as daily average stress intensity were positively skewed. Their kurtosis and skewness, however, were all within limits (kurtosis  $\leq 1$ ; skewness  $\leq 2$ ; Hair et al., 1998). Therefore, we decided not to transform these variables. Daily average negative affect and positive affect were both close to normal on Q-Q plots. In addition, Q-Q plots for the variables relevant to Research Aim 3 (negative appearance-focused family culture, past dieting, current or past eating disorders, and neuroticism) revealed that they were all normally distributed.

The average number of daily diary records participants completed was 12.24 ( $SD = 2.02$ ). The majority of participants completed either 13 days of records (25.4%) or all 14 days (33.8%)

of daily diary records. The lowest number of days of daily diary records completed were 5 days ( $n = 1$ ) and 6 days ( $n = 1$ ). These 2 participants, however, had informed the researcher during the study that they had technical issues with the SEMA3 application and only received notifications every 2 days, instead of every day. Troubleshooting on the researcher's, developers', and participants' ends did not resolve the issues. Four participants (2.8%) completed 7 days of records, three participants (2.1%) completed 8 days of records, 6.3% of participants completed 9 days of records, 6.3% of participants completed 10 days of records, eight participants (5.6%) completed 11 days of records, and 23 participants (16.2%) completed 12 days of records. There were no missing data in our sample on the baseline measures.

The average daily ON symptoms reported by the participants was 14.46 ( $SD = 11.93$ ). Given the maximum score on this measure is 92, participants self-reported low levels of ON behaviors each day. The average daily stress intensity score was 3.44 ( $SD = 3.32$ ). Considering that the maximum score a participant could rate per stressful event in a day was 7, this shows that on average, participants experienced moderate levels of stress intensity in their daily lives. Based on the individual items on the daily stress checklist, participants reported experiencing interpersonal stress, academic stress, embarrassment, illness, injury or accident, job-related stressors, financial problems, and also selected the "other types of stress not captured by the above" option.

Academic stress was most frequently endorsed among all the options on the checklist.

Participants reported experiencing an average daily negative affect of 11.42 ( $SD = 2.48$ ); the maximum score possible was 45, suggesting that participants reported low-to moderate levels of daily negative affect (about 25% of the maximum score).

Descriptive statistics and bivariate correlations between all study baseline and daily diary variables (averaged across the 14 days) are in Table 3. Average daily negative affect strongly

correlated in a positive direction with average daily ON symptoms,  $r = .50, p < .001$  ( $r = .44, p < .001$ , using daily ON symptoms without the negative affect items included). This provides preliminary support for Hypotheses 2 and 6. Moreover, a healthy diet was positively associated with participants' baseline ON symptoms,  $r = .18, p = .04$ . In addition, perfectionism was significantly correlated with average daily stress intensity,  $r = .25, p = .003$ , daily negative affect,  $r = .30, p < .001$ , baseline ON symptoms,  $r = .19, p = .02$ , negative appearance-focused family culture,  $r = .28, p = .001$ , and OCD symptoms,  $r = .40, p < .001, r = .34, p < .001$ . Moreover, self-oriented perfectionism was significantly correlated with average daily negative affect,  $r = .28, p = .001$ , and baseline ON symptoms,  $r = .21, p = .01$ . Negative appearance-focused family culture (composite) was positively associated with daily ON symptoms,  $r = .34, p < .001$  ( $r = .28, p = .001$ , using daily ON symptoms without negative affect items).

We conducted independent samples t-tests to test for potential differences between males and females on the baseline and daily diary measures in our sample. There was a significant difference on the BFI neuroticism scale,  $t(140) = 2.39, p = .02$ , whereby females ( $M = 25.08, SD = 6.64$ ) reported significantly higher levels of neuroticism than males ( $M = 22.06, SD = 5.38$ ). There was also a significant difference on the EDDS symptoms total score,  $t(140) = 4.02, p < .001$ , such that females ( $M = 22.55, SD = 13.95$ ) reported significantly higher eating disorder symptoms than males ( $M = 11.97, SD = 10.57$ ). There was also a significant difference between females and males on the negative appearance-focused family culture composite,  $t(140) = 3.27, p = .001$ , such that females reported higher levels of negative appearance-focused family culture behavior ( $M = 0.37, SD = 2.61$ ) than males ( $M = -1.25, SD = 2.07$ ). Examining the individual measures that make-up the negative appearance-focused family culture composite, there were significant differences between females and males reports' on the DEBQ,  $t(140) = 2.36, p =$

.02, and the FFTQ (Family Subscale),  $t(140) = 3.88, p < .001$ . On the DEBQ, females reported significantly higher restraint behavior from their parents ( $M = 28.06, SD = 10.87$ ) than males ( $M = 23.12, SD = 9.36$ ). Likewise, females ( $M = 19.34, SD = 8.44$ ) reported significantly higher levels of family fat talk than males ( $M = 13.09, SD = 6.93$ ). There were no significant differences between female and males on their daily average ON symptoms,  $t(140) = 1.33, p = .19$ , and daily average ON symptoms without negative affect items included,  $t(140) = 1.18, p = .24$ . Based on these results, we did not control for sex in models related to Research Aims 1 and 2; however, we did control for sex in regression models testing negative appearance-focused family culture on ON behavior (Research Aim 3; Hypothesis 11).

We also tested for differences between participants with a current or past history of eating disorder diagnosis on the baseline and daily diary measures in our sample. Participants who reported having an eating disorder diagnosis in the past reported significantly higher ON symptoms on the ON baseline composite score ( $M = 1.80, SD = 2.77$ ) compared to those who had never been diagnosed with an eating disorder ( $M = -0.26, SD = 1.63$ ),  $t(140) = -4.53, p < .001$ . Participants who reported a history of an eating disorder diagnosis also reported higher levels of negative appearance-focused family culture in their families ( $M = 1.66, SD = 2.94$ ) compared to those without a history of an eating disorder diagnosis ( $M = -0.24, SD = 2.45$ ),  $t(140) = -3.00, p = .003$ . In addition, participants with a history of an eating disorder diagnosis reported higher eating disorder symptomology on the EDDS ( $M = 29.39, SD = 16.58$ ) compared to participants who had never been diagnosed with an eating disorder ( $M = 18.74, SD = 13.06$ ),  $t(140) = -3.12, p = .002$ .

For the daily average ON symptoms, participants who reported a history of an eating disorder diagnosis reported significantly higher daily ON symptoms on average ( $M = 21.21, SD = 14.74$ )

compared to participants without an eating disorder diagnosis ( $M = 13.48$ ,  $SD = 11.20$ ),  $t(140) = -2.62$ ,  $p = .01$ . Likewise, they reported higher daily average ON symptoms without the negative affect items ( $M = 17.06$ ,  $SD = 5.10$ ) compared to participants without an eating disorder diagnosis ( $M = 10.96$ ,  $SD = 9.10$ ),  $t(140) = -2.50$ ,  $p = .01$ . Examining the composite variables further, group differences were found on the FFTQ family scale, DEBQ restraint scale, and both measures that made up the ON composite.

### **3.2. Multilevel Models**

First, we added reporting day (diary day 1 = 0) to test whether ON behaviors systematically changed during the reporting period. *Reporting Day* was not significant,  $p = .14$ , however, we decided to retain this variable based on best practices recommendations by Bolger and Laurenceau (2013) who stated that elapsed time should always be included in the model because conceivably, it could be an important index of other variables that were unmeasured in the model that are closely related to time. Next, we tested if ON behaviors systematically differed on weekends vs. weekday by adding a dichotomous *Type of Day* variable to Level 1. Weekend was significant at Level 1,  $p < .001$ . Therefore, we retained *Type of Day* in all our models.

### **3.3. Research Aim 1**

Our first aim was to test daily stressors and negative affect as predictors of ON behavior in daily life. We expected that there would be a positive within-person association between daily stress and orthorexia symptoms on the same day (Hypothesis 1), as well as a positive, within-person association between negative affect and orthorexia symptoms on the same day (Hypothesis 2). That is, we expected participants to report higher levels of ON-related behavior on days with higher-than-usual daily stress intensity or daily negative affect on the same day. Results from the multilevel model testing these hypotheses are in Table 4. There was a positive

within-person association between daily stress intensity and ON behavior on the same day, such that those who experienced higher levels of stress than usual that day also engaged in higher levels of ON behavior,  $b = 0.10$ ,  $SE = 0.04$ ,  $p = .04$ . Moreover, there were significant between-person associations between stress intensity and negative affect in predicting ON behavior. Specifically, on average, those with lower stress intensity levels across the 14-day period, relative to the others in the sample, engaged in more ON behaviors,  $b = -0.93$ ,  $SE = 0.29$ ,  $p = .002$ . On average, those with higher levels negative affect across the 14-day period, relative to others in the sample, also had higher average levels of ON behavior,  $b = 2.26$ ,  $SE = 0.29$ ,  $p < .001$ . In addition, on average, those with higher levels of positive affect across the 14-day period, relative to others in the sample, also had higher average levels of ON behavior,  $b = 0.72$ ,  $SE = 0.34$ ,  $p = .04$ . There was also a positive between-person association between current/past eating disorder history and ON behavior on the same day, such that people who have or had ever been diagnosed with an eating disorder engaged in higher levels of ON behavior, on average,  $b = 5.80$ ,  $SE = 2.48$ ,  $p = .02$ .

Next, we examined the extent to which the association between daily stress (Hypothesis 3) or negative affect (Hypothesis 4) and ON behavior was moderated by an already healthy diet. We expected that having a healthy diet would exacerbate the association between daily stress (Hypothesis 3) and negative affect (Hypothesis 4) and ON behaviors, such that at higher levels of a healthy diet, the association between daily stress/negative affect and orthorexia nervosa symptoms would be stronger, and at lower levels of a healthy diet, the association between daily stress/negative affect and orthorexia nervosa symptoms would be weaker. Results from the multilevel model are presented in Table 5. The positive within-person association between daily stress intensity and ON behavior on the same day remained significant,  $b = 0.10$ ,  $SE = 0.42$ ,  $p =$



.03; however, an already healthy diet did not significantly moderate this association,  $b = 0.01$ ,  $SE = 0.01$ ,  $p = .29$ . There was not a significant within-person association between daily negative affect and ON behavior on the same day,  $b = 0.14$ ,  $SE = 0.09$ ,  $p = .11$ , nor did a healthy diet moderate this association,  $b = -0.03$ ,  $SE = 0.02$ ,  $p = .12$ . The between-person associations of (a) stress intensity,  $b = 0.87$ ,  $SE = 0.29$ ,  $p = .003$ , (b) negative affect,  $b = 2.26$ ,  $SE = 0.29$ ,  $p < .001$ , and (c) positive affect,  $b = 0.70$ ,  $SE = 0.34$ ,  $p = .04$ , remained significant.

In addition, we expected that previous day stress (Hypothesis 5) and negative affect (Hypothesis 6) would significantly predict next-day ON-related behavior, controlling for the previous day's ON behavior. Results from this multilevel model are presented in Table 6. Neither previous day stress intensity,  $b = -0.01$ ,  $SE = 0.04$ ,  $p = .86$ , nor negative affect,  $b = -0.19$ ,  $SE = 0.09$ ,  $p = .24$ , significantly predict ON behavior on the next day. The autoregressive effect of the previous day ON behavior, however, significantly predicted next-day ON behavior,  $b = 0.35$ ,  $SE = 0.03$ ,  $p < .001$ , such that higher levels of previous day ON symptoms predicted higher levels of next-day ON symptoms. The between-person associations of (a) stress-intensity,  $b = -0.61$ ,  $SE = 0.20$ ,  $p = .003$ , (b) negative affect,  $b = 1.47$ ,  $SE = 0.20$ ,  $p < .001$ , and (c) positive affect,  $b = 0.48$ ,  $SE = 0.03$ ,  $p < .001$ , remained significant.

### **3.4. Research Aim 2**

Our second aim was to test the extent to which perfectionism moderated within-person relations between daily stress and ON behaviors and relations between daily negative affect and ON behaviors. We expected that higher levels of perfectionism would exacerbate the association between same day stress and ON behavior (Hypothesis 7) as well as the association between same day negative affect and ON behavior (Hypothesis 8), such that at higher levels of perfectionism, the within-person association between daily stress/negative affect and orthorexia

nervosa symptoms would be stronger, and at lower levels of perfectionism, the association between daily stress/negative affect and ON symptoms would be weaker. Results from the multilevel model are presented in Table 7. The positive within-person association between daily stress intensity and ON behavior on the same day remained significant,  $b = 0.09$ ,  $SE = 0.04$ ,  $p = .04$ ; however, this association was not moderated by perfectionism,  $b = -0.0001$ ,  $SE = 0.001$ ,  $p = .29$ . The within-person association between daily negative affect and ON behavior on the same day was not significant,  $b = 0.16$ ,  $SE = 0.09$ ,  $p = .08$ , nor was it moderated by levels of perfectionism,  $b = 0.0001$ ,  $SE = 0.003$ ,  $p = .53$ . The main effect of perfectionism was also not significant,  $b = -0.02$ ,  $SE = 0.03$ ,  $p = .45$ . The between-person associations of (a) stress intensity,  $b = -0.80$ ,  $SE = 0.32$ ,  $p = .02$ , and (b) negative affect,  $b = 2.18$ ,  $SE = 0.32$ ,  $p < .001$ , remained significant.

We also expected that higher levels of perfectionism would significantly exacerbate the relation between previous day stress (Hypothesis 9) or negative affect (Hypothesis 10) and next day ON symptoms. That is, at higher levels of perfectionism, the association between previous day stress and next day ON symptoms would be stronger, and at lower levels of perfectionism, the association between previous day stress and next day ON would be weaker. Results from this multilevel model are presented in Table 8. In this model, neither daily stress intensity,  $b = -0.01$ ,  $SE = 0.44$ ,  $p = .81$ , nor negative affect,  $b = -0.12$ ,  $SE = .009$ ,  $p = .17$ , were significantly associated within-person with ON behavior on the same day. Moreover, perfectionism also did not significantly moderate the association between previous day stress and next day ON symptom,  $b = 0.001$ ,  $SE = 0.001$ ,  $p = .44$ , nor did it significantly moderate the association between previous day negative affect and next day ON symptoms,  $b = 0.003$ ,  $SE = .003$ ,  $p = .31$ . The main effect of perfectionism was also not significant,  $b = -0.0001$ ,  $SE = 0.02$ ,  $p = .07$ . Previous day ON

symptoms were significantly associated with higher ON symptoms the next day,  $b = 0.36$ ,  $SE = 0.03$ ,  $p < .001$ . The between-person associations of (a) stress intensity,  $b = -0.59$ ,  $SE = 0.19$ ,  $p = .004$ , (b) negative affect,  $b = 1.39$ ,  $SE = 0.21$ ,  $p < .001$ , and (c) positive affect,  $b = 0.45$ ,  $SE = 0.23$ ,  $p = .05$ , remained significant.

### **3.5. Research Aim 3**

The results from the linear multiple regression are presented in Table 9. As hypothesized, the results demonstrated that negative appearance-focused comments and behaviors in participants' families significantly predicted higher levels of baseline ON symptoms,  $b = 0.27$ ,  $SE = 0.06$ ,  $p < .001$ ,  $\beta = 0.36$ , over and above other known predictors of ON (perfectionism, OCD symptoms, neuroticism, dieting, current or past history of eating disorders) and controlling for participant sex. This model accounted for 28% of the variance in participants' baseline ON symptoms. We also conducted a post-hoc step-wise linear regression to examine the proportion of variance that appearance-focused comments and behaviors added to the model. In Step 1, we added sex and the known predictors of ON (i.e., perfectionism, OCD symptoms, neuroticism, dieting, current or past history of eating disorders). In Step 2, we added negative appearance-focused family culture. Appearance-focused comments and behaviors predicted an additional 9.4% of the variance in the model (Step 1  $R^2 = .19$ , Step 2  $R^2 = .28$ ,  $\Delta R^2 F(1, 132) = 17.38$ ,  $p < .001$ ).

### **3.6. Supplemental Exploratory Aims**

As a supplemental, exploratory aim, we also examined the different domains of perfectionism (self-oriented perfectionism and socially-prescribed perfectionism) as separate moderators to test the extent to which they differentially moderate associations. We expected that both SOP and SPP would exacerbate the relation between daily total stress and ON symptoms on

the same day, such that at higher levels of SOP or SPP, the association between daily stress/negative affect and ON symptoms would be stronger on the same day, and at lower levels of SOP or SPP, the association between daily stress/negative affect and ON symptoms would be weaker on the same day. Results from this multilevel model are presented in Table 10. The positive within-person association between daily stress intensity and ON behavior on the same day remained significant,  $b = 0.10$ ,  $SE = 0.04$ ,  $p = .03$ ; neither self-oriented perfectionism,  $b = -0.004$ ,  $SE = 0.003$ ,  $p = .24$ , nor socially prescribed perfectionism  $b = 0.002$ ,  $SE = 0.003$ ,  $p = .60$ , significantly moderated this association. There were, however, main effects of self-oriented perfectionism  $b = 0.16$ ,  $SE = 0.07$ ,  $p = .02$ , and socially prescribed perfectionism,  $b = -0.18$ ,  $SE = 0.06$ ,  $p = .004$ , whereby people with higher levels of self-oriented and socially prescribed perfectionism, on average, engaged in higher levels of ON behaviors across the 14 days.

Another supplemental exploratory aim was to examine whether type of day (weekend or weekday) significantly moderated the within-person relations between daily stress or negative affect and ON symptoms. No a priori hypotheses were made regarding the extent to which type of day (weekend vs. weekday) would moderate the within-person relation between daily stress/negative affect and ON symptoms on the same day. Results from this multilevel model are presented in Table 11. In this model, neither daily stress intensity,  $b = 0.08$ ,  $SE = 0.09$ ,  $p = .10$ , nor negative affect,  $b = 0.16$ ,  $SE = 0.09$ ,  $p = .18$ , was associated with ON symptoms on the same day. Type of day also did not significantly moderate the association between daily stress intensity and ON symptoms,  $b = -0.04$ ,  $SE = 0.09$ ,  $p = .55$ , or negative affect and ON symptoms,  $b = 0.02$ ,  $SE = 0.15$ ,  $p = .92$ . There was, however, a main effect of type of day,  $b = -1.47$ ,  $SE = 0.39$ ,  $p < .001$ , indicating that ON symptoms were higher on the weekends compared to the weekdays.

A third supplemental exploratory aim was to examine baseline eating pathology measured by the Eating Disorder Diagnostic Scale (EDDS; Stice et al., 2000) as a moderator of the relation between daily stress or negative affect and ON symptoms. We expected that higher current levels of eating pathology would exacerbate the relation between daily stress or negative affect and ON symptoms on the same day, such that at higher levels of current eating pathology, the within-person relation between daily stress/negative affect and ON symptoms would be stronger on the same day, and at lower levels of current eating pathology, the relation between daily stress/negative affect and ON symptoms would be weaker on the same day. Likewise, we expected the same moderating effect when examining next-day associations. Results from these multilevel models are in Table 12 and 13. Although there was a positive within-person association between daily stress intensity and same-day ON behavior,  $b = 0.10$ ,  $SE = 0.05$ ,  $p = .04$ , baseline eating pathology did not significantly moderate this association,  $b = 0.001$ ,  $SE = 0.003$ ,  $p = .85$ . Baseline eating pathology also did not moderate within-person associations between negative affect and ON behavior the same day,  $b = 0.004$ ,  $SE = 0.01$ ,  $p = .47$ . There was, however, a main effect of baseline eating pathology, such that higher levels of baseline eating pathology measured by the EDDS was associated with higher average levels of ON symptoms across the diary days,  $b = 0.20$ ,  $SE = 0.07$ ,  $p = .01$ . Next-day ON behavior was not significantly associated with daily stress intensity,  $b = -0.005$ ,  $SE = 0.05$ ,  $p = .92$ , or negative affect  $b = -0.11$ ,  $SE = -0.11$ ,  $p = .23$ , at the within-person level. Baseline eating pathology also did not significantly moderate the within-person associations between previous day stress intensity,  $b = -0.0002$ ,  $SE = 0.002$ ,  $p = .93$ , or previous day negative affect,  $b = .002$ ,  $SE = 0.01$ ,  $p = .80$ , and next day ON symptoms.

### **3.7. Sensitivity Analyses Removing Negative Affect Items from Daily ON Composite**

Without the negative affect items included, the within-person association between daily stress intensity and ON behavior on the same day was no longer significant,  $b = 0.06$ ,  $SE = 0.03$ ,  $p = .07$ . The between-person associations for current/past eating disorder history, stress intensity, negative affect, and positive affect all remained significant and in the same direction as in our model that included the negative affect items. The next-day associations without the negative affect items included also did not change from our model including the negative affect items; neither previous day stress intensity nor negative affect significantly predict ON behavior on the next day. Moreover, the null moderating effects of an already healthy diet and perfectionism same-day and next-day model remained non-significant.

## Chapter 4

### DISCUSSION

The purpose of this study was to test how daily stress and negative affect predict ON behavior in college students, as well as the moderating effects of perfectionism and an already healthy diet on these relations. Moreover, we also tested the predictive effect of negative appearance-focused family cultures on baseline levels of ON symptoms. There has been a scarcity of research on the relatively new phenomena of ON compared to established traditional eating disorders such as anorexia nervosa and bulimia nervosa. The limited studies to date have examined direct main effects and/or correlations between ON and other factors, such as previous eating disorder diagnoses, as well as the impact of ON on other health outcomes. Moreover, empirically-tested interventions specifically for ON have not been established. Therefore, it is imperative to examine factors associated with ON symptoms – including those on a within-person and between-person basis – so that we can better understand ON as a psychological disorder and develop interventions and preventative programs. In addition, examining possible family-level risk factors of ON can inform current family-based treatments for eating disorders and preventative efforts, such as public service campaigns educating parents about the adverse impact of comments about dieting, weight, and shape in the family.

There were three main study findings that emerged. First, daily stress intensity level was positively associated with ON behavior on the same day; that is, when participants experienced higher stress intensity levels than usual, they engaged in more ON behavior on the same day.

This finding should be taken with caution, however, because this association was no longer significant in our models that removed the negative affect items from our daily ON measure. Previous cross-sectional studies have reported that higher stress was associated with pathological and restrictive eating behaviors (Cattanach et al., 1998; Crowther et al., 2001; Raffi et al., 2000). Furthermore, people with higher scores of ON behaviors report higher levels of anxiety, stress, and depressive symptoms (Strahler et al., 2018).

Restrictive and controlled eating has been conceptualized as a type of coping mechanism in response to stress in EMA studies with BED (Barker et al., 2006) and AN (White et al., 2016). The Transactional Model of Emotion Dysregulation (Haynos & Fruzzetti, 2011) explains this response as it applies to AN. In this model, individuals with AN who experience ordinary stressful or emotional events have an increased emotional sensitivity compared to the average person. Three factors influence the individual's heightened arousal to daily stressful events: (1) the person's vulnerabilities to negative arousal, (2) the event itself, (3) and the judgments he/she makes about the event, self, and/or others. When an individual is highly emotionally aroused because of a stressor, this leads to an increased likelihood of an inaccurate expression of their internal experience, which can lead to expressing a secondary emotion rather than a primary one or may result in out-of-control behaviors (e.g., self-injury, eating disorder behavior). The food restriction is negatively reinforced because it reduces the emotional arousal (e.g., anxiety, shame) in the short-term. Because of this inaccurate expression of emotions, however, it is less likely that those around the individual will understand their emotional experience and, thus, it is more likely that the individual will feel invalidated by others, further exacerbating their emotional dysregulation.



This model may explain the potential mechanisms underlying the positive, within-person association between daily stress intensity and ON behavior that we found. When individuals experience more stress than usual, the resulting emotional arousal and dysregulation may lead an individual to express their emotion in a secondary manner, through controlling their diet and eating habits (eating disordered behavior), which helps to reduce their feelings of stress. In turn, the dieting, restriction, and control is reinforced. A recent study in Germany with a young adult sample ( $M = 28.5$  years,  $SD = 7.8$ ) found that people with higher ON tendencies believed that only healthy foods relieve stress. Therefore, the researchers posited that individuals with ON behavior have developed beliefs that nutritional food is not only important for physical health reasons (e.g., avoid physical illnesses, maintain a healthy body physique), also for psychological health; thereby reinforcing their ON behavior (Steinmann et al., 2022).

Although daily stress intensity was positively associated with ON symptoms on the same day, we did not find this association with next-day effects. According to the Transactional Model of Emotion Dysregulation, engaging in ON behavior on the same day provides sufficient relief from the stress the individual is feeling about the same-day event; thus, spillover of stress to the next day's eating behavior is not necessarily expected. Previous daily diary studies also did not find that previous day stress predicted next-day eating disorder behavior (Barker et al., 2006; Goldschmidt et al., 2014; Heatherton & Baumeister, 1991; Polivy & Herman, 1993, 1999; Smyth et al., 2007; White et al., 2016). Taken together, research suggests that perhaps emotional relief obtained from eating disordered behavior is short-lived.

Counter to our hypotheses and existing literature on eating disorders, the between-person association between stress intensity and ON behavior was negative. That is, those with lower average stress intensity levels across the 14-day period, relative to the others in the sample,

engaged in *more* ON behaviors. This finding could be explained by existing literature on stress-induced eating (Greeno & Wing, 1994) and social status. A systematic review (Moore et al., 2012) found that people in higher social status positions (measured by education, income, and occupational prestige) tended to have lower stress levels, which was significantly associated with healthier eating patterns and lower body weight. On the other hand, higher stress was associated with less healthy dietary habits and higher body weight in people from a lower socioeconomic background (Moore et al., 2012). Our sample was recruited from a private university of which students often come from higher social status positions. Perhaps their lower stress levels on average actually led to better healthier eating habits which was captured as ON behaviors in our study. In fact, several studies have found a correlation between higher income/socioeconomic status and ON (Barnes & Caltabiano, 2017; Hyrnik et al. 2016), as well as more time individuals can afford to buying/preparing foods (Missbach et al., 2015). Hence, it seems like in order to engage in ON, one has to be in a social position that gives them resources (money and time) and accessibility to healthier foods. It is also important to note that previous studies that found a significant relation between higher stress and eating pathology looked at traditional eating disorders such as AN and BN (Berge et al., 2015; Goldschmidt et al., 2014; Leehr et al., 2015; White et al., 2016) and not ON, which likely has different mechanisms than traditional eating disorders.

In addition, the present study did not find significant within-person associations between negative affect and ON behavior either on the same day or next day. Thus, it is possible that preoccupation with food is related to stress rather than negative affect. For example, Barrada and Roncero (2018) found that preoccupation and worries about eating unhealthy foods and of the effect of food quality and composition on physical and/or emotional health was associated with

higher levels of stress (Barrada & Roncero, 2018). Our null finding is counter to previous EMA studies examining other eating disorders (e.g., Engel et al., 2005; Lavender et al., 2013). Most of these studies, however, did not control for stress. Of the studies that did control for stress, Goldschmidt and colleagues (2014) used EMA methodology and assessed the association between both stress and negative affect and bulimic behavior. Notably, they found that whereas stress preceded the occurrence of bulimic behaviors, higher negative affect following stressful events was a mediator between stressful events and bulimic behaviors (e.g., binge eating and purging; Goldschmidt et al., 2014). Barker and colleagues' (2006) EMA study also controlled for stress and found that binge eating significantly predicted next-day negative affect; however, stress did not significantly predict binge eating. Notably, existing measures of ON include negative affect items. Common measures of eating disorder behaviors and attitudes, such as the Eating Disorder Inventory (EDI-3; Garner, 2004), also contain items that overlap with negative affect. Thus, it is possible the reported positive associations between negative affect and eating disordered behavior in previous studies is an artefact of overlap in their measures. Nonetheless, in the present study's supplemental analyses when negative affect items were removed from the daily ON measure, the findings did not change.

Although we did not find within-person associations between affect and ON behavior, we did find significant between-person associations. That is, on average, those with higher levels of negative affect across the 14-day period, relative to others in the sample, also reported higher average levels of ON behavior. Moreover, those with higher levels of positive affect across the 14-day period, relative to others in the sample, also reported higher average levels of ON behavior. This may be a result of how affect is associated with engaging in eating disordered behavior. In a study on binge eating disorder, Barker and colleagues (2006) found that positive

affect increased immediately after engagement in binge eating behavior, but in the longer term, negative affect increased. Perhaps our participants experienced an overall increase in positive affect due to engaging in ON behavior; however, we did not assess negative affect and positive affect immediately before or after ON behavior, but rather at the end of each day and therefore could not tease apart the precise time when affect was experienced relative to their ON behavior.

Moreover, we found a significant positive between-person association between current or past eating disorder history and ON behavior on the same day, such that people who have or had ever been diagnosed with an eating disorder engaged in higher levels of ON behavior, on average, during the study period. This makes sense because although ON has not been recognized as a psychological diagnosis in the DSM-V or ICD-10, it shares symptoms and valences with traditional eating disorders. Using the framework of the HiTOP (Kotov et al., 2017), shared valences and symptomology overlap, like comorbidities. Moreover, correlational studies with ON have also shown a positive association with current/past eating disorder history (Barnes & Caltabiano, 2017; Brytek-Matera et al., 2015; Gramaglia et al., 2017; Missbach et al., 2015; Segura-Garcia et al., 2015), with Barnes and Caltabiano (2007) finding that history of an eating disorder was the strongest predictor of ON over and above weight preoccupation and appearance orientation.

Furthermore, it is worth noting that in some of our HLM models, there was a main effect of type of day. That is, on average, individuals reported significantly more ON symptoms during weekdays than on weekends. Perhaps college students experience more stress intensity on weekdays and hence, engage in more ON behavior, compared to weekends. This is similar to a study with binge eating disorder where the researchers found that individuals with BED had

significantly more binge eating episodes on weekdays compared to weekends (Schreiber-Gregory et al., 2013).

Second, our predicted moderators (an already healthy diet and perfectionism) of the relation between stress intensity and ON behavior were not significant for same day effects nor next day effects. In our exploratory analyses examining the different types of perfectionism, however, there were main effects of both self-oriented perfectionism (SOP) and socially-prescribed perfectionism (SPP), but in opposite directions from each other. Whereas SOP was positively associated with ON symptoms, SPP was negatively associated with ON symptoms. These findings provide a potential explanation for why we did not find a significant association in our origin model using total perfectionism as a measure: these opposite direction of associations for the separate perfectionism types could have canceled each other out. Consistent with our results, the current literature has also demonstrated positive associations between SOP and other types of eating disordered behavior. For example, Lavender and colleagues (2016) found that SOP and dietary restraint were positively associated. Further, SOP and dieting have been found to be positively associated in a study examining disordered eating and dimensions of perfectionism (Bardone-Cone, 2007). Moreover, in a sample of college students in Australia, SOP and ON had a moderate positive correlation (Barnes & Caltabiano, 2017). SOP is a type of perfectionism in which one has high expectations of themselves that can be unrealistic; this individuals' dietary and eating behaviors may be an extension of these unrealistically high expectations.

On the other hand, Lavender and colleagues (2016) found that in a sample of adult women with anorexia nervosa, SPP was not associated with dietary restraint, nor with ED preoccupations (Lavender et al., 2016). Individuals high in SPP are in frequent conflict with others (Mushquash & Sherry, 2012), which is often accompanied by a sense of disharmony with

others (e.g., Hewitt et al., 2006; Mackinnon et al., 2012). Since SPP is a type of perfectionism that focuses on meeting perfectionistic expectations that one feels others expect of them, Mushquash and Sherry (2012) posited that people high in SPP have a perpetuating self-defeating cycle of depressive affect: self-defeating interpersonal behaviors leads to interpersonal conflict, and consequently, their perfectionistic self-presentation backfires because these become new opportunities to view themselves as falling short of others' expectations. Indeed, Hewitt and colleagues (2003) have found that people high in SPP binge-eat, avoid tasks, and often come into conflict with others (Hewitt et al., 2003). Moreover, SPP and bulimic symptoms have been demonstrated to have a greater effect size than SOP and bulimic symptoms (Bardone-Cone, 2007). This may be why we found a negative association in our present study: perhaps individuals high in SPP in our study engage in tasks that are self-defeating rather than “healthy” – they eat comfort foods or binge eat instead of controlling their diet when encountering stressful situations.

Third, in our cross-sectional models, we found that negative-appearance focused family comments and behaviors significantly predicted higher levels of baseline ON symptoms, over and above other known predictors of ON (perfectionism, OCD symptoms, neuroticism, dieting, and current/past history of ED) and controlling for participant sex. That is, comments such as “you look great, but you could look even better if you lost some weight” or “you need to lose weight”, or even family members complaining about their own weight were positively associated with higher levels of ON behavior. Our findings support the tripartite influence model of body image and eating disturbance, which posits that sources of influence – including a family's behavior and comments – are related to body dissatisfaction because these behaviors and comments increases appearance comparison, which in turn may motivate disordered eating

(Kluck, 2010; van den Berg et al., 2002). Family comments and behavior that focus on body image, weight, and dieting can increase appearance comparison and instill in children a sense of judging their self-worth by their physical attributes. Moreover, this focus on appearance comparison may lead to a never-ending dissatisfaction with one's physical appearance – and hence, a never-ending battle to control one's diet and activities to “fix” one's physical appearance. For example, a study with female undergraduate students found significant mediation such that family behavior and comments about weight and appearance was associated with disordered eating through its impact on appearance comparison (van den Berg et al., 2002).

Although appearance-focused family cultures have been known to contribute to the development of traditional eating disorders such as AN and to eating disorder-related factors such as body dissatisfaction (Neumark-Sztainer et al., 2010)), its association with ON behavior had not been examined before. Notably, the involvement of the family in traditional eating disorders treatment is paramount (Treasure & Schmidt, 2013) and examining the impact of family environments on ON symptoms may give us a clue as to whether this would also be the case for ON treatment. Moreover, examining the impact of the family will also help us understand how one's family could also hinder treatment if the family engages in negative appearance-focused comments and behavior.

#### **4.1. Limitations and Future Directions**

There were several limitations of this study which provide directions for future research. First, even though we achieved good reliability for our daily ON measure, we created it for this study because there were no existing daily ON measures. We also cannot guarantee the ON measure we created was psychometrically sound because we did not go through the recommended best practices of rigorous psychometric test creation and validation (Clark &

Watson, 1995). Future studies should consider creating a psychometrically sound ON measure to test for daily ON symptomology.

Second, we did not obtain parent or other family member reports about the family's comments and behaviors but rather relied on retrospective self-reports from the study participants. Future studies should consider including other reporters to measure family's comments and behaviors for a more valid and holistic view of the family climate.

Finally, because we focused primarily on main effects between stress, negative affect, and ON, we did not measure potential underlying mechanisms of ON, namely body image dissatisfaction and health-focused self-concept. Several studies have indicated that body image dissatisfaction could be a mediator between stress and eating disordered behaviors (Kluck 2010; Neumark-Sztainer et al., 2010). For example, Yung and Tabri (2022) found that perfectionism was indirectly and positively associated with ON symptoms via a health-focused self-concept. Importantly, the indirect association was only observed among participants high, but not low, in erroneous beliefs about health. Future studies should consider including measures of body image dissatisfaction and health-focused self-concept as they may be important mediating variables.

#### **4.2. Individual and Cultural Diversity, Ethical Considerations**

Finally, it is important to consider diversity and ethical considerations in our study. Overall, we did not have a very diverse sample – our sample was predominantly White, and hence our findings may not be representative of the minority population. One recent study examined cross-cultural differences in ON behaviors and associations with personality traits in Germany and Lebanon (Strahler et al., 2020). They found that, in general, higher levels of ON were reported in the Lebanon sample compared to the Germany sample. The researchers posit that the higher levels of ON reported in Lebanon can be attributed to an increase in Western media and body



ideals influence in the Middle East, including Lebanon. That is, as the Lebanese attempt to meet a body ideal that is not traditionally of their own culture, they turn to pathologic ways of doing so like ON (Strahler et al., 2020). In addition, negative affect and agreeableness traits were negatively associated with ON for the Lebanese sample but not the German sample. The researchers posit these personality differences between Lebanon and Germany can be explained by whether collectivism or individualism is valued. In individualistic societies, such as Germany, individual success and achievements receive the greatest reward and social recognition; whereas, in collectivistic cultures, such as Lebanon, harmony is valued within the group, and individual gain is less important relative to improvement for the social group. Hence, agreeableness – cooperation, harmony – are more prevalent in collectivistic cultures like Lebanon than individualistic cultures (Hofstede, 1984; Hoffman & Hinton, 2014). In fact, high agreeableness has been associated with lower eating disordered behavior (Cassin et al., 2005) and self-regulation of eating attitudes, as well as lower risk of developing eating pathology (Ghaderi & Scott, 2000). It is possible that the Lebanese had higher levels of agreeableness and this was related to lower ON levels. A systematic review found considerable association between ED and acculturation – although it varied based on type of minority group. That is, whereas some studies found that greater acculturation to the majority culture was associated with higher risk of ED symptoms, other studies found that lower acculturation was associated with risk of developing ED. The authors posited that these mixed findings are likely an artifact of differences in how acculturation was conceptualized and measured across studies. This is an important consideration because research has shown that assimilating to dominant standards of beauty for minorities puts increased pressure on looking a certain way, and hence can lead to body image dissatisfaction (Doris et al., 2015). Therefore, cultural differences should be examined for ON, as it can inform

our understanding on unique factors that may contribute to the development of ON for minority groups, and in turn, factors that should be of a focus in the treatment of ON and eating disorders for minority groups.

#### **4.3. Summary and Practical Implications**

Our study found significant associations between one's stress intensity and engagement in ON behaviors on the same day. Moreover, our study highlighted the importance of an individual's negative appearance-focused family culture as a contributing factor to development of ON. Overall, our study showed that several of the factors that have been significantly associated with traditional eating disorders, namely, stress, family environment, and some types of perfectionism, are also applicable to a condition that is more "hidden" and has not yet been recognized as a disorder in the DSM-V and ICD-10.

The present study underscores the need to further examine the underlying factors of ON in order to utilize the information to create preventative efforts and interventions specific for ON among college students. Our study also emphasizes the need for including modules in existing family-based treatment (FBT) to target negative appearance-focused family culture in all forms of eating disorders as current FBT interventions do not focus on negative appearance-focused behavior or comments families may engage in. It may help to think of negative appearance-focused family culture as a form of expressed emotion about food and appearance in its detrimental effects on the prognosis of individuals with eating disorders. Expressed emotion is a type of adverse family environment that has been found to predict symptom relapse in a wide range of psychological illnesses such as schizophrenia and anorexia nervosa (Cherry et al., 2017). It is a family environment that mental health professionals pay close attention to and try to address during treatment of individuals with these psychological disorders (Butzlaff &

Hooley, 1998; Weintraub et al., 2016). It consists of a wide range of behavior and can be described as a caregiver's attitude towards a person with a psychological condition (Butzlaff & Hooley, 1998; Breitborde et al., 2010). Expressed emotion comprises of the following behavioral patterns and factors: criticism, hostility, and emotional over-involvement (Miklowitz et al., 1989; Weintraub et al., 2016). Just like expressed emotion, perhaps negative appearance-focused family environments need equal attention in the treatment of eating disorders to improve the treatment outcome of individuals with eating disorders. Indeed, the current gold standard treatment of eating disorders (especially with youth) is FBT which focuses primarily on the youth with the eating disorder and having the family be a resource to help deliver treatment to the patient - the focus is primarily on how the family can help with the refeeding stage and meal times, rather than on family dynamics and communication (Treasure & Schmidt, 2013). Recent developments in FBT, however, have implemented some focus on family communication, particularly expressed emotion (Allan et al., 2017). They found that having a separate parent-focused format of family therapy led to a significant decrease in maternal criticism (a component of expressed emotion), and a significantly higher chance of remission of anorexia in the youth with AN (Allan et al., 2017). These findings bolster the importance of including family dynamics and communication in the treatment of eating disorders.

Outside of traditional/clinical eating disorders treatment, healthcare professionals who encounter college students and adults with ON behavior may consider using cognitive behavioral therapy (CBT; Beck, 1995) to target the appearance-focused comments and beliefs that they have learned and accepted from their family and social environments. Many parts of CBT focus on helping individuals learn how to reframe their negative thoughts to more adaptive thoughts. A core component of CBT is addressing one's core beliefs – that is, an individual's fundamental

beliefs about themselves and the world that drive their perspectives and actions – and replacing maladaptive core beliefs with more adaptive or neutral ones (Beck, 1995). CBT techniques can be used to target negative appearance-focused thoughts and beliefs about themselves in a person who struggles with ON. Our findings on the relation between negative appearance-focused family cultures also emphasizes the need for public health professionals to develop public service campaigns and outreach to the public to educate them on healthy ways of communicating about weight, shape, and food in order to increase public awareness and hopefully drive a cultural change around the way we talk about food, diet, weight, and body shapes in our society.

### *Demographic Information of Sample*

<b>Age</b>	M=20.41 (SD = 1.62)
<b>Gender</b>	
<i>Female</i>	76.8% (n = 109)
<i>Male</i>	23.2% (n = 33)
<b>Year in College</b>	
<i>Freshman</i>	41.5% (n = 59)
<i>Sophomore</i>	35.9% (n = 51)
<i>Junior</i>	12% (n = 12)
<i>Senior</i>	10.6% (n = 15)
<b>Race</b>	
<i>White</i>	74.6% (n = 106)
<i>Black/African American</i>	5.6% (n = 8)
<i>Asian</i>	12.7% (n = 18)
<i>American Indian/Alaskan Native</i>	1.4% (n = 2)
<i>Native Hawaiian/Other Pacific Islander</i>	0.7% (n = 1)
<i>Other/More than One of Above</i>	4.9% (n = 7)
<b>Ethnicity</b>	
<i>Hispanic/Latino/Spanish Origin</i>	16.9% (n = 24)
<b>Family Structure</b>	
<i>Lived with 2 biological parents</i>	81.7% (n = 116)
<i>Lived with one biological parent</i>	4.9% (n = 7)
<i>Lived with one biological and one adoptive/step-parent</i>	2.8% (n = 4)
<i>Lived with two adoptive parents</i>	1.4% (n = 2)
<i>Other types of parental figures not listed</i>	9.2% (n = 12)
<b>Other Family Members</b>	
<i>Lived with one or more grandparents</i>	7.0% (n = 10)
<i>Lived with cousins</i>	1.4% (n = 2)
<i>Lived with uncles/aunts</i>	0.7% (n = 1)
<i>Lived with one or more of the above and/or other family not listed</i>	3.5% (n = 5)
<b>Current/Past Non-medical or Non-religiously Prescribed Diet</b>	27.5% (n = 39)
<b>College Athlete</b>	7.7% (n = 11)

Table 1. Demographic Information of Sample

	<i>M</i>	<i>SD</i>	<i>t</i> (1, 173)	<i>p</i>
Age			0.58	.57
<i>Chi-Square Tests of Independence</i>				
Gender	$\chi^2(1) = 2.82, p = .09$			
Year in College	$\chi^2(3) = 0.72, p = .87$			
Race	$\chi^2(4) = 2.49, p = .65$			
Ethnicity	$\chi^2(1) = 1.88, p = .17$			
Athlete	$\chi^2(1) = 0.03, p = .87$			
Family Structure	$\chi^2(5) = 2.61, p = .76$			
Number of Siblings	$\chi^2(6) = 6.17, p = .41$			
Other Family Members in the Household	$\chi^2(3) = 0.71, p = .87$			
Eating Disorder Diagnosis	$\chi^2(1) = 1.36, p = .24$			
Eating Disorder Diagnosis in the Last 6 Months	$\chi^2(1) = 0.74, p = .39$			
Non-religious/Non-medically prescribed Diet	$\chi^2(50) = 37.57, p = .90$			

Table 2. Means, Standard Deviations, Independent T-Test and Chi-Square Tests of Independence of Demographics and Exclusion from Study (Missing Data, Attention and Time Checks)

Variable	<i>M</i> ( <i>SD</i> )	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Average Daily ON Behavior	14.46 (11.93)	--								
2. Average Daily ON Behavior (Without NA Items)	11.73 (9.84)	.99**	--							
3. Average Daily Stress Intensity	7.75 (5.02)	.09	.04	--						
4. Average Daily Negative Affect	11.42 (3.32)	.50**	.44**	.48**	--					
5. Average Daily Positive Affect	10.55 (2.48)	.09	.11	-.11	-.15	--				
6. ON Composite <sup>†</sup>	0 (1.93)	.59**	.57**	.12	.37**	-.15	--			
7. Perfectionism (Total Score)	185 (29.78)	.11	.07	.25**	.30**	-.06	.19*	--		
8. Perfectionism (Self-Oriented)	113.71 (18.92)	.16	.13	.20*	.28**	-.06	.21*	.91**	--	
9. Perfectionism (Socially-Prescribed)	129.81 (19.72)	-.01	-.03	-.12	.14	.05	.06	.90**	.74**	--
10. Negative Appearance-Focused Family Composite	0 (2.58)	.34**	.28**	.44**	.51**	-.22**	.45**	.28**	.25**	.08
11. Healthy Eating Assessment	31.94 (2.58)	.10	.14	-.22**	-.11	.07	.18*	-.01	-.04	-.01
12. Sex (1 = female, 2 = male)	1.23 (0.42)	-.11	-.10	-.02	-.16	-.07	-.10	.01	.05	.04
13. Current and/or Past Eating Disorder Diagnosis (yes = 1, no = 0)	0.13 (0.33)	.22**	.21*	.03	.10	-.06	.36**	.13	.10	.11
14. OCDI-R <sup>†</sup>	35.18 (13.13)	.14	.12	.24**	.49**	-.11	.24**	.30**	.36**	.34**
15. BFI Neuroticism <sup>†</sup>	24.38 (6.48)	.12	.08	.12	.46**	-.29**	.25**	.34**	.30**	.23**
16. Dieting	0.27 (0.45)	.16	.14	.10	.28**	-.05	.17*	.14	.04	.09

Table 3. Descriptive Statistics and Intercorrelations Among Study Variables

Variable	10.	11.	12.	13.	14.	15.	16.
1. Average Daily ON Behavior							
2. Average Daily ON Behavior (Without NA Items)							
3. Average Daily Stress Intensity							
4. Average Daily Negative Affect							
5. Average Daily Positive Affect							
6. ON Composite <sup>f</sup>							
7. Perfectionism (Total Score)							
8. Perfectionism (Self-Oriented)							
9. Perfectionism (Socially-Prescribed)							
10. Negative-Appearance-Focused Family Composite	--						

Table 3 (continued).



<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	p	Lower	Upper
Intercept	17.46	1.31	<.001	14.88	20.04
Day	-0.07	0.07	0.32	-0.19	0.06
Weekend	-1.47	0.39	<.001	-2.23	-0.70
Stress Intensity (Within)	0.10	0.04	.04	0.01	0.18
Negative Affect (Within)	0.15	0.09	.08	-0.02	0.33
Positive Affect (Within)	-0.06	0.09	.53	-0.25	0.13
Current/Past Eating Disorder History	5.80	2.48	.02	0.90	10.70
Stress Intensity (Between)	-0.93	0.29	.002	-1.50	-0.36
Negative Affect (Between)	2.26	0.29	<.001	1.69	2.83
Positive Affect (Between)	0.72	0.34	.04	0.05	1.39
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	p	Lower	Upper
Level 2					
Intercept	95.79	14.78	<.001	70.78	129.62
Day	0.23	0.03	.002	0.12	0.44
Stress Intensity	0.04	0.03	.21	0.01	0.17
Negative Affect	0.20	0.10	.06	0.07	0.56
Positive Affect	0.33	0.15	.03	0.14	0.80
Level 1 (within-person)					
Residual	54.13	2.28	<.001	49.83	58.80
Autocorrelation	0.12	0.03	<.001	0.05	0.19
<i>Note.</i> Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”					

Table 4. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms as a Function of Daily Stress Intensity and Negative Affect on the Same Day

<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	<i>p</i>	Lower	Upper
Intercept	17.46	1.29	<.001	14.91	20.01
Day	-0.07	0.07	.33	-0.20	0.07
Weekend	-1.49	0.39	<.001	-2.26	-0.73
Stress Intensity (Within)	0.10	0.42	.03	0.01	0.18
Negative Affect (Within)	0.14	0.09	.11	-0.03	0.31
Positive Affect (Within)	-0.05	0.09	.62	-0.23	0.14
Current/Past Eating Disorder History	5.78	2.48	.02	0.87	10.69
Stress Intensity (Between)	-0.87	0.29	.003	1.69	2.83
Negative Affect (Between)	2.26	0.29	<.001	-1.45	-0.30
Positive Affect (Between)	0.70	0.34	.04	0.03	1.36
Healthy Diet	0.33	0.24	.16	-0.13	0.80
Stress Rating (Within) X Healthy Diet	0.01	0.01	.29	-0.01	0.30
Negative Affect (Within) X Healthy Diet	-0.03	0.02	.12	-0.08	0.01
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	<i>p</i>	Lower	Upper
Level 2 (between-person)					
Intercept	90.19	14.08	<.001	66.41	122.47
Day	0.26	0.08	.001	0.14	0.48
Stress Intensity (Within)	0.02	0.03	.55	0.001	0.41
Negative Affect (Within)	0.16	0.10	.11	0.05	0.55
Positive Affect (Within)	0.31	0.14	.03	0.13	0.75

Table 5. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms as a Function of Daily Stress Intensity and Negative Affect as Moderated by Existing Healthy Diet

		<i>CI<sub>95</sub></i>		
Random Effects ([co-]variances)				
Level 1 (within-person)				
	Estimate	(SE)	<i>p</i>	
Residual	54.13	2.29	<.001	Lower Upper
Autocorrelation	0.12	0.03	<.001	58.79 0.18

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 5 (continued).

Fixed Effects (intercept, slopes)	<i>CI<sub>95</sub></i>			
	Estimate	(SE)	<i>p</i>	
Intercept	15.74	0.92	<b>&lt;.001</b>	Lower Upper
Day	-0.04	0.05	.48	13.91 17.59
Weekend	0.05	0.42	.91	-0.15 0.07
Previous Day ON Symptoms	0.35	0.03	<b>&lt;.001</b>	-0.78 0.88
Stress Intensity (Within)	-0.01	0.04	.86	0.30 0.40
Negative Affect (Within)	-0.19	0.09	.24	-0.09 0.08
Positive Affect (Within)	-0.14	0.09	.09	-0.27 0.07
Current/Past Eating Disorder History	3.59	1.69	<b>.04</b>	-0.31 0.02
Stress Intensity (Between)	-0.61	0.20	<b>.003</b>	0.20 6.99
Negative Affect (Between)	1.47	0.20	<b>&lt;.001</b>	-1.01 -0.22
Positive Affect (Between)	0.48	0.23	<b>.04</b>	1.06 1.88
				0.02 0.94

Random Effects ([co-]variances)	<i>CI<sub>95</sub></i>			
	Estimate	(SE)	<i>p</i>	
Level 2 (between-person)				Lower Upper
Intercept	38.41	8.45	<b>&lt;.001</b>	24.96 59.12
Negative Affect (Within)	0.02	0.08	.84	<.001 332.83
Level 1 (within-person)				
Residual	65.11	2.96	<b>&lt;.001</b>	59.56 71.17
Autocorrelation	-0.16	0.05	<b>.004</b>	-0.26 -0.05

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 6. Estimates from Multilevel Model Testing Next Day Orthorexia Nervosa Symptoms as a Function of Previous Day Stress Intensity and Negative Affect Controlling for the Previous Day Orthorexia Nervosa Symptoms

<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	<i>p</i>	Lower	Upper
Intercept	17.14	1.50	<.001	13.93	20.36
Day	-0.07	0.07	.36	-0.23	0.09
Weekend	-1.45	0.49	.01	-2.45	-0.45
Stress Intensity (Within)	0.09	0.04	.04	0.005	0.19
Negative Affect (Within)	0.16	0.09	.08	-0.02	0.34
Positive Affect (Within)	-0.05	0.09	.59	-0.24	0.14
Current/Past Eating Disorder History	5.14	2.68	.07	-0.40	10.68
Stress Intensity (Between)	-0.80	0.32	.02	-1.46	-0.15
Negative Affect (Between)	2.18	0.32	<.001	1.51	2.86
Positive Affect (Between)	0.60	0.36	.11	-0.15	1.36
Perfectionism	-0.02	0.03	.45	-0.09	0.04
Stress Rating (Within) X Perfectionism	-0.001	0.001	.29	-0.004	0.001
Negative Affect (Within) X Perfectionism	0.001	0.003	.53	-0.004	0.01
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	<i>p</i>	Lower	Upper
Level 2 (between-person)					
Intercept	152.55	31.77	<.001	0.05	0.19
Day	0.36	0.11	.001	0.19	0.66
Weekend	11.68	5.09	.02	4.98	27.42

Table 7. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms as a Function of Daily Stress Intensity and Negative Affect as Moderated by Perfectionism

Random Effects ([co-]variances)	Estimate	(SE)	p	<i>CI</i> <sub>95</sub>	
				Lower	Upper
Level 2 (between-person)					
Stress Intensity (Within)	0.03	0.03	.39	0.003	0.27
Negative Affect (Within)	0.18	0.10	.07	0.06	0.53
Positive Affect (Within)	0.27	0.14	.05	0.10	0.74
Level 1 (within-person)					
Residual	53.18	2.41	<.001	48.67	58.11
Autocorrelation	0.12	0.04	.001	0.05	0.19

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 7 (continued).

Fixed Effects (intercept, slopes)	Estimate	(SE)	<i>p</i>	Lower	Upper
Intercept	15.71	0.92	<.001	13.88	17.53
Day	-0.04	0.06	.50	-0.15	0.07
Weekend	0.06	0.43	.90	-0.78	0.89
Previous Day ON Symptoms	0.36	0.03	<.001	0.31	0.41
Stress Intensity (Within)	-0.01	0.44	.81	-0.10	0.07
Negative Affect (Within)	-0.12	0.09	.17	-0.30	0.05
Positive Affect (Within)	-0.14	0.09	.09	-0.31	0.02
Current/Past Eating Disorder History	3.66	1.68	.03	0.30	7.03
Stress Intensity Between	-0.59	0.19	.004	-0.98	-0.20
Negative Affect Between	1.39	0.21	<.001	0.97	1.80
Positive Affect Between	0.45	0.23	.05	-0.002	0.90
Perfectionism	-0.001	0.02	.97	-0.04	0.04
Stress Rating (Within) X Perfectionism	0.001	0.001	.44	-0.002	0.004
Negative Affect (Within) X Perfectionism	0.003	0.003	.31	-0.003	0.01

Table 8. Estimates from Multilevel Model Testing Next Day Orthorexia Nervosa Symptoms as a Function of Previous Day Stress Intensity and Negative Affect as Moderated by Perfectionism Controlling for Previous Day Orthorexia Nervosa Symptoms

Random Effects ([co-]variances)	<i>CI<sub>95</sub></i>			
	Estimate	(SE)	<i>p</i>	
Level 2 (between-person)				
Intercept	36.91	8.29	<.001	57.34
Negative Affect (Within)	0.01	0.08	.93	0.14
Level 1 (within-person)				
Residual	66.09	3.06	<.001	72.36
Autocorrelation	-0.17	0.05	.002	-0.06

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 8 (continued).



	<i>B</i> ( <i>SE</i> )	$\beta$	<i>p</i>
Intercept	-1.54 (1.09)	--	.16
Negative Appearance-Focused Family Composite	0.27 (0.06)	0.36	<.001
Perfectionism	0.001 (0.01)	0.02	.85
OCDI-R <sup>†</sup>	0.004 (0.01)	0.03	.78
Dieting	0.17 (0.34)	0.04	.62
Current/Past History of Eating Disorders	1.52 (0.45)	0.26	.001
Sex (1 = female, 2 = male)	0.34 (0.38)	0.08	.36
Neuroticism	0.02 (0.03)	0.08	.41
	<i>R</i> <sup>2</sup>		
	0.28		

<sup>†</sup>Note. OCDI-R = Obsessive Compulsive Disorder Inventory – Revised.

Table 9. Multiple Regressions testing Negative Appearance-Focused Family Culture as a predictor of Baseline ON Symptoms

Fixed Effects (Intercept, slopes)	Estimate	(SE)	p	Lower	Upper
Intercept	17.14	1.35	<.001	14.86	20.20
Day	-0.07	0.07	.30	-0.21	0.06
Weekend	-1.43	0.49	.01	-2.41	-0.45
Stress Intensity (Within)	0.10	0.04	.03	0.01	0.19
Negative Affect (Within)	0.15	0.09	.09	-0.03	0.33
Positive Affect (Within)	-0.04	0.09	.64	-0.23	0.14
Current/Past Eating Disorder History	6.24	2.42	.01	1.44	11.03
Stress Intensity (Between)	-0.81	0.28	.01	-1.37	-0.25
Negative Affect (Between)	2.02	0.29	<.001	1.43	2.60
Positive Affect (Between)	0.77	0.33	.02	0.11	1.42
Self-Oriented Perfectionism	0.16	0.07	.02	0.02	0.29
Socially Prescribed Perfectionism	-0.18	0.06	.004	-0.31	-0.06
Stress Rating (Within) X Self-Oriented Perfectionism	-0.004	.003	.24	-0.01	.003
Negative Affect (Within) X Self-Oriented Perfectionism	0.01	0.01	.30	-0.01	0.02
Stress Rating (Within) X Socially Prescribed Perfectionism	0.002	0.003	.60	-0.005	0.01
Negative Affect (Within) X Socially Prescribed Perfectionism	-0.004	0.01	.59	-0.02	0.01

Table 10. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms as a Function of Daily Stress Intensity and Negative Affect as Moderated by Self-Oriented Perfectionism and Socially Prescribed Perfectionism

Random Effects ([co-]variances)	<i>CI<sub>95</sub></i>			
	Estimate	(SE)	<i>p</i>	
Level 2 (between-person)				
Intercept	117.16	20.50	<.001	Lower Upper
Day	0.29	0.09	.001	83.14 165.08
Weekend	12.80	5.11	.01	0.16 0.53
Stress Intensity (Within)	0.03	0.03	.32	5.85 28.01
Negative Affect (Within)	0.17	0.10	.09	0.004 0.23
Positive Affect (Within)	0.28	0.14	.05	0.06 0.55
				0.10 0.76
Level 1 (within-person)				
Residual	52.86	2.38	<.001	48.39 57.74
Autocorrelation	0.12	0.04	.001	0.05 0.19

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 10 (continued).

<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	<i>p</i>	Lower	Upper
Intercept	16.71	1.30	<.001	13.88	19.54
Day	-0.06	0.07	.33	-0.20	0.07
Stress Intensity (Within)	0.08	0.05	.10	-0.02	0.19
Negative Affect (Within)	0.16	0.09	.18	-0.13	0.44
Positive Affect (Within)	-0.06	0.09	.55	-0.28	0.16
Current/Past Eating Disorder History	5.80	2.48	.03	0.67	10.93
Stress Intensity (Between)	-0.93	0.29	.01	-1.55	-0.32
Negative Affect (Between)	2.26	0.29	<.001	1.63	2.90
Positive Affect (Between)	0.72	0.34	.05	-0.01	1.44
Weekend	-1.47	0.39	<.001	-2.24	-0.71
Stress Rating (Within) X Weekend	-0.05	0.09	.55	-0.22	0.12
Negative Affect (Within) X Weekend	0.02	0.15	.92	-0.29	0.32
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	<i>p</i>	Lower	Upper
Level 2 (between-person)					
Intercept	95.94	14.81	<.001	70.89	129.85
Day	0.23	0.08	.002	0.12	0.44
Stress Intensity (Within)	0.04	0.03	.22	0.01	0.17
Negative Affect (Within)	0.20	0.11	.06	0.07	0.56
Positive Affect (Within)	0.33	0.15	.03	0.13	0.80

Table 11. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms as a Function of Daily Stress Intensity and Negative Affect as Moderated by Type of Day of the Week (Weekday/Weekend)

Random Effects ([co-]variances)	<i>CI<sub>95</sub></i>			
	Estimate	( <i>SE</i> )	<i>p</i>	Lower Upper
Level 1 (within-person)				
Table 11 (continued)				
Residual	54.15	2.28	<.001	49.86 58.82
Autocorrelation	0.12	0.03	<.001	0.05 0.19
<i>Note.</i> Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”				

Table 11(continued).

<i>CI<sub>95</sub></i>						
Fixed Effects						
( <u>intercept</u> , slopes)	Estimate	(SE)	p	Lower	Upper	
Intercept	16.83	1.30	<.001	14.26	19.39	
Day	-0.07	0.06	.32	-0.19	0.06	
Weekend	-1.46	0.39	<.001	-2.23	-0.69	
Stress Intensity (Within)	0.10	0.05	.04	0.004	0.19	
Negative Affect (Within)	0.14	0.09	.13	-0.04	0.32	
Positive Affect (Within)	-0.06	0.09	.52	-0.24	0.13	
Current/Past Eating Disorder History	4.07	2.48	.10	-0.85	8.98	
Stress Intensity (Between)	-0.98	0.28	.001	-1.53	-0.42	
Negative Affect (Between)	1.93	0.30	<.001	1.33	2.53	
Positive Affect (Between)	0.92	0.33	.01	0.26	1.58	
Baseline Eating Pathology	0.20	0.07	.01	0.06	0.33	
Stress Rating (Within) X Baseline Eating Pathology	0.001	0.003	.85	-0.01	0.01	
Negative Affect (Within) X Baseline Eating Pathology	0.004	0.01	.47	-0.01	0.02	
<i>CI<sub>95</sub></i>						
Random Effects						
([co-]variances)	Estimate	(SE)	p	Lower	Upper	
Level 2 (between-person)						
Intercept	91.92	14.38	<.001	67.64	124.91	
Day	0.22	0.07	.003	0.11	0.42	
Stress Intensity (Within)	0.04	0.03	.19	0.01	0.16	
Negative Affect (Within)	0.20	0.11	.06	0.07	0.57	

Table 12. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms as a Function of Daily Stress Intensity and Negative Affect as Moderated by Baseline Eating Pathology

Random Effects ([co-]variances)	$CI_{95}$			
	Estimate	(SE)	p	
Level 2 (between-person)				
Positive Affect (Within)	0.33	0.15	<b>.03</b>	Lower      Upper
				0.13      0.79
Level 1 (within-person)				
Residual	54.48	2.32	<b>&lt;.001</b>	59.22
Autocorrelation	0.13	0.03	<b>&lt;.001</b>	0.19

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 12 (continued).

<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	p	Lower	Upper
Intercept	15.35	0.92	<.001	13.51	17.19
Day	-0.04	0.06	.46	-0.15	0.07
Weekend	0.05	0.42	.91	-0.78	0.88
Previous Day ON Symptoms	0.35	0.03	<.002	0.30	0.40
Stress Intensity (Within)	-0.005	0.05	.92	-0.10	0.09
Negative Affect (Within)	-0.11	0.09	.23	-0.29	0.07
Positive Affect (Within)	-0.14	0.09	.10	-0.31	0.03
Current/Past Eating Disorder History	2.52	1.71	.15	-0.91	5.95
Stress Intensity (Between)	-0.64	0.19	.002	-1.03	-0.25
Negative Affect (Between)	1.27	0.22	<.001	0.84	1.70
Positive Affect (Between)	0.61	0.23	.01	0.15	1.07
Baseline Eating Pathology	0.13	0.05	.01	0.03	0.22
Stress Rating (Within) X Weekend	-0.0002	0.002	.93	-0.004	0.004
Negative Affect (Within) X Weekend	0.002	0.01	.80	-0.01	0.01
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	p	Lower	Upper
Level 2 (between-person)					
Intercept	91.92	14.38	<.001	67.64	124.91
Day	0.22	0.07	.003	0.11	0.42
Stress Intensity (Within)	0.04	0.03	.19	0.01	0.16

Table 13. Estimates from Multilevel Model Testing Next Day Orthorexia Nervosa Symptoms as a Function of Previous Day Stress Intensity and Negative Affect as Moderated by Baseline Eating Pathology Controlling for Previous Day Orthorexia Nervosa Symptoms



Random Effects ([co-]variances)	Estimate	(SE)	p	CI <sub>95</sub>	
				Lower	Upper
Negative Affect (Within)	0.20	0.11	.06	0.07	0.57
Positive Affect (Within)	0.33	0.15	.03	0.13	0.79
Level 1 (within-person)					
Residual	65.03	2.94	<.001	59.51	71.06
Autocorrelation	-0.15	0.05	.01	-0.26	-0.04

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 13 (continued).

<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	p	Lower	Upper
Intercept	14.63	1.11	<.001	12.44	16.82
Day	-0.05	0.06	.39	-0.17	0.06
Weekend	-1.63	0.36	<.001	-2.34	-0.91
Stress Intensity (Within)	0.06	0.03	.07	-0.005	0.13
Negative Affect (Within)	0.15	0.08	.06	-0.003	0.30
Positive Affect (Within)	0.02	0.07	.75	-0.12	0.16
Current/Past Eating Disorder History	5.47	2.10	.01	1.32	9.61
Stress Intensity (Between)	-0.80	0.24	.001	-1.28	0.32
Negative Affect (Between)	1.72	0.24	<.001	1.23	2.20
Positive Affect (Between)	0.66	0.28	.02	0.10	1.22
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	p	Lower	Upper
Level 2 (between-person)					
Intercept	64.66	10.19	<.001	47.48	88.06
Day	0.14	0.06	.02	0.06	0.33
Negative Affect (Within)	0.14	0.06	.03	0.06	0.34
Level 1 (within-person)					
Residual	48.10	2.13	<.001	44.09	52.48
Autocorrelation	0.19	0.03	<.001	0.12	0.25

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 14. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms (without NA Items) as a Function of Daily Stress Intensity and Negative Affect on the Same Day

<i>CI<sub>95</sub></i>					
Fixed Effects					
(intercept, slopes)	Estimate	(SE)	<i>p</i>	Lower	Upper
Intercept	14.52	1.10	<.001	12.35	16.68
Day	-0.05	0.06	.36	-0.17	0.06
Weekend	-1.63	0.36	<.001	-2.34	-0.91
Stress Intensity (Within)	0.08	0.04	.03	0.01	0.15
Negative Affect (Within)	0.13	0.08	.10	-0.03	0.28
Positive Affect (Within)	0.03	0.07	.73	-0.11	0.16
Current/Past Eating Disorder History	5.13	2.08	.02	1.01	9.25
Stress Intensity (Between)	-0.71	0.24	.004	-1.20	-0.23
Negative Affect (Between)	1.72	0.24	<.001	1.24	2.20
Positive Affect (Between)	0.62	0.28	.03	0.07	1.18
Healthy Diet	0.38	0.20	.06	-0.02	0.77
Stress Rating (Within) X Healthy Diet	0.01	0.01	.18	-0.004	0.02
Negative Affect (Within) X Healthy Diet	-0.03	0.02	.13	-0.07	0.01
<i>CI<sub>95</sub></i>					
Random Effects					
([co-]variances)	Estimate	(SE)	<i>p</i>	Lower	Upper
Level 2 (between-person)					
Intercept	62.17	9.96	<.001	45.42	85.09
Day	0.14	0.06	.02	0.06	0.33
Negative Affect (Within)	0.13	0.06	.04	0.05	0.34

Table 15. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms (without NA Items) as a Function of Daily Stress Intensity and Negative Affect as Moderated by Existing Healthy Diet

Random Effects ([co-]variances)	Estimate	(SE)	p	CI <sub>95</sub>	
				Lower	Upper
Level 1 (within-person)					
Residual	48.18	2.14	<.001	44.15	52.57
Autocorrelation	0.19	0.03	<.001	0.12	0.26

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/[Past History](#) of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 15 (continued).

Fixed Effects (Intercept, slopes)	$CI_{95}$			
	Estimate	(SE)	p	Lower Upper
Intercept	12.73	0.71	<.001	11.31 14.16
Day	-0.05	0.05	.33	-0.14 0.05
Weekend	0.06	0.38	.88	-0.68 0.80
Previous Day ON Symptoms	0.43	0.02	<.001	0.38 0.48
Stress Intensity (Within)	-0.04	0.04	.33	-0.11 0.04
Negative Affect (Within)	-0.06	0.08	.44	-0.23 0.10
Positive Affect (Within)	-0.13	0.07	.07	-0.29 0.01
Current/Past Eating Disorder History	2.53	1.27	.05	-0.02 5.08
Stress Intensity (Between)	-0.48	0.15	.002	-0.78 -0.18
Negative Affect (Between)	0.97	0.15	<.001	0.66 1.27
Positive Affect (Between)	0.37	0.17	.04	0.02 0.71

Random Effects ([co-]variances)	$CI_{95}$			
	Estimate	(SE)	p	Lower Upper
Level 2 (between-person)				
Intercept	20.40	4.94	<.001	12.69 32.77
Negative Affect (Within)	.09	.08	.30	0.01 0.56
Level 1 (within-person)				
Residual	53.60	2.52	<.001	48.89 58.78
Autocorrelation	-0.20	0.05	.004	-0.29 -0.10

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 16. Estimates from Multilevel Model Testing Next Day Orthorexia Nervosa Symptoms (without NA Items) as a Function of Previous Day Stress Intensity and Negative Affect Controlling for the Previous Day Orthorexia Nervosa Symptoms

<i>CI<sub>95</sub></i>					
Fixed Effects (intercept, slopes)					
	Estimate	(SE)	p	Lower	Upper
Intercept	14.65	1.11	<.001	12.46	16.84
Day	-0.05	0.06	.44	-0.16	0.07
Weekend	-1.61	0.37	<.001	-2.33	-0.89
Stress Intensity (Within)	0.07	0.04	.06	-0.004	0.13
Negative Affect (Within)	0.15	0.08	.06	-0.003	0.31
Positive Affect (Within)	0.02	0.07	.81	-0.12	0.16
Current/Past Eating Disorder History	5.80	2.10	.01	1.64	9.96
Stress Intensity (Between)	-0.76	0.24	.002	-1.24	-0.27
Negative Affect (Between)	1.68	0.25	<.001	1.18	2.18
Positive Affect (Between)	0.64	0.28	.03	0.08	1.21
Perfectionism	-0.02	0.02	.49	-0.07	0.03
Stress Rating (Within) X Perfectionism	-0.001	0.001	.47	-0.003	0.001
Negative Affect (Within) X Perfectionism	-0.0002	0.003	.92	-0.01	0.005
<i>CI<sub>95</sub></i>					
Random Effects ([co-]variances)					
	Estimate	(SE)	p	Lower	Upper
Level 2 (between-person)					
Intercept	63.45	10.16	<.001	46.36	86.84
Day	0.14	0.06	.02	0.06	0.33
Negative Affect (Within)	0.14	0.06	.03	0.06	0.35

Table 17. Estimates from Multilevel Model Testing Orthorexia Nervosa Symptoms (without NA Items) as a Function of Daily Stress Intensity and Negative Affect as Moderated by Perfectionism

Random Effects ([co-]variances)	<i>CI<sub>95</sub></i>			
	Estimate	(SE)	<i>p</i>	
Level 1 (within-person)				Upper
Residual	48.50	2.17	<.001	52.93
Autocorrelation	0.19	0.03	.001	0.25

*Note.* Weekend was coded 0 for Weekday and 1 for Weekend. Current/Past History of Eating Disorder History was coded 0 for “no” and 1 for “yes.”

Table 17 (continued).

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