

# **Stress-induced food choice: the contributing role of eight domain-specific stressors**

*Exploring how food choice is (negatively) influenced by eight domain-specific stressors, with a focus on “anxiety and depression”, and assessing how three coping resources may condition these effects, with a focus on “impulsiveness”.*



## **Master Thesis**

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## Preface

Throughout the past few years I developed a passion for living a healthy and balanced lifestyle, by being active and consuming proper nutrition. This passion caused me to write my bachelor thesis about a food-related topic, which amplified my interest in food and dietary habits even further. During my “healthy lifestyle” journey, one obstacle which I encountered, and sometimes still do, is turning to less healthy food choices whenever I faced stress; it was a way to cope with the tension. So, when I came across “stress-induced food choice” as topic for my marketing master thesis, I immediately knew; this is something I want to explore further.

Besides considering studying this as personally relevant, “stress eating” is something affecting many people resulting in negative effects in terms of both mental and physical health, which further spills over to society at large by taking up a substantial part of the financial health burden. This paper is therefore especially written for health organizations to improve the understanding of stress-induced food choice by exploring several domain-specific stressors and discussing the underlying mechanism of how they can lead to poorer food choice. Hopefully, the accumulated knowledge clarifies the importance of stress-management initiatives and interventions which are well-targeted and suited to the specific stressor and individual, in order to limit the risks stress may pose on dietary habits.

While the project started with great value-delivering ambitions, a major setback encountered during the writing process was the announcement that the originally intended dataset was not ready for usage yet. This considerably decreased the study’s potential of contributing new, relevant, and rich insights, as the substitute dataset contained much less data. However, I greatly want to thank my supervisor Ms Belei for her efforts in searching for alternatives, as well as for her overall efforts in guiding me along the writing process, which made it possible for me to still deliver an interesting and comprehensive paper. I also want to thank Ms Aarts for her role in providing an alternative dataset as well as her overall presence during the project, and Ms Hermans for her efforts as my second examiner. Lastly, I would like to thank my family for their unconditional support throughout this project as well as throughout my time studying at Radboud University.

Anouk de Lange, the Netherlands, 21-06-2022

## **Abstract**

Stress may contribute to poor diets, leading to a variety of negative consequences affecting both the individual and society at large. Building on the Transactional Model of Stress and Coping, the current study therefore aimed to explore how a total of eight domain-specific stressors may influence food choice negatively by focusing on “poorer food choice” as stress-coping behavior. Moreover, three stress-coping resources were explored to assess their conditioning effects. An extensive literature review was executed first, to assess the stressors’ individual- as well as relative influence on food choice and to develop a comprehensive theoretically-guided framework. Second, an empirical study was executed on data of 65 healthy participants collected by a previous study through the means of a stress-induced food intake test (Janssen et al., 2018), to assess the effects of one stressor and coping resource in particular. Results of the empirical study showed that anxiety and depression as stressor were not significantly related to poorer food choice, and that impulsiveness as coping resource did not have a moderation effect. This was in contradiction with what was expected from the literature review. The study generally supports the idea that some stressors pose a higher risk for poor food choices than others, on which future research may build by adding empirically-obtained knowledge. For health organizations this has as implication that they should take a versatile perspective towards the stress-coping mechanism, and adapt their intervention-efforts accordingly.

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## 1. Introduction

The food choices an individual makes are part of one's everyday life and are a serious precursor to one's overall health. So are poor diets often linked to physical health outcomes such as cardiovascular risk, diabetes, cancer and obesity (OECD, 2019), and mental health outcomes such as depression and appreciation of life (Boelsma, Brink, Stafleu, & Hendriks, 2010; Jacka et al., 2017; O'Neil et al., 2014). This does not only pose a risk for the individual, but also affects society at large. First, managing the health consequences of poor diets takes up a substantial account of the health care costs (e.g. 8.4% for countries part of the Organization for Economic Co-operation and Development (OECD)) (OECD, 2019). Moreover, according to research by the OECD (2019), increased weight goes paired with reduced performance in schools as well as reduced productivity at work, thereby further adding to a decrease in GDP (e.g. 3.3% for OECD countries). The seriousness of these side-effects on both the individual- as well as societal level highlights the importance of understanding which factors may influence food choices negatively. One such factor is stress, which may stimulate the consumption of snacks high in energy, fat and salt (Baum & Posluszny, 1999; Oliver & Wardle, 1999).

Stress has become a highly researched topic in the past decades, which is not surprising considering its severe influences on mental- as well as physical health (Thoits, 2010). Whereas much confusion exists about the right conceptualization of stress, this paper will generically conceptualize stress as "*the nonspecific response of the body to any demand*", as first defined by Selye (1975, p. 39). Importantly, a further distinction should be made between *stress* and *stressor*. While stress reflects the response which can both be psychological and behavioral in nature (Mcewen, 2008), stressors are the factors causing the stress response. In a practical sense, anything which provokes a stress response can be regarded as a stressor, leading to a large variety of both external- as well as internal stressors (Selye, 1956). This paper will focus on stressors occurring in an individual's everyday life, also referred to as "minor stressors" (Bolger, DeLongis, Kessler, & Schilling, 1989).

When being exposed to stress, coping behaviors as part of the stress response are often employed which can be explained by the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), and implies a "transaction" between an individual and its environment (Lazarus & Folkman, 1987). Generally, these coping behaviors can be in adaptive or maladaptive forms, and influence how stress is dealt with (Lazarus & Folkman, 1984). Often, coping behaviors in the maladaptive form are used to counter aversive states caused by unpleasant stimulations (such as stress), and attain feelings of gratification instead (Zilman

& Bryant R., 1985). The problem, however, is that while such coping behaviors may bring pleasure in the short term, their effects usually become negative in terms of health on the longer term and can even reinforce stress (Bruce & McEwen, 1998). Examples of such behaviors are: smoking, decreased sleep quality, and poor food choices (Hasking, 2006; Mcewen, 2008; Paxton & Diggens, 1997). The latter, poorer food choice, is the coping behavior of interest within this paper, and will be used to understand how a variety of stressors may influence food choice. It refers to the choice for consuming nutritionally poorer (i.e. less healthy) food items than one would consume without the presence of stress. Often, these food items are in the form of snacks and are high in fat and energy (Barrington, Beresford, McGregor, & White, 2014; Baum & Posluszny, 1999; Ng & Jeffery, 2003; Oliver & Wardle, 1999).

What makes some individuals more vulnerable to use such coping behavior than others? Previous research has demonstrated that which events are perceived as stressors and subsequently, which stress responses will follow, differs strongly per individual (Lazarus & Folkman, 1987; Schneiderman, Ironson, & Siegel, 2005; Selye, 1956, 1975). According to Selye (1975), this is due to *conditioning factors* which can be both external as well as internal, and which make some individuals more vulnerable to the effects of stress than others. The current study will therefore explore three of such conditioning factors related to an individual's cognitive processes and personality.

While the large variety in conceptualizations of stress in literature hint to its multi-dimensional nature, a large part of current studies about daily life stressors still take a rather generic perspective to stress (Bolger et al., 1989). Moreover, when specific stressors are examined this is usually done in isolation thereby not paying attention to the stressors' relative importance. The general aim of the current paper is therefore to develop an understanding of how different stressors may have a different relative influence on stress-induced food choice, and how this may be further dependent on conditioning factors. The adopted research design to support this aim consists therefore of (1) a more descriptive part and (2) an empirical part, with each their own objective. First, a comprehensive literature review will be provided in which the multi-dimensionality of stress will be recognized through differentiating between a total of eight domain-specific stressors and three conditioning factors, and discussing how they may influence food choice. Second, empirical knowledge will be contributed by exploring the stressor, and besides mental health proxy, "anxiety and depression" in more detail through the execution of an empirical study. Stages of anxiety and depression may put additional internal stress on the individual, making them less

adequate to appropriately cope with stress. Moreover, research has found that poor diets are related to decreased well-being and mental health (Davison et al., 2021; O'Neil et al., 2014), meaning that individuals may end up in a vicious circle of worsening mental health when using poorer food choice as coping strategy which further highlights the relevance of studying this specific stressor. Together the literature review and empirical study contribute to the academic field by providing a theory-guided framework on which future studies can further build, as well as providing empirically-obtained insights about the mental health proxy.

Besides its academic relevance, the study also provides society with relevant insights. Considering the large health burden poor diets pose on society, understanding which stressors in particular may lead to such diets and how conditioning factors may influence this is of high relevance. While this study does not empirically analyze all the stressors, it does deliver a comprehensive overview of the studies which did analyze this for the individual stressors. This already provides insights into which stressors in particular may need more attention in regard to minimizing its negative consequences (through e.g. interventions), and what kind of individuals may be more vulnerable based on the discussed conditioning factors.

To reach the research aim, two research questions, one for each objective, will be explored throughout this paper. The first research question will be theory-guided and reads the following:

*RQ 1: “How do daily stressors influence food choice, and how are these effects further influenced by three conditioning factors?”*

The second research question will be answered through the empirical study and is:

*RQ 2: “How does anxiety and depression as internal stressor influence food choice, and how is this effect further influenced by impulsiveness?”*

The remainder of the paper is structured as follows. Previous research will be discussed first extensively in the literature review. This review will end with a proposed conceptual framework and two hypotheses related to the second research question. Thereafter, the conducted research will be explained in the methodology chapter, and the results and its implications will be discussed in the results and discussion chapters respectively. The paper ends with several limitations and directions for future research.



## 2. Literature Review

How come that some individuals are able to sustain a healthy weight and others are not? Apart from metabolic and genetic aspects, this is largely influenced by psychological and behavioral processes (Baum & Posluszny, 1999). How stress is dealt with and which food choices are being made are part of such processes, and can thus influence one's health. In this chapter, the theory functioning as the underlying framework will be presented first. Next, literature about the relation between stress as overarching concept and food choice will be discussed. After that, this relation will be investigated in more detail by reviewing literature about the individual stressors. To provide more context, a total of three factors which could potentially condition this relation are discussed next. The chapter will end with the presentation of the conceptual model on which the empirical study will be built.

### 2.1 Transactional Model of Stress and Coping

When stressors are experienced, a stress response follows which includes biological, behavioral, cognitive, physiological and emotional responses (Baum & Posluszny, 1999). While stress events (i.e. stressors) in essence can also be positive, it usually goes paired with feelings of tensions and discomfort, whether the events causing the stress are perceived as negative or positive (Baum & Posluszny, 1999). Therefore, the stress response is often paired with coping strategies which are used to react to the stressful event. With *coping* is meant "that response to danger consisting of behavior or other activities that are intended to resolve the stressor or minimize its effects" (Baum & Posluszny, p. 142, 1999). To further understand the stress-coping process, the Transactional Model of Stress and Coping as introduced by Lazarus & Folkman (1984) will be used as theoretical foundation throughout this paper. According to this theory, coping behaviors result as part of the stress response when (1) stress is perceived (i.e. the primary appraisal) and (2) when insufficient coping resources are present to deal with the stress (i.e. the secondary appraisal). Lazarus & Folkman (1984) distinguish between two broad coping-categories: adaptive forms and maladaptive forms, with the latter often leaving stressful events unresolved as they are not effectively dealt with (Mahmoud, Staten, Hall, & Lennie, 2012). Maladaptive coping includes a variety of sub-coping strategies such as that of avoidance coping. Avoidance strategies are generally considered as maladaptive as they often negatively influence health by behaviors such as smoking, decreased sleep quality, - and the coping behavior of interest within this paper - poor food choices (Hasking, 2006; McEwen, 2008; Paxton & Diggins, 1997).

Coping behaviors are further influenced through the secondary appraisal, which is an

assessment if the stress event can be managed by evaluating the availability of *coping resources* (Wah, 2010), frequently referred to as “conditioning factors” throughout this paper. These coping resources can be more contextual/external (e.g. social support), or personal/internal (e.g. resilience) (Kraaij, Garnefