Stress-induced food intake: The effect of mental health-related psychological distress on food intake in the context of acute stress.

What determines an individual's vulnerability to consume more food in the context of stress?

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Date: June 27, 2022

Abstract

Stress is argued to influence an individual's food intake and, indirectly, their physical health in negative ways. This stress-induced eating behavior will most likely lead to adverse physical health effects like obesity. Specifically, this study aimed to examine whether mental health-related psychological distress from anxiety and depression positively influences an individual's food intake moderated by education. To test this, 65 participants completed a self-reported questionnaire called the Hospital Anxiety and Depression Scale to assess their mental health and were exposed to an acute stressor. Afterward, their food intake was assessed. Mental health-related psychological distress was found to have no significant effect on food intake after experiencing acute stress.

Additionally, the interaction between mental health-related psychological distress and education was also non-significantly related to food intake under the experience of acute stress. These results suggest that more extensive research is needed on stress-induced eating behavior since prior literature shows compelling evidence of significant relationships between stress and food intake. By addressing a comprehensive range of influential stressors in different experimental settings, possible significant associations between stress and food intake may be revealed. Nevertheless, more research on the negative effects of stress-induced eating can prevent society from corresponding adverse health effects.

Preface

In this section, I will discuss the circumstances behind writing this thesis in more detail since there were some influential and important inconveniences during the process. This thesis was initially aimed to determine an individual's vulnerability to unhealthy food choices in the context of stress and the corresponding physical health effects by using a subset of the data that originated from a new study (called the Healthy Brain Study, hereafter referred to as HBS) in collaboration with the Donders Institute. The HBS is a longitudinal, interdisciplinary, and cohort study that provides accessible insight into how the human brain individually and dynamically functions in a biological, social, and environmental context (Overbeek & Fernandez, 2021). Within this study, data was collected based on an extensive range of stressors that could be used to examine, in this case, food choice in combination with the Food Auction Task from Veling et al. (2017). However, this data was not finished when I started writing my thesis but was expected to be finished soon. Unfortunately, there was a huge delay in collecting and finishing the data as this was the responsibility of the researchers from the HBS. Hence, after several discussions on how to move on with the thesis, on May 20, 2022, together with my supervisor and the representatives from the Donders Institute and the HBS, we concluded that the data would not be finished on time regarding the upcoming deadline for the final thesis document. Therefore, I ended up working with another data set I retrieved from Dr. Esther Aarts from the Donders Institute, which was also associated with stress-induced eating behavior. However, this led to the necessity of rewriting chapters 1, 2, and 3, which took a lot of time. To save a part of the work that I had already done, I chose to keep the extensive literature review about a wide range of domain-specific stressors as a big front-end part for, among other things, potential future research on this topic and ended up focusing on just two of them in the analysis part since these were captured in the methodology. In addition, I also chose to stick to the outcome proxy physical health since I perceive the adverse physical health effects of stress-induced eating behavior as highly relevant for this study. This unforeseen inconvenience in writing this thesis has required a lot of flexibility from me as a master's student at the end of the writing process. I am very glad that I could continue writing this thesis based on another dataset, but this also led to some inconsistencies in the report itself, which will be addressed in the limitations section. Since these circumstances were entirely out of my control, I would like to thank you for understanding my unforeseen situation when reading this study.

Contents

1. Introduction

1.1 Problem definition

Obesity and overweight are serious physical health problems that have increased globally among all age groups in the past few years (Chooi, Ding & Magkos, 2019). This increase has led to the fact that in 2019, a third of the world's population was classified as being overweight or having obesity (Chooi et al., 2019). This fact results in the fact that obesity and weight gain are urgent problems requiring more attention (Chooi et al., 2019). Research has provided evidence that stress plays a significant role in developing eating disorders (e.g., obesity) (Mckay et al., 2021; Mouchacca, Abbott & Ball, 2013; Richardson, Arsenault, Cates, & Muth, 2015; Stone & Brownell, 1994). Common knowledge suggests that due to the experience of stress, an individual's food consumption can either increase or decrease (Stone & Brownell, 1994). In particular, prior research has shown that stress-related negative feelings are related to increased food intake (Epel, Lapidus, McEwen, & Brownell, 2001). Additionally, research has shown that negative feelings due to stress may typically lead to a behavior that will cause individuals to consume more unhealthy snack-type foods as a way to comfort themselves and reduce feelings of psychological distress (Baum & Posluszny, 1999; Pecoraro, Reyes, Gomez, Bhargava & Dallman, 2004; Zellner et al., 2006). From this point of view, food intake can be perceived as a coping mechanism for dealing with such psychological distress.

Furthermore, prior literature also argues that as a consequence of perceived stress, an individual's food preference and food choice are most likely to change in a way that typically results in increased consumption of high caloric and palatable snack-type foods (Baum & Posluszny, 1999; Dalmazo et al., 2019; Oliver & Wardle, 1999; Oliver, Wardle & Gibson, 2000). These findings highlight the importance of further research on relevant stressors that could determine an individual's vulnerability to an increased food intake and the corresponding physical health effects.

Furthermore, researchers such as Mckay et al. (2021) support the finding that stress-induced eating behavior is likely to contribute to the development of obesity and, therefore, an increased Body Fat Mass Index (hereafter referred to as BMI). To clarify, BMI is defined as: ‘’An important indicator of health. It predicts many health outcomes’’ (Berset, Semmer, Elfering, Jacobshagen & Meier, 2011, p. 45). In addition, Mouchacca, Abbott and Ball (2013) also found that high perceived stress could lead to a higher BMI for women and eventually contribute to higher obesity risk. On the other hand, a study by Nguyen-Rodriguez, Chou,

Unger, and Spruijt-Metz (2008) about the relationship between stress and emotional eating found no differences in emotional eating under perceived stress between normal weight- and overweight participants. This study concludes that the relationship between BMI and emotional eating can be more complicated since consuming food may be a coping strategy for normal-weight and overweight individuals (Nguyen-Rodriguez, Chou, Unger, & Spruijt-Metz, 2008). These contrary findings emphasize a need for more research on the relationship between BMI and food intake.

Moreover, Tryon, DeCant, and Laugero (2013) investigated whether chronic stress and acute stress reactivity could influence an individual's food choice and food intake. The authors found that chronic stress positively affects an individual's total fat mass and body fat percentage (Tryon, DeCant & Laugero, 2013). The notion that chronic stress could lead to the development of eating disorders, and on the other hand, acute stress could lead to increased food consumption is also supported by Stone and Browell (1994). These outcomes are most likely to result in adverse physical health effects.

Prior literature has shown that previous studies focused mainly on the direct relationship between the general notion of stress and eating behavior. For example, the study of Stone and Brownell (1994) focused on the eating behavior of individuals as the severity of stress increases. This study shows that food intake equally increases across several stress levels (Stone & Brownell, 1994). However, food intake drastically decreases when the severity of stress increases (Stone & Brownell, 1994). This finding supports the understanding that increased food intake is more likely to occur at lower levels of stress and that decreased food intake is more likely to occur at higher levels of stress (Stone & Brownell, 1994). With this insight, we may assume that when individuals perceive low-stress levels, their weight could increase due to increased food intake. Adding to findings addressed earlier in this section, Richardson, Arsenault, Cates, and Muth (2015) found that perceived stress positively relates to unhealthy eating behaviors. However, the writers could not prove that perceived stress influenced an individual's weight through eating behavior (Richardson et al., 2015). This finding suggests that potentially other physiologic mechanisms and non-diet-related behaviors associated with high levels of perceived stress could also contribute to the development of obesity (Richardson et al., 2015). However, the authors imply that the various mechanisms by which stress influences eating behavior are not yet fully understood (Richardson et al., 2015). In addition, the authors found that even though stress can induce unhealthy eating behaviors, high-stress levels could also affect non-dietary factors, which

may increase the risk of obesity (Richardson et al., 2015). This finding highlights the importance of understanding stress-induced dietary- and non-dietary mechanisms and physiologic responses to specific stressors that could cause stress-induced eating behavior and, in the long term, obesity (Richardson et al., 2015). Stone and Brownell (1994) also highlight the need for more research into the relationship between stress and eating behavior by examining various psychosocial, psychological, and environmental factors that could cause stress. In addition, Baum and Posluszny (1999) argue that there is a need for a thoughtful analysis of stress-related weight changes through food consumption.

1.2 Theoretical and Managerial implications

To summarize, research based on food intake associated with stress shows compelling evidence of the importance of psychosocial and behavioral variables (Baum & Posluszny, 1999; Richardson et al., 2015; Stone & Brownell, 1994). However, there is a limited understanding of how food intake is influenced by more specific stressors that primarily concern an individual's lifestyle, mental health, social/relationship, and work. Therefore, this study will dive into the existing theoretical background of various stressors from an individual's daily life that could affect their food intake. However, the fundamental analysis in this study will focus on only two equivalent mental health-related stressors as a direct cause of an increased food intake. In addition, this study will have a thoughtful analysis of physical health changes due to stress-induced eating behavior as an indirect consequence of acute stress.

Moreover, this study will contribute to the current literature by adding the socio-demographic variable: 'education' as a moderator variable to gain insight into whether an individual's level of education affects the relationship between acute stress and food intake. Prior research that supports the relevance of the socio-demographic variable 'education' as a relevant moderating variable stresses the importance of potential differences in outcomes when distinguishing between different levels of education (Brunello, Fort, Schneeweis, & Winter-Ebmer, 2016; Lê et al., 2013; Jones, 2007; Lenthe, Jansen, & Kamphuis, 2015; White, Nieto, & Barquera, 2020). For example, several researchers found that a higher degree of education about the nature of unhealthy foods can help individuals make healthier food choices (Jones, 2007; White et al., 2020). This finding is also supported by a study by van Lenthe, Jansen, and Kamphuis (2015). The authors of this study imply that higher educated individuals are more likely to make healthier food choices due to their nutritional knowledge

and knowledge about the relationship between nutrients and diseases, which can be acquired through increasing levels of education (van Lenthe et al., 2015). Hence, Brunello, Fort, Schneeweis, and Winter-Ebmer (2016) point out that education can be seen as a coping mechanism for stress and most likely produces healthier behaviors. In addition, a study by Lê et al. (2013) found that attitudes toward healthy food choices are associated with a higher level of education.

Regarding these findings, it is plausible to assume that healthy food choices result in a lower calorie intake compared to unhealthy food choices. To clarify, from a general understanding, unhealthy food options (e.g., chocolate and chips) contain more calories than healthier food options (e.g., fruit and vegetables). Nevertheless, several studies show compelling evidence of the possibility that an individual's level of education can affect the relationship between the experience of stress and an increased food intake (Brunello et al., 2016; Lê et al., 2013; Jones, 2007; van Lenthe et al., 2015; White et al., 2020). Since these studies predominantly suggest that higher levels of education evoke attitudes and motivations toward making healthier food choices and, therefore, a lower calorie intake, the level of education can be perceived as a factor of resilience towards stress-induced eating behavior (Brunello et al., 2016; Lê et al., 2013; Jones, 2007; van Lenthe et al., 2015; White et al., 2020).

In conclusion, the decision to use this moderator is mainly based on the study by Lê et al. (2013). These authors found that an individual's education plays a significant role in explaining differences between socio-economic groups regarding unhealthy food choices (Lê et al., 2013). Besides, a study from Vabø and Hansen (2014) also argues that demographic variables, such as level of education, interact with motivations behind food choice and are therefore relevant to investigate. On the other hand, a study from Komulainen et al. (2018) found that the development of genetic obesity may be sensitive to an individual's level of education, suggesting that lower levels of education may increase an individual's BMI.

1.3 Research question

This quantitative research aims to investigate the effect of mental health-related stress (consisting of the stressors anxiety and depression), moderated by the level of education, on an individual's food intake and indirectly on their physical health. This effect will be examined by answering the following research question:

To what extent does mental health-related psychological distress determine an individual's food intake under the experience of acute stress when differentiating between various educational levels, and how does this indirectly affect an individual's physical health?

1.4 Outline of the thesis

The following pages will provide a literature review about various relevant stressors from an individual's daily life and their influence on food intake, a more in-depth elaboration on anxiety and depression as mental health-related stressors for the actual analysis, the moderating variable 'education', and the dependent variable 'food intake'. These variables require a thoughtful analysis to provide an answer to the research question. In addition, two hypotheses are derived from prior literature. These hypotheses are aimed to test the direct effect of psychological distress from an individual's mental health on their food intake moderated by the level of education. Hereafter, the methodological approach will be discussed with a detailed elaboration of the process for data collection. Afterward, the findings are reported and discussed based on their contributions to the current knowledge, the practical and managerial implications, a critical reflection on the research limitations, and directions for further research will be provided for prospective contributions to the literature.

2. Literature review

As mentioned in the introduction chapter, knowledge about the complex interaction between a comprehensive collection of environmental, psychological, nutritional, societal, and biological factors is limited in the current literature about stress as a potential risk for adverse physical health outcomes, such as obesity (Baum & Posluszny, 1999; Geiker, Astrup, Hjorth, Sjödin, Pijls & Markus, 2018; Richardson et al., 2015; Stone & Brownell, 1994). According to Geiker, Astrup, Hjorth, Sjödin, Pijls, and Markus (2018), various health professionals from prior literature focused on identifying specific types of foods and drinks as the main causes of obesity among stressed individuals (Geiker et al., 2018). Either way, Geiker et al. (2018) posit that the stress-induced consumed food types are just mediators and not causes for overweight and obesity. This finding indicates that the real causes of obesity may stem from the complex interaction between other factors that could influence stress-induced eating behavior (Geiker et al., 2018). Based on relevant findings from prior literature, these stress-related factors are expected to directly affect an individual's food intake (Baum & Posluszny, 1999; Oliver & Wardle, 1999; Oliver et al., 2000; Stone & Brownell, 1994). However, Geiker et al. (2018) also stress the importance of the most common perceived stressors in an individual's life and their association with overweight and obesity since stress-induced food intake is likely to result in several potential physical health outcomes. Geiker et al. (2018) specifically mentioned the need for research on different types of stress.

To contribute to this gap in the literature, this study will more specifically elaborate on the theoretical background behind the most comprehensive critical stress-related factors that together capture a complete picture of stressors embedded in an individual's life. However, the actual analysis in this study will specifically focus on psychological distress from mental health (i.e., anxiety and depression) and its effect on food intake after the experience of acute stress.

Initially, the constructs of importance for this study are stress and resilience. As a broad independent construct, stress is divided into four domains within this study. These four domains represent various stressors from an individual's daily life in contrast to most studies that investigated stress as a general and broad understanding. The four domains represent lifestyle-related-, mental health-related-, social/relationship-related-, and work-related stressors.

Resilience is a construct of high importance for discussing the results later in this study. This study defines resilience as: ‘’One's self-reported capacity to bounce back after

stress'' (Britt, Shen, Sinclair, Grossman & Klieger, 2016, p. 383). A study by Thurston, Hardin, Kamody, Herbozo, and Kaufman (2018) about binge eating among young adult women found that higher perceived stress could lead to more severe binge eating symptoms. In clarification, binge-eating episodes are defined as ''Eating, in a discrete period of time (e.g., a two-hour period), an amount of food that is definitely larger than what most people would eat during a similar period of time and under similar circumstances'' (Thurston, Hardin, Kamody, Herbozo, & Kaufman, 2018, p.114). On the other hand, the authors found that higher resilience was associated with fewer binge-eating symptoms (Thurston et al., 2018). This finding highlights the weakening impact of resilience on stress-induced eating behavior (Thurston et al., 2018). After all, some individuals may have more stress resilience than others, which could impact their actual food intake and even their indirect physical health outcomes. This finding could suggest that, in the context of binge eating, individuals with a high-stress resilience capacity are more likely to restrain their food intake under the experience of stress compared to individuals with a low-stress resilience capacity (Thurston et al., 2018). Therefore, it is essential to consider what is helping these high resilient individuals not experience so much stress when discussing the results.

Given these points about the relevance of resilience, a few stressors discussed in this study can be perceived as coping mechanisms rather than stressors. To clarify, the mental health-related stressors: cognitive regulation of emotions, and mindfulness, may influence food intake without causing stress. Therefore, it makes more sense to interpret these variables as mechanisms that help individuals cope with stress instead of mechanisms that cause stress. In addition, the moderating variable 'education' can also be perceived as a coping mechanism. Similarly, this variable is expected to affect the relationship between the experience of psychological distress from mental health and food intake in a way that higher levels of education are most likely to produce healthier behaviors and vice versa (Brunello et al., 2016; Lê et al., 2013; Jones, 2007; van Lenthe et al., 2015; White et al., 2020).

In summary, higher resilient individuals, as a consequence of higher educational levels, may not let stress induce their food intake because they are highly aware of the potential adverse health outcomes of consuming high energy-dense and snack-type foods and therefore able to cope with stress better than lower educated individuals.

2.1 Stressors

According to a study by Ulrich-Lai, Fulton, Wilson, Petrovich, and Rinaman (2015), a wide range of stressors impact an individual's energy balance and affective state, which depends on various biological and environmental factors. In addition, a study from Leng et al. (2017) about the determinants of food choice found that physiological mechanisms can influence an individual's self-rewarding feeling through eating. Particularly, cognitive-affective factors (e.g., perceived stress, depression, and anxiety) and dietary components (e.g., palatable food) are perceived as determinants of food choice (Leng et al., 2017). Moreover, Torres and Nowson (2007) argue that internal factors (e.g., psychological mechanisms), as well as external factors (e.g., social factors), can influence an individual's food intake.

As mentioned before, most researchers focused mainly on the general concept of stress instead of examining a more comprehensive range of psychosocial, psychological, and environmental factors that can cause stress (Baum & Posluszny, 1999; Richardson et al., 2015; Stone & Brownell, 1994). Therefore, this study will subdivide the broad construct of stress into a collection of the most relevant and capturing stressors that individuals face on a daily basis. In the following sections, all so-called stressors and their influence on food intake and eventually an individual's physical health will be discussed in more detail. Afterward, the analysis will focus on anxiety and depression as the comprehensive drivers of mental health-related psychological distress that are expected to be positively related to stress-induced eating behavior.

2.1.1 Lifestyle stressors

Prior literature argues that lifestyle-related elements such as stress evoked by sleep deprivation are becoming more critical in investigating their influence on an individual's eating behavior (Leiferman, 2017; Yau & Potenza, 2013). In addition, early research has pointed out that lifestyle-related factors that result in stress-induced eating of sugary- and fatty foods contribute to obesity and weight gain (Kaplan & Kaplan, 1957). The two highly relevant lifestyle-related stressors discussed in this domain are sedentary behavior and sleep quality. These variables are highly applicable to all individuals and are closely intertwined, according to Yang, Shin, Li, and An (2017).

Sedentary behavior

The first lifestyle-related stressor is sedentary behavior. Sedentary behavior is defined as ‘’A sitting or reclining posture and low energy expenditure’’ (Yang, Shin, Li & An, 2017, p. 481). According to Leng et al. (2017), a large extent of the health burden is caused by behaviors that can be modified, such as sedentary behavior. In addition, researchers argue that sedentary behavior negatively affects an individual's physical health (Edwardson et al., 2012; Wolk & Somers, 2007). Moreover, prior literature has found that more time spent in sedentary behavior (e.g., because individuals have a sedentary job) causes stress that can lead to metabolic syndromes (Sisson et al., 2009). In contrast, by reducing sedentary behaviors, an individual could prevent the development of such a metabolic syndrome (Edwardson et al., 2012). In addition, a study by Grothe et al. (2013) focused on the relationship between sedentary behavior and food cravings in a sample of women suffering from being overweight. This study found that more inactive individuals craved high-fat foods, leading to more negative physical health outcomes (Grothe et al., 2013).

Moreover, the study of Grothe et al. (2013) suggests that the relationship between sedentary behavior and food cravings could be influenced by an individual’s choice (e.g., watching television on the weekends) or necessity (e.g., having a sedentary job) to sit or recline. In both cases, these overweight individuals are more likely to make unhealthy food choices because they sit or recline (Grothe et al., 2013).

Sleep quality

The second lifestyle-related stressor is sleep quality. Impaired sleep quality is defined as ‘’The difficulty in initiating or maintaining sleep or nonrestorative sleep together with impaired daytime functioning’’ (Gieselmann, de Jong-Meyer & Pietrowsky, 2018, p.2). According to the literature, evidence about the notion that poor sleep can be considered a stressor is emerging (Geiker et al., 2018). Poor sleep quality is generally associated with physical health issues and induced stress (Geiker et al., 2018; Yang et al., 2017). In addition, authors from several studies found that poor and short sleep and also very long sleep are both associated with higher levels of mental stress and obesity (Charles et al., 2011; Iftikhar, Donley, Mindel, Pleister, Soriano, & Magalang, 2015; Olson et al., 2016; Ryu, Kim, & Han, 2011). In addition, stress caused by impaired sleep increases an individual’s emotional self-rewarding behavior by eating palatable foods, which will increase the risks for the development of obesity (Geiker et al., 2018). Furthermore, Yang et al. (2017) found that

sedentary behavior is also associated with an increased risk of sleep disturbance and insomnia (i.e., no sleep). Sleep quality could be negatively influenced by certain sedentary behaviors like watching television or using a computer (Yang et al., 2017). This finding shows a bridge between lifestyle stressors and their combined risk of making unhealthy food choices that negatively affect an individual's health (Yang et al., 2017). Moreover, Yau and Potenza (2013) specifically highlight the need for more research on the relationship between food intake and insufficient sleep.

2.1.2 Mental health stressors

Perceived stress

Perceived stress is a critical mental health-related stressor defined as: ‘’The degree to which situations in one’s life are appraised as stressful’’ (Cohen, Kamarck, & Mermelstein, 1983, p. 387). Prior research found that individuals who experience higher perceived stress are more likely to aim their food choice at convenience foods and energy-dense snacks (Liu et al., 2007; Zellner et al., 2006). Several researchers found that perceived stress in an individual's daily life could increase BMI (Mouchacca et al., 2013; Richardson et al., 2015; Roberts, Campbell & Troop, 2014; Tomiyama, Dallman & Epel, 2011; Tryon et al., 2013). Ford, Lee, and Jeon (2017) suggest that perceived stress can cause increased food consumption that leads to emotional eating, defined as ‘’Overeating high calorie- and high-fat foods in response to negative affect’’ (Ford, Lee, & Jeon 2017, p. 488). This emotional eating behavior could result in stress that forms another risk for the development of obesity (O’Connor & O’Connor, 2004; Stapleton & Mackay, 2015; van Strien, Engels, van Leeuwe, & Snoek, 2005).

Daily hassles

In addition to perceived stress, another relevant stressor concerning mental health are the daily hassles of an individual's everyday life, such as keeping house and handling the finances (Kanner, Coyne, Schaefer & Lazarus, 1981). Daily hassles are defined as ‘’The repetitive, chronic strains of everyday life’’(Crowther, Sanftner, Bonifazi & Sheperd, 2001, p. 450). Daily hassles are potential predictors of psychological symptoms such as stress (Kanner et al., 1981). As a form of psychological stress, daily hassles are perceived as irritating, frustrating, and distressing demands that characterize everyday transactions with an individual's environment (Kanner et al., 1981). Newman, O'Connor, and Conner (2007) found

that increased daily hassles lead to increased snack intake. This study about stress experienced from daily hassles provides evidence for the negative physical health consequences of an individual's food intake (Newman, O'Connor, & Conner, 2007). For example, daily hassles such as time pressures and busy schedules could cause an increased food intake of fast and convenience foods (Baum & Posluszny, 1999).

Cognitive regulation of emotions

Stress responses partially depend on various cognitive processes (Fink, 2000). The cognitive regulation of emotions is defined as all the conscious and non-conscious strategies in an individual's mind used to increase, maintain or decrease emotional responses (Gross, 2001; Jermann, Van der Linden, d'Acremont & Zermatten, 2006). An example of such a strategy is 'putting into perspective,' which means relativizing negative experiences to other experiences (e.g., to convince themselves that the experience could be worse) (Jermann et al., 2006). Prior research has shown that the cognitive regulation of emotions is associated with an individual's life and aims to keep emotions in control during stressful experiences (Garnefski et al., 2002). An example of an individual's cognitive regulation of emotions is the cognitive decision to restrict eating when experiencing stress during a diet (Weinstein, Shide, & Rolls, 1997). According to Fink (2000), stress should be considered a transactional model. This argument stresses the importance of cognitive appraisal because, according to Ford et al. (2017), stress is only experienced when an individual perceives that demands from his/her environment exceed his/her available resources and capabilities. The theory of cognitive emotion regulation holds that thoughts and actions are different processes (Garnefski et al., 2002). Therefore, cognitive strategies should be considered apart from behavioral strategies (Garnefski et al., 2002; Garnefski, Kraaij, & Spinhoven, 2001).

In addition, a prior study suggests that individuals sometimes eat to cope with their emotional stress and negative emotions (Ford et al., 2017). This study shows that some respondents identified negative feelings as a critical emotional trigger that could lead to emotional eating (Ford et al., 2017). These individuals are more likely to turn to food when they do not know how to handle the emotions they are experiencing (Ford et al., 2017). Examples of such stress and negative emotions are traumatic experiences from the past, grief, and attempting to cope with the death of a loved one, which could trigger emotional eating and the maintenance of negative relationships with food (Ford et al., 2017). In contrast, other individuals showed that both positive- and negative emotions could be drivers of emotional

eating (Ford et al., 2017). An example of positive emotions that can cause emotional eating behavior is eating during the individuals' beloved holidays or when certain foods remind an individual of their loved ones (Ford et al., 2017). Besides, eating behavior is also closely related to an individual's mood (Christensen & Brooks, 2006; Fernstrom, 1988). Prior research argues that one respondent stated that he/she did not taste the food he/she picked when feeling moody (Ford et al., 2017). However, he/she just feels the comforting sensation of emotional eating (Ford et al., 2017).

These findings suggest that individuals' cognitive ability to regulate their emotions affects their food intake (Ford et al., 2017). When individuals are exposed to various emotions, they are more likely to eat more than they want to because they cannot cognitively regulate their intake due to emotional stimuli (Volkow et al., 2003). This behavior could lead to even more negative feelings, like a feeling of shame or guilt that reinforces a negative feedback loop towards eating more unhealthy food as a way to deal with these emotions. This problematic behavior will eventually lead to more stress and an increased risk of developing eating disorders which will negatively influence the physical health of that individual (Ford et al., 2017).

As mentioned before, it makes more sense to interpret the ability to cognitively regulate emotions as a coping mechanism for stress instead of a stressor. To illustrate, prior literature argues that conscious cognitive regulation of emotions is closely related to the concept of cognitive coping strategies (Garnefski et al., 2002). Thus, individuals can use cognitive emotion regulation strategies to manage stressful experiences (Garnefski & Kraaij, 2007). Therefore, a plausible assumption regarding this coping mechanism is that individuals who are better able to cognitively regulate their emotions are more able to consciously regulate their food intake.

Mindfulness

Another critical mental health-related stressor is mindfulness. Mindfulness is defined as: ‘’The awareness that arises by paying attention on purpose, in the present moment, and non-judgmentally’’ (Kabat-Zinn, 2013, p. 25). Mindfulness is known to be used in treatment programs to reduce an individual's perceived stress (e.g., by meditating) (Bohlmeijer, ten Klooster, Fledderus, Veehof & Baer, 2011; Kabat-Zinn, 2013). In addition, mindfulness is related to improved well-being through, for instance, better self-regulation (Brown & Ryan, 2003). Similarly, mindless eating is a potentially relevant concept of mindfulness (Bekker,

van de Merendonk, & Mollerus, 2004; Meyer & Waller, 1999). Mindless eating is a situation where eating is seen as a distraction from an individual's current emotional state (Bekker et al., 2004; Meyer & Waller, 1999). Mindless eating can result in an overconsumption of calories and a lack of control over an individual's food intake (Ford et al., 2017). Mindless eaters leave their underlying problems unresolved by maintaining a good positive feeling while eating, even though this leads to overeating (Ford et al., 2017).

Nowadays, mindfulness-based interventions and therapies for various psychological symptoms are increasing (Bohlmeijer et al., 2011). As mentioned before, mindfulness can be perceived as a coping mechanism for stress reduction instead of a stressor. Hence, an individual's grip on their ability to use mindfulness for stress reduction could be an essential determiner of their food intake and, therefore, their subsequent physical health.

Anxiety

Ford et al. (2017) argue that anxiety is an essential determinant of emotional eating. Anxiety is defined as ‘’An organism's preparatory response to contexts in which a threat may occur’’ (Randler et al., 2017, p. 12). Mainly, early studies argue that normal-weighted individuals will respond to the experience of anxiety by reducing their food intake (Herman, Polivy, Lank, & Heatherton, 1987; Randler et al., 2017). However, a study by Herman, Polivy, Lank, and Heatherton (1987) argues that anxiety or stress has no strong effect on an individual’s eating behavior. To illustrate, the authors found that hungry dieters increased their food intake when feeling anxious (Herman et al., 1987). In contrast, the food intake of hungry dieters that did not feel anxious was not affected (Herman et al., 1987).

Depression

Every year, 7% of the European population suffers from depression (Leng et al., 2017). Depression is defined as ‘’A common and serious medical illness that negatively affects how you feel, the way you think, and how you act’’ (American Psychiatric Association, 2020). Commonly, depression can cause an alteration in an individual's food intake (Leng et al., 2017). Nevertheless, depression is perceived as an essential determinant of emotional eating behavior (Ford et al., 2017; Leng et al., 2017; Ouwens, van Strien, & van Leeuwe, 2009). Prior literature points out that higher symptoms of depression result in higher levels of emotional eating (Konttinen, Männisto, Sarlio-Lähteenkorva, Silventoinen, & Haukkala, 2010). Consequently, stress-induced eating behavior resulting from depression

could result in a vicious circle in which weight gain and depression reinforce each other towards adverse health effects (Leng et al., 2017). Prior research argues that, in general, depressed individuals seek more carbohydrates and food types that contain high amounts of sugar and fat in their eating behavior (Ford et al., 2017). In this study, participants often stated that when feeling depressed, they liked to consume more unhealthy foods (Ford et al., 2017). In addition, depression is most likely to decrease an individual's motivation to adhere to healthy dietary habits and will result in a poor diet (Crawford, Khedkar, Flaws, Sorkin, & Gallicchio, 2011). Furthermore, Greeno and Wing (1994) argue that a fraction of depressed individuals gain weight when feeling depressed. In addition, Stunkard, Faith, and Allison (2003) argue that depressed individuals are likely to experience increased stress, potentially leading to obesity in some individuals. Besides, a study by Privitera, King-Shepard, Cuifolo, and Doraiswamy (2019) found that individuals that suffer from depression and obesity have an increased food intake.

As the critical mental health-related stressors for the analysis, a hypothesis is derived from prior literature for the expected effect of anxiety and depression combined into mental health as a measurement construct.

H_1: Mental health-related psychological distress positively influences an individual's food intake.

2.1.3 Social/relationship stressors

Prior research argues that social stressors are increasing among humanity (Tryron et al., 2013). This finding highlights the importance of investigating the effect of social/relationship stressors on an individual's food intake (Tryron et al., 2013).

Loneliness

Several studies suggest that social influences concerning food consumption could play a role in developing and maintaining physical health problems such as obesity (Janssen, Davies, Richardson & Stevenson, 2018a). Higgs and Thomas (2016) suggest that an individual's social context strongly influences their eating behavior. An important stressor in this study is loneliness which is defined as: ''A painful and emotional experience that is threatening to the self and accompanies the perception that one's social needs are not being met by social relationships'' (Welch, Ellis, Green & Ferrer, 2019, pp. 1016-1017). Loneliness

forms a critical risk for the development of obesity and unhealthy eating behaviors (Mason, 2020). For example, Ford et al. (2017) found that some participants became emotional eaters or developed a negative relationship with food due to an experience of abandonment by their parents during their childhood. Some individuals from this study stated that they find comfort in food (Ford et al., 2017). This statement supports the finding that a few participants from the research of Ford et al. (2017) view eating as something that gives them a comforting and calming feeling because these individuals did not perceive themselves as being supported by social contacts or other intimate relationships in comparison to other participants. An important insight from this study is that these individuals felt that food, in contrast to other people, would never fail them, broke their promises, or hurt their feelings (Ford et al., 2017). One of these individuals that have felt a lack of support from social contacts and relationships stated that food is like a dependable best friend to him/her (Ford et al., 2017). This statement supports the notion that food is altered into a friend, companion, lover, and a distractor from perceived stressors by emotional eaters, which should not be the intended purpose of food (Ford et al., 2017).

Need to belong

The need to belong (i.e., being accepted by others) is a fundamental and broadly researched human motive (Leary, 2013). An individual's need to belong is defined as: ‘’A strong desire to form and maintain enduring interpersonal attachments’’ (Leary, 2013). A study by Widjaja and Prihaningtyas (2020) suggests that an individual's food intake can change due to the influence of eating in a social group. Prior literature suggests that individuals consume more when they are in a group or company of their friends than when they eat alone (Higgs & Thomas, 2016; Janssen, 2018a). In addition, researchers found evidence that the unhealthy food intake was associated with the unhealthy food intake of a group of which the individual is part (Janssen et al., 2018a). Moreover, the trigger behind this change in eating behavior in groups is that other individuals could set a norm for appropriate behavior for other individuals (Higgs, 2015). So, the group members could find it odd when other group members consume more or less food than other individuals in that group (Higgs, 2015). Moreover, some individuals became emotional eaters because they felt rejected during their childhood (Ford et al., 2017). These individuals found comfort in consuming high-energy-dense, snack-type foods, such as desserts (Ford et al., 2017). These findings suggest that individuals could increase their food consumption due to social influences such as peer

pressure because they feel the need to belong to that group or adhere to their appropriate behavior (Ford et al., 2017). This increased food intake of high energy-dense and snack-type foods could eventually result in adverse physical health outcomes.

2.1.4 Work stressors

Work-life balance

Work-life balance is defined as ‘’Bringing work, whether done on the job or at home and leisure time into balance and to live life to its fullest’’ (Simmons, 2012, p. 25). Simmons (2012) suggests that home responsibilities must be balanced with work responsibilities to prevent stress and potential burnout. Prior research shows that stress mainly occurs in the workplace, but the possible adverse health effects of chronic work stress are the most prominent physical health concerns (Leng et al., 2017). Moreover, Nevanperä et al. (2012) stated that obesity and abnormal eating behavior could be associated with changes in an individual's work life. In addition, prior literature points out that work stress is associated with obesity and an increased BMI (Berset et al., 2011; Block, He, Zaslavsky, Ding & Ayanian, 2009). Moreover, burnouts are a possible result of an imbalanced work-life balance and are defined as ‘’A state of continual physical and mental exhaustion’’ (Simmons, 2012, p. 25). According to Nevanperä et al. (2012), burnout may affect an individual's eating behavior and results from chronic stress caused by job demands that exceed an employee's resources. In addition, a study by Bauer, Hearst, Escoto, Berge, and Neumark-Sztainer (2012) suggests that higher work-life stress among parents could lead to an unhealthier food environment and eating patterns within that family. These negative consequences of work-life stress may affect related health outcomes of the whole family (Bauer, Hearst, Escoto, Berge, & Neumark-Sztainer, 2012).

2.2 Education

The motives behind food intake are expected to depend on an individual’s level of education (Wadolowska, Babicz-Zielińska & Czarnocińska, 2008). According to Agustina et al. (2021), individuals with a lower level of education have an increased risk of adolescent overweight and obesity. In addition, the authors found that a length of more than nine years of education is a protective factor for overweight and obesity (Agustina et al., 2021). These findings suggest that individuals who lack education have an increased risk of developing obesity compared to higher-educated individuals (Agustina et al., 2021). This suggestion is

plausible because higher educated individuals are expected to make healthier food choices than lower educated individuals (Agustina et al., 2021). In addition, another study found that higher educated individuals have a lower obesity prevalence than lower educated individuals (Gallus et al., 2015). To support the findings above, Hiza, Casavale, Guenther, and Davis (2013) suggest that a higher level of education could be associated with higher nutrition knowledge and the ability to translate this knowledge into better dietary-related practices. So, a higher level of education is expected to make individuals more able to cope with stress-induced food intake than when an individual has a lower level of education. Therefore, expectations concerning the moderating variable 'education' hold that higher educated individuals are more likely to restrain their food intake under the experience of stress than lower educated individuals. Based on prior literature, the following hypothesis is derived:

H_2: The positive effect of mental health-related psychological distress on an individual's food intake decreases in strength for individuals with higher levels of education.

2.3 Food intake

As the dependent variable, food intake is a variable of high importance for this study. As mentioned before, an individual's eating behavior and food choices can be influenced by various interrelated factors (Janssen et al., 2018a). A prior study from Greeno and Wing (1994) found that under the experience of stress, restrained females (e.g., because of a diet) are more likely to have an increased food intake compared to non-stressed females. Second, this study also found that the food intake of normal-weighted individuals is not influenced by the experience of stress (Greeno & Wing, 1994). Third, this study found no differences in vulnerability to stress-induced food intake between individuals suffering from obesity and normal weighted people (Greeno & Wing, 1994). Several studies show that individuals coping with stress crave carbohydrates, salty foods, high-fat foods, sugars, and other sweets (Fernstrom, 1988; Killgore & Yurgelun-Todd, 2006). In addition, stress predicts a higher intake of fast food consumption (Mouchacca et al., 2013). It is highly relevant to investigate what determines an individual's vulnerability to consume more food under the experience of stress since all these findings stress the potential negative consequences of stress-induced food intake on, among other things, an individual's physical health. Therefore, food intake will be measured by individually examining the participants' total amount of calories from snack-type foods that were consumed in the experiment of this study.

2.4 Physical health

As mentioned, stress-induced eating behavior can affect an individual's weight and BMI (Kaplan & Kaplan, 1957; McKay et al., 2021; Richardson et al., 2015). Overweight (BMI of 25 or more) and obesity (BMI of 30 or more) are defined as ‘’Abnormal or excessive fat accumulation that presents a risk to health according to the World Health Organization’’ (Ford et al., 2017, p. 488). Overall, the majority of findings from prior literature in this chapter stress the importance of the adverse physical health effects caused by stress-induced eating behavior. Therefore, the influence of stress-induced eating behavior on physical health will be measured as an additional analysis in this study by assessing BMI values.

2.5 Conceptual framework

Figure 1 visualizes the conceptual framework tested in this study.

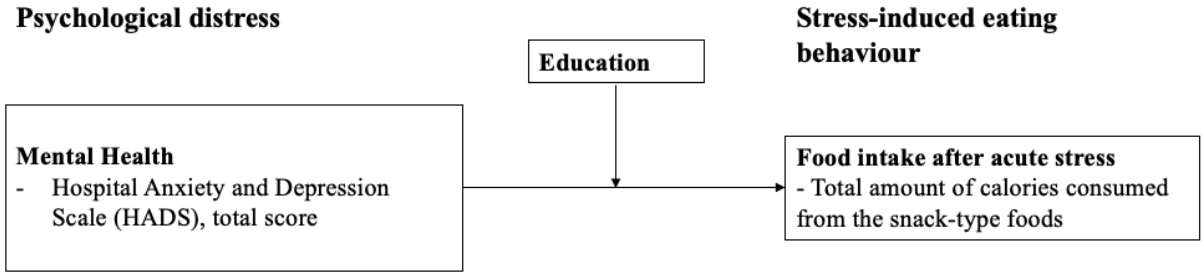

Figure 1. Conceptual Framework

3. Methodology

3.1 Design of the study

This study will analyze a dataset from a sample of 65 individuals obtained from a practice about greater mindful eating and the association with better reversal learning (Janssen et al., 2018b). The experiment aimed to examine whether experimentally created acute stress could influence food intake at one point in time. However, participants were unaware of this aim during the experiment (E. Aarts, personal communications, May 23, 2022). The tool used to induce acute stress is called the socially evaluated cold pressor test (hereafter referred to as SECPT) by Schwabe and Wolf (2010). This chapter will briefly describe how the data was collected, who participated in the research, and what measures were used.

Participants

As mentioned, the sample included 65 healthy individuals aged 19-53, of which 12 were male, and 53 were female (Janssen et al., 2018b). The mean age of the participants is 32 years ($\bar{x}$ = 31.9) (Janssen et al., 2018b). All participants stem from the Nijmegen region (Janssen et al., 2018b). Additionally, this study aimed to only recruit healthy participants between the age range of 18-55 years old, with a BMI ranging from 19 to 35, and with a high motivation to change their undesired eating behavior (e.g., overeating) (Janssen et al., 2018b). Hence, the 65 participants were screened in advance to rule out that these participants were suffering from, among other things, eating disorders, clinical mood disorders, and if they were currently on a diet to guarantee that the experiment was not biased by these factors (Janssen et al., 2018b). For a complete overview of all the exclusion criteria, see the paper of Janssen et al. (2018b).

Testing protocol

The testing protocol started with the screening procedure (as described in the paragraph above), in which potential participants were determined to either be included or excluded from the analysis (Janssen et al., 2018b). Secondly, the procedure was followed by a pre-test session in the laboratory a month before the intervention and a post-test session after the intervention (Janssen et al., 2018b). During these laboratory visits, the physical measurements (e.g., to assess obesity) were first taken (Janssen et al., 2018b). Secondly, the participants filled in some complementary self-reported questionnaires (such as The Hospital Anxiety and Depression Scale discussed in the next paragraph) (Janssen et al., 2018b). Lastly, the digit span was assessed (Janssen et al., 2018b). The digit span measures an individual's

verbal short-term memory for temporary information storage in the human brain (Cambridge Brain Sciences, n.d.). Generally, the pre-and post- laboratory visits began at 11:00 AM or 12:30 PM (Janssen et al., 2018b). Importantly, hunger was not assessed in the experiment to keep the participants unaware of the actual purpose of the experiment (E. Aarts, personal communications, May 23, 2022).

Furthermore, the SECPT intervention was only used in the post-test session (E. Aarts, personal communications, May 23, 2022). The primary purpose of the SECPT intervention was to create acute stress among the participants without them being aware of it (E. Aarts, personal communications, May 23, 2022). During the SECPT, participants needed to stick their right hand and wrist into ice water for three minutes (this amount of time was unknown to the participants) (Schwabe & Wolf, 2010). When participants immersed their right hand and wrist into the ice water, they knew that the experimenter recorded their facial expressions on video (Schwabe & Wolf, 2010). Moreover, the participants were socially evaluated and monitored during the experiment by a rather inhospitable and cold-hearted person whom the participants did not meet in advance (Schwabe & Wolf, 2010). The results of the SECPT intervention were measured through blood pressures, subjective stress ratings, and cortisol concentrations in saliva to see whether the SECPT successfully induced acute stress (Schwabe & Wolf, 2010). As a next step, participants were guided to a more comfortable room by a rather hospitable and warm person 20 minutes after the SECPT was conducted (E. Aarts, personal communications, May 23, 2022). Because this time gap was relatively small, the participants' hypothalamic pituitary adrenal axis (hereafter referred to as HPA) as a response to stress was still high (van Strien, Roelofs, & Weerth, 2013). This response to stress results in cortisol (i.e., stress hormone) production that helps the body cope with stressors (Guy-Evans, 2021). After arriving in this room, stress-induced food intake was assessed (E. Aarts, personal communications, May 23, 2022). This part of the experiment refers to a setting where participants were instructed to watch a small nature-related documentary (E. Aarts, personal communications, May 23, 2022). Before the start of the SECPT and the corresponding stress-induced food intake test, all participants finished a functional Magnetic Resonance Imaging (fMRI) session that lasted 3,5 hours (E. Aarts, personal communications, May 23, 2022). Because of this, it was plausible to assume that all participants were approximately equally hungry (E. Aarts, personal communications, May 23, 2022). Next, before the start of the documentary, participants were informed about the possibility of eating some leftover snacks that were placed in several bowls from another experiment that would

be thrown away at the end of the day (E. Aarts, personal communications, May 23, 2022). This part of the experiment took 20 minutes (E. Aarts, personal communications, May 23, 2022).

3.2 Measures

The following sections will provide a detailed description of how the variables in this study were measured.

3.2.1 Mental health

As the independent variable, mental health (which consists of both anxiety and depression) was measured with The Hospital Anxiety and Depression Scale (hereafter referred to as the HADS) by Zigmond and Snaith (1983). The HADS was assessed as a self-reported questionnaire during the intake session, the pre-test session, and the post-test session (E. Aarts, personal communications, June 11, 2022). However, only the results from the HADS on the post-test session are used in the analysis because these measures were taken on the same day where the SECPT intervention and the food intake task took place (E. Aarts, personal communications, June 11, 2022). According to the developers of the HADS, anxiety, and depression are the most common neurosis-related aspects in hospitals (Zigmond & Snaith, 1983). Hence, anxiety and depression are the only two components of the broad construct 'mental health' that are captured with the HADS for the analysis in this study (Zigmond & Snaith, 1983). The HADS is a valid self-assessment mood scale developed to detect several states of anxiety and depression (Zigmond & Snaith, 1983). The HADS was initially designed to be used in hospital departments that are non-psychiatric (Zigmond & Snaith, 1983). Besides assessing the presence of anxiety and depression, the HADS is a helpful tool for assessing changes in a participant's emotional state (Zigmond & Snaith, 1983). Therefore, it is highly relevant to use the HADS repeatedly to capture specific changes in the emotional state of a participant in this study (Zigmond & Snaith, 1983). As mentioned before, the HADS measures both anxiety and depression but separately from each other (Zigmond & Snaith, 1983). Hence, the scale contains fourteen items, of which seven measure depression and the remaining seven measure anxiety (Zigmond & Snaith, 1983). These items were all measured based on a four-point scale that mostly differs per item (Zigmond & Snaith, 1983). To assess the extent to which an individual suffers from anxiety and depression, the separate scores are summed up after completing the survey (Zigmond & Snaith, 1983).

Higher total scores indicate higher levels of anxiety and depression in an individual respondent (Zigmond & Snaith, 1983). For the data usage, anxiety and depression scores will be combined as one total score representing the independent variable that captures 'mental health' (E. Aarts, personal communications, May 23, 2022). For an overview of all the specific items and measurement scales, see table A.1 from appendix A. For a more detailed description and explanation of the HADS, see the paper of Zigmond and Snaith (1983).

3.2.2 Food intake

As the dependent variable, food intake was measured among all participants under the experience of acute stress. Therefore, acute stress was induced through the aforementioned SECPT, as discussed by Schwabe and Wolf (2010). For the data usage, the food intake is based on the sum of the total amount of calories from all five snack items together (E. Aarts, personal communications, May 23, 2022). The five snack items used in this study are: M&Ms, wine gums, Lays Paprika Chips, cocktail nuts, and raisins (E. Aarts, personal communications, May 23, 2022). Table 1 indicates the total amount of calories per gram of each snack item compared to the other snack-type foods. Finally, the total amount of calories consumed after the experience of acute stress during the documentary phase of the experiment was based on the total weighted grams of the filled bowls before and after the food intake (E. Aarts, personal communications, May 23, 2022).

Snack item	**Calories (kcal) per 1 gram**	**Source**
M&Ms Choco	5,06	(Calorielijst, n.d.)
Wine gums	3,20	(Voedingscentrum, n.d.a)
Lays Paprika Chips	5,52	(Fatsecret, n.d.a)
Cocktail nuts	5	(Voedingscentrum, n.d.b)
Raisins	2,99	(Fatsecret, n.d.b)

Table 2. Overview total calories per snack item

3.2.3 Education

The educational level of the participants was assessed through the Dutch version of the National Adult Reading Test (Janssen et al., 2018b). For the analysis, an individual's level of education was based on a 1-7 point scale of which the numbers indicate the following educational levels that apply to the Dutch community as a whole: 1= never finished or the

repeating of classes in elementary school 2= elementary school without repeating classes, 3= Secondary Ordinary Primary Education (i.e., VGLO in the Netherlands), 4= lower vocational education (i.e., domestic school or mavo-3), 5= secondary vocational education (i.e., mulo or mavo-4), 6= HBS, MMS, Gymnasium, HAVO, higher professional education, and 7= university, agriculture college, technical college/university (E. Aarts, personal communications, May 27, 2022). However, when one of these educational levels was not fully completed, one point was subtracted from the participant's score on the 1-7 point scale for the analysis (E. Aarts, personal communications, May 27, 2022).

3.2.4 Physical health

As discussed in previous chapters, stress-induced eating behavior and physical health are closely related (Kaplan & Kaplan, 1957; McKay et al., 2021; Richardson et al., 2015). This study uses BMI to indicate 'good' and 'poor' physical health. Generally, an ideal BMI value for adults falls between 18.5 and 24.9 (NHS, 2019). However, values below 18.5 indicate underweight, values between 18.5 and 24.9 indicate healthy weight, values between 25 and 29.9 indicate overweight, and values between 30 and 39.9 indicate obesity (NHS, 2019). Since this study also stresses the importance of the negative influences of stress-induced eating behavior on an individual's physical health, it might be interesting to analyze if an individual's BMI influences their food intake. This analysis expects that participants with higher BMI values had a higher food intake during the experiment.

3.3 Ethics

First, the testing/experimental protocol was approved according to the provisions of the World Medical Association Declaration of Helsinki and the institutional guidelines of the CMO of region Arnhem and Nijmegen, which serves as the local ethics committee (Janssen et al., 2018b). Moreover, every participant gave written informed consent and was compensated with money (more specifically, 10 euros per hour for scanning and 8 euros per hour for behavioral tests) for the time the participants had spent in the lab (Janssen et al., 2018b). This compensation was based on the local guidelines regarding reimbursement (Janssen et al., 2018b). Additionally, there is a high probability that incidental findings can occur in any research or experiment (Janssen et al., 2018b). Five participants were excluded from the analysis in this study due to incidental findings such as missing values and poor task-related performance (Janssen et al., 2018b).

4. Results

In this study, a multiple regression analysis was used to predict food intake from mental health moderated by education. Hence the following hypotheses were proposed.
H_1: Mental health-related psychological distress positively influences an individual's food intake.
H_2: The positive effect of mental health-related psychological distress on an individual's food intake decreases in strength for individuals with higher levels of education.

Since this study aims to measure the effect of metrically scaled predictor variables on a metrically scaled outcome variable, a multiple regression analysis is the most suitable multivariate analysis technique (Blazevic, n.d.a; Hair, Black, Babin, & Anderson 2019, p. 265). Multiple regression analysis uses linear components that consist of weighted predictor variables that are expected to collectively predict the outcome variable (Blazevic, n.d.a; Hair et al., 2019, p. 265). In addition, the individual error terms are assumed to have a mean of zero because, in multiple regression, errors cannot be formally assessed (Blazevic, n.d.a). Therefore, the random error is excluded from the equation in this analysis:

$$\text{Food intake} = b_0 + b_1 \text{Mental Health} + b_2 \text{Education} + b_3 \text{Interaction}$$

For multiple regression analysis, a minimum sample size of 50 is required to indicate a sufficient amount of power as long as the dependent variable is normally distributed (Blazevic, n.d.b). In addition, another critical sample size consideration indicates a ratio of 5:1 observations per variable, but preferably 15-20 observations (Blazevic, n.d.b; Hair et al., 2019, p. 279). Since this analysis contains a sample size of 65, a sufficient amount of power is met to conduct the analysis.

Before looking at the required assumptions, it is crucial to assess whether the data set contains influential scores, called outliers (Field, 2018, p. 227). The boxplot does not show any extreme scores. However, according to SPSS, value 21 is suggested to be a mild outlier. Nevertheless, this value will not be removed from the analysis because it indicates a valid score that is not out of the ordinary (Field, 2018, p. 241). Besides, the frequencies statistics show that the data set does not contain any missing values that could influence the analysis.

4.1 Univariate analysis

When examining the data, assessing whether it is normally distributed (Field, 2018, p. 233) is crucial. The Tests of Normality statistics in table B.1. from appendix B shows that the Shapiro-Wilk test is significant ($p < .001$). In the case of small samples, a significant result could indicate a lack of power to detect whether a variable is not normally distributed (Field, 2018, p. 248). Field argues to be aware of such a significant result even though it might not declare a valid extent of non-normality in the distribution of the dependent variable (Field, 2018, p. 248). In contrast, frequencies are perceived as a more useful tool for assessing normality in small samples (Field, 2018, p. 246). The levels of skewness and kurtosis need to be close to the expected value when assessing the normality of a distribution, which is zero (Field, 2018, p. 249). For this analysis, skewness and kurtosis values at an alpha level of .05 need to fall within the range of -1.96 and 1.96 as the corresponding z-score to assume a normal distribution (Field, 2018, p. 249). If these values are greater than 1.96, they are significant (Field, 2018, p. 249). In this case, skewness and kurtosis values are both non-significant for all variables, and therefore a normal distribution may be assumed. In addition, normality can also be assessed by looking at frequency distributions such as histograms and normal probability plots (hereafter referred to as P-P Plots) (Field, 2018, p. 243). As a result, the histograms of all variables represent a curve that can be perceived as a normal distribution. In contrast, the histogram of the dependent variable looks a bit positively skewed. However, a normal distribution may be assumed when comparing skewness and kurtosis values with the corresponding z-scores.

4.2 Bivariate analysis

In multiple regression, all predictor variables should have low correlations with each other (Field, 2018, p. 409). The Correlations statistic is a useful tool to detect collinearity between the predictor variables (Field, 2018, p. 409). Collinearity is defined as ‘’The association, measured as the correlation, between two independent variables’’ (Hair et al., 2019, p. 270). The correlations statistic in table B.2 from Appendix B does not show multicollinearity between predictor variables since all Pearson Correlation (r) values are below .90 (Field, 2018, p. 409). On the contrary, the predictor variables are expected to correlate with the outcome variable highly. Therefore, a value of $r > .30$ indicates a sufficient correlation between predictor variables and the outcome variable (Field, 2018, p. 340). However, this is not the case since all correlations between the predictor variables, and the

outcome variable are < .30 and non-significant. Thus, the highest but still non-significant correlation is between education and food intake (r = -.201, p =.054). Finally, the Coefficients statistic displayed in table B.3 from Appendix B contains a Tolerance column. To indicate less multicollinearity, all Tolerance values should be higher than .10 (Field, 2018, p. 402). The Tolerance values are all around .90, so less multicollinearity can be assumed (Field, 2018, p. 402). In addition, the VIF column also indicates an association between the variables in the model (Blazevic, n.d.d; Field, 2018, p. 402). For low multicollinearity, the values in the VIF column should be close to 1 and not below .10 (Blazevic, n.d.d; Field, 2018, p. 402). Overall, the Coefficients statistic contains VIF values close to 1. So, less multicollinearity can be assumed.

4.3 Assumptions

When conducting a multiple regression analysis, the data must adhere to the four assumptions addressed in this paragraph.

Linearity and homoscedasticity

Both linearity and the homogeneity of variance in the data can be assessed by looking at the scatterplot based on the standard residuals, and the standard predicted values of the dependent variable (Field, 2018, p. 257). The scatterplot shows no clear pattern in the distribution of the data points, and the standardized residuals and standardized predicted values fall within the range of -3 and +3. Therefore, the data can be perceived as unbiased and homoscedastic (Blazevic, n.d.c).

Independence of error terms

The independence of the error terms can be assessed by looking at the Residuals Statistics (Hair et al., 2019, p. 291). The standardized predicted value indicates whether the error terms correlate with the independent variables. The assumption is met when the mean of the standardized predicted values has a value of 0, and the standard deviation has a value of 1. Since this is the case, it can be concluded that the errors do not correlate with the independent variables in this analysis.

Normality of error term distribution

All variables are normally distributed according to the histograms and skewness- and kurtosis values. When running the regression analysis, the output shows a histogram with a normal curve of standardized residuals and a P-P Plot. First, the histogram shows a normally distributed curve. Second, the P-P Plot of the regression standardized residuals looks normally distributed since the dots are spread on and closely around the diagonal.

4.4 Regression and model fit

First, the predictor variables are mean-centered before conducting the regression analysis to avoid multicollinearity and to make the main predictor variables interpretable (Field, 2018, p. 487; Blazevic, n.d.e). Next, an interaction term was created to assess the moderation effect.

Overall model fit

First, the participants' mental health can be assessed by interpreting the descriptive statistics of this predictor variable. Since the separate scores for depression and anxiety are combined into one variable within the dataset, the $\bar{x}$= 8.54 needs to be divided by two to assess the score with the HADS (Rishi et al., 2017). This calculation leads to an $\bar{x}$= 4.27 that, according to the HADS, is classified as a normal case (Rishi et al., 2017). Therefore, it can be concluded that the sample has no mental health problems involving anxiety and depression (Rishi et al., 2017). Secondly, the educational levels of the participants can also be assessed by interpreting the descriptive statistics of this moderating variable. The educational levels of the participants ranged between 5 and 7, and the $\bar{x}$= 6.385 indicates that, on average, the participants finished HBS, MMS, Gymnasium, HAVO, and higher professional education. Thus, the participants included in this experiment are perceived as higher educated individuals.

Furthermore, the ANOVA statistic tests statistical significance for rejecting the null hypothesis through the F statistic (Field, 2018, p. 379). The null hypothesis indicates that all the regression coefficients are equal to zero. This test points out whether there is at least one significant regression coefficient (Field, 2018, p. 379). The bigger the F value, the higher the probability that there is at least one linear relationship between a predictor variable and the outcome variable (Field, 2018, p. 379; Jacobs, n.d.a). However, mental health non-significantly predicts food intake, $F(2,62) = 1.368$, $p = .262$. Second, the interaction effect

between mental health and education also non-significantly predicts food intake, $F(3,61) = .901$, $p = .446$). These values, derived from the ANOVA statistic displayed in table B.4 from Appendix B, show very low and non-significant values. Therefore the null hypothesis needs to be accepted for both models. So, the results indicate that there is no significant direct effect between mental health and food intake as well, as there is no significant interaction effect when adding the moderating variable education to the equation. As a consequence, both H_1 and H_2 are rejected.

Additionally, the Coefficients statistic in table B.3 from Appendix B shows the t-value, which represents the test for causal relationships between each predictor variable and the outcome variable (Jacobs, n.d.a; Jacobs, n.d.b). This value is significant when $p < .05$ (Jacobs, n.d.b). According to the Coefficients statistic, the relationships between each predictor variable and the outcome variable are non-significant. Therefore, the null hypothesis needs to be accepted. Accordingly, there is again no significant indication that the predictor variables and the interaction term either negatively or positively determine an individual's food intake.

Moreover, the Model Summary statistic in table B.5 from Appendix B displays R^2 values to assess how much of the variance in the outcome variable is explained by each model in the analysis (Jacobs, n.d.b). The Model Summary statistic consists of two models. Model 1 refers to the direct effects of mental health and education on food intake because, for a valid interaction term, both the predictor variable and the moderator variable must be included in the model (Field, 2018, p. 486). Model 2 refers to the interaction effect between mental health and education. First, the $R^2 = .042$ depicts that mental health and education explain only 4,2% of the variance in food intake. However, when including the interaction between mental health and education, $R^2 = .042$. Therefore, the interaction between mental health and education non-significantly predict food intake, ($F(1,61) = .010$, $p = .920$). More importantly, because $R^2 = .042$, the interaction between mental health and education does not increase the percentage of explained variance in the food intake (Field, 2018, p. 411). To summarize, by adding the interaction effect in the final model, a statistically non-significant interaction was observed when interpreting the R^2 value. However, when examining the explained variance of several models with relatively small sample sizes, it is advised to interpret the value of the adjusted R^2 since this value corrects for complexity in regression models (Jacobs, n.d.b). First of all, the $R^2_{adj} = .011$ depicts that mental health and education explain only 1.1% of the proportion of variance in food intake. Second, the $R^2_{adj} = -.005$ depicts that only -0.5% of the

variance in food intake is explained by the interaction between mental health and education. Ideally, the R^2_{adj} = -.005 value should be the same as or close to the R^2 = .042. In this case, the difference between these two values in the final model is rather high (.042 + .005 = .047 or about 4,7%). To put it briefly, the model can be perceived as a poor predictor of food intake for the population because it has no explanatory power (Field, 2018, p. 411; Jacobs, n.d.a). Table 2 provides a conclusion regarding the hypotheses testing after assessing the results based on the overall model fit.

Hypothesis	Predicted effect	Confirmation (Yes/No)
H_1	Mental health-related psychological distress positively influences an individual's food intake.	No
H_2	The positive effect of mental health-related psychological distress on an individual's food intake decreases in strength for individuals with higher levels of education.	No

Table 2. Hypotheses testing

Interpretation of results

When interpreting the regression results, it is interesting to look at the Coefficients statistic (Jacobs, n.d.b). The Coefficients statistic in table B.3 from Appendix B shows the beta-values of standardized coefficients. When comparing these absolute values, a conclusion can be made regarding the strength of the effects of both models (Jacobs, n.d.b). However, since all beta-values are non-significant, a comparison between these values is not allowed (Jacobs, n.d.b). Either way, both values have weak effects on the food intake.

4.5 Additional analysis

Since this study also stresses the importance of stress-related eating behavior on an individual's physical health measured by body composition, it might be interesting to analyze whether there is an association between BMI and food intake. A conclusion can be made about the participants ' physical health by looking at the descriptive statistics when running a simple regression analysis. The mean value of BMI among all 65 participants is 26.29. This value indicates that the sample is approximately classified as overweight (NHS, 2019). No participants can be classified as underweight since the lowest BMI value in this sample is

19.07 (NHS, 2019). In contrast, five extreme scores range between 32.74 and 35.76. These participants can be classified as obese (NHS, 2019). For the analysis, it can be concluded that the variable BMI is normally distributed when looking at the skewness and kurtosis values, the histogram, and the Shapiro-Wilk statistic where p =.196. Moreover, like all the predictor variables used in the main regression analysis, BMI will also be mean-centered.

As the next step, a simple regression analysis shows a low correlation between BMI and food intake, r = .147 (as stated before, this value is sufficient when > .30). In contrast, the P-P Plot and the scatterplot look good and show no suspicious patterns. However, the null hypothesis needs to be accepted since BMI non-significantly predicts food intake, $F(1,63) = 1.400$, $p = .241$, as displayed in table C.1 from appendix C. This result means that there is no correlation between BMI and food intake. Furthermore, the model summary statistic in table C.2 from Appendix C shows that the $R^2 = .022$, $p = .241$, which indicates that BMI explains only 2,2% of the variance in food intake. Besides, the $R^2_{adj} = .006$ indicates that when correcting for small samples and complexity in the model, BMI only explains 0.6% of the variance explained in participants' food intake. Therefore, a valid conclusion regarding these results is that BMI is not associated with food intake for this sample.

5. Discussion

As discussed throughout this study, prior researchers mainly argued that negative feelings due to stress typically lead to behavior that causes individuals to consume more unhealthy snack-type foods as a way to comfort themselves and reduce feelings of psychological distress (Baum & Posluszny, 1999; Pecoraro et al., 2004; Zellner et al., 2006). In addition, prior researchers mainly found that higher educated individuals are more likely to make healthier food choices and, therefore, have a lower calorie intake. This notion of resilience towards unhealthy eating is a consequence of more knowledge about, among other things, nutrients and the relationship between nutrients and diseases, acquired through increasing levels of education (Lê et al., 2013; Fort, Schneeweis, & Winter-Ebmer, 2015; Jones, 2007; van Lenthe et al., 2015; White et al., 2020).

This study aimed to investigate to what extent mental health-related psychological distress directly determines an individual's food intake and indirectly affects an individual's physical health under the experience of acute stress when differentiating between various educational levels. The answer to this research question was examined by testing the causal relationship between mental health-related psychological distress and food intake moderated by the level of education. The results show that mental health-related psychological distress and the level of education do not determine an individual's food intake after the experience of acute stress for the sample used in this study. Besides, the interaction between mental health and education also shows no significant effect on food intake. This result means that the stress-induced food intake did not differ based on various educational levels. Additionally, the results from the additional analysis show that BMI is also no predictive factor of food intake for the sample used in this study.

Inconsistent with findings from prior studies in which experimentally created acute stress was induced to examine food intake, this study showed no increase in food intake after the experience of acute stress (Epel et al., 2001; Rutters, Nieuwnhuizen, Lemmens, Born, & Westerterp-Plantenga, 2009). However, in line with a study from Geliebter et al. (2012) among women with obesity, a similar acute laboratory stressor did not significantly predict an individual's food intake. This non-significant result is also supported by a study from Appelhans, Pagoto, Peters, and Spring (2010). Together with the study of Geliebter et al. (2012), the non-significant result in this study might be explained by the fact that, in contrast to acute stress, chronic stress might have a more significant influence on the development of obesity through an increased food intake (Geliebter et al., 2012). This study found that

participants with higher levels of chronic stress and lower cortisol reactivity from acute stress had a significantly higher food intake (Tryon et al., 2013). In these participants, chronic stress also increased their negative mood due to stress, body fat percentage, and total fat mass (Tryon et al., 2013).

Moreover, the sample used in this study mainly included female participants (approximately 82%). This ratio could affect the generalizability of the results and the results themselves. Prior research argues that, compared to men, female subjects are more likely to restrict their intake of certain food types for health- and weight loss reasons (Rand & Kuldau, 1991; Wardle et al., 2004). This finding could clarify why this study found a non-significant causal relationship between mental health and stress-induced food intake. Similarly, the concept of stress resilience could highly contribute to the non-significant results in this study since Thurston et al. (2018) highlight the weakening impact of resilience on stress-induced eating behavior. It could be the case that the individuals included in this experiment appear to have a relatively high stress-resilience capacity and are therefore not affected by either the experimentally created acute stressor or the expected vulnerability to increase their food intake. Therefore, it is essential to consider the concept of resilience when discussing the results of stress-related research. Nevertheless, many resilient factors could explain what is helping high resilient individuals not to be affected by induced stress when assessing food intake (e.g., dietary- or health considerations, mindfulness, and their cognitive ability to regulate their emotions).

Furthermore, from a statistical point of view, a lack of power in small sample sizes can also explain non-significant findings (Field, 2018, p. 90; Jacobs, n.d.a). Since the sample size in this study was relatively small (i.e., 65 participants), the results cannot be generalized and do not have much explanatory power for the proportion of variance in food intake explained by mental health-related psychological distress (i.e., depression and anxiety), education, and the interaction between the two predictor variables. Therefore, a bigger sample is expected to be more powerful in predicting stress-induced food intake.

Lastly, the non-significant findings of the main effect between mental health-related psychological distress and food intake can be explained by the fact that the sample did not suffer from any mental health-related distress. The mean score on the HADS indicated that the participants included in the experiment were approximately all normal cases concerning anxiety and depression when assessing their mental health (Rishi et al., 2017).

6. Limitations and future research

This study highlights several important limitations for its theoretical contributions and for future research. An important limitation of this study is that the actual experiment does not quite match how stress is formulated regarding the broad range of stressors discussed in the literature review section. Initially, this study aimed to examine the effects of various stressors from an individual's daily life on their food choices, as discussed in the preface of this study. However, in the determining experiment for the data analysis, acute stress was experimentally created by implementing the SECPT intervention. So, the original thought to examine stress induced by the discussed stressors (e.g., anxiety and depression) does not match the type of stress induced in this study's actual experiment. This inconsistency in the type of induced stress for predicting food intake can be resolved in future research by leaving out any form of experimentally created stress when conducting an experiment that is aimed to investigate determinants of an increased food intake in the context of stress. Conversely, future research should focus more on stress induced by a broad range of stressors of which anxiety and depression are part since prior researchers imply that the mechanisms by which stress influences eating behavior are not yet fully understood (Richardson et al., 2015).

Secondly, a study by Zellner et al. (2006) found that stressed individuals consumed more unhealthy food types (e.g., M&Ms) and less healthy food types (e.g., grapes) compared to unstressed individuals. Conversely, this study categorized raisins as a high-energy-dense snack type food. However, since raisins are dried grapes and have many health-related benefits when assessing their nutrients, it is plausible to wonder why they are categorized as a relatively 'unhealthy' food choice in this study (Cafasso, 2019). However, raisins are relatively close to wine gums when assessing their total calories in Table 1 from Chapter 3. Hence, raisins are called 'nature's candy' because they contain high amounts of sugar and calories compared to other natural food types (Cafasso, 2019). Additionally, Cafasso (2019) argues that dried fruit consumption should be restricted to a handful and not too much since it contains high amounts of sugar and calories. Since overeating is a prevalent consequence in the context of experiencing stress, raisins were also considered a snack-type food in this study (O'Connor & O'Connor, 2004; Stapleton & Mackay, 2015; van Strien, Engels, van Leeuwe, & Snoek, 2005). However, it is acceptable that opinions about this nutrition-related classification may differ in various points of view and research topics. Therefore, a better option should be to not only include 'unhealthy' snack-type food options when conducting an experiment like the one used in this study. Alternatively, it would be better to also provide

healthier snack-type food options (e.g., fruit, vegetables, and raw and unsalted nuts). Given this experiment, it seems that the participants' food choices were somewhat biased because only high caloric and palatable snack-type food options were offered of which the intake is most likely to increase as a consequence of perceived stress (Baum & Posluszny, 1999; Dalmazo et al., 2019; Oliver & Wardle, 1999; Oliver et al., 2000).

Moreover, since the SECPT was only measured in the post-test session, no baseline was created that indicates whether participants already differed from each other in acute stress responses before the experiment (E. Aarts, personal communications, May 23, 2022). Additionally, the relationship between mental health-related psychological distress and food intake was measured at one point in time in this study. Therefore, it would be relevant to repeatedly measure this relationship by experimenting on several points in time in future studies. By investigating this relationship at several points in time, differences in stress responses can be captured since physiological responses, and stimuli may differ for the various phases in the experience of stress (Sousa, Silva, & Galvão-Coulho, 2015).

In addition, participants' mental health was assessed during the intake session, the pre-test session, and the post-test session. However, only the results of the HADS from the post-test session were included in the dataset (E. Aarts, personal communications, June 11, 2022). This limitation could potentially bias the participants' mental health since measurement at one point in time does not control for potential life events. Greeno and Wing (1994) argue that mood and anxiety measures should be measured before and after the exposure to, in this case, an acute stressor to examine whether the exposure to stress was successful. Besides, since the HADS was a self-reported assessment, the outcomes that indicate mental health could be biased by the participants.

Since food intake drastically decreases when the severity of stress increases, it could be highly relevant to examine more severe and chronic types of stress rather than acute types of stress. This examination could test the assumption that decreased food intake is more likely to occur at higher stress levels (Stone & Brownell, 1994).

Furthermore, there remains a need for more research on the possible relationships between BMI and food intake. It could be highly relevant to assess the direct relationship between BMI and food intake. Given that, in a study about sedentary behavior, obese individuals (i.e., individuals with a high BMI between 30-39.9 (NHS, 2019)) are more likely to make unhealthy food choices in stress-inducing situations compared to normal-weight individuals (Grothe et al., 2013). This finding suggests a future analysis in which, for

instance, several groups of individuals with various BMI values can be compared based on their food intake to assess whether these groups differ in their food intake.

Similarly, only higher education participants were included in the experiment to predict food intake. Future research could focus on comparing more individuals with various educational levels (e.g., low educated individuals, medium educated individuals, and higher educated individuals) to assess the differences in the direct relationship between education and food intake.

As mentioned before, the majority of the analyzed sample was female. From this point of view, a few studies from prior literature suggest that women are most likely to restrict their 'unhealthy' food intake under the experience of stress for weight-loss reasons (Rand & Kuldau, 1991; Wardle et al., 2004). However, another study by Greeno and Wing (1994) argues that, in general, females are more vulnerable to stress-induced eating behaviors. These inconsistencies highlight the need for more research on stress-induced eating behavior and potential factors of resilience for an increased food intake in women.

The main findings and limitations of this study support further research into stress-induced eating behavior and its potential associations with physical health. This study has a big front-end part where it sheds light on a broad range of relevant stressors and coping mechanisms that are still expected to increase food intake. For better generalizability in future research, data from a study like the initial HBS is expected to produce more reliable and generalizable results on stress-induced eating behavior. As an illustration, the HBS aimed to study a sample of 1.000 participants for a whole year through behavioral-, affective-, physiological-, and cognitive testing, bio-sampling, neuroimaging, ecological momentary assessment, real word assessments through wearable devices, and a broad range of questionnaires (Overbeek & Fernandez, 2021). Moreover, future research could also focus on the direct relationship between stress and weight changes to investigate what stressors could lead to adverse health effects (e.g., obesity). The more attention future researchers will pay to stress-induced eating behavior, the more awareness and even coping strategies may be derived to prevent the society from possible adverse health effects as a consequence of perceived stress.

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Appendices

Appendix A. Questionnaire

D	A		D	A	
		I feel tense or 'wound' up:			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like 'butterflies' in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often

1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book or radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Table A.1 Hospital Anxiety and Depression Scale (HADS)

Please check you have answered all the questions

Scoring:
Total score: Depression (D) _____ Anxiety (A) _____
0-7 = Normal
8-10 = Borderline abnormal (borderline case)
11-21 = Abnormal (case)
(Rishi et al., 2017)

Appendix B. Multiple regression analysis

	Shapiro-Wilk		
	Statistic	df	Sig.
total_kcal	.926	65	<.001

Table B.1 Tests of normality

		total_kcal	mean_HADStot	mean_edu	mean_HADStot Xmean_edu
Pearson Correlation	total_kcal	1.000	-.017	-.201	.011
	mean_HADStot	-.017	1.000	-.136	-.206
	mean_edu	-.201	-.136	1.000	.050
	mean_HADStotXmean_edu	.011	-.206	.050	1.000
Sig. (1-tailed)	total_kcal	.	.448	.054	.465
	mean_HADStot	.448	.	.141	.050
	mean_edu	.054	.141	.	.346
	mean_HADStotXmean_edu	.465	.050	.346	.

Table B.2 Correlations

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	330.242	32.759		10.081	<.001		
	mean_HADStot	-2.359	6.635	-.045	-.355	.723	.982	1.019
	mean_edu	-87.239	52.909	-.207	-1.649	.104	.982	1.019
2	(Constant)	330.711	33.349		9.917	<.001		
	mean_HADStot	-2.220	6.829	-.042	-.325	.746	.942	1.062
	mean_edu	-87.362	53.351	-.207	-1.638	.107	.981	1.019
	mean_HADStot Xmean_edu	1.109	10.993	.013	.101	.920	.957	1.045

Table B.3 Coefficients

Model		df	F	Sig.
1	Regression	2	1.368	.262[b]
	Residual	62		
	Total	64		
2	Regression	3	.901	.446[c]
	Residual	61		
	Total	64		

Table B.4 ANOVA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.206[a]	.042	.011	264.10893	.042	1.368	2	62	.262
2	.206[b]	.042	-.005	266.24273	.000	.010	1	61	.920

Table B.5 Model Summary

Appendix C. Additional simple regression analysis

Model		df	F	Sig.
1	Regression	1	1.400	.241[b]
	Residual	63		
	Total	64		

Table C.1 ANOVA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.147[a]	.022	.006	264.79718	.022	1.400	1	63	.241

Table C.2 Model summary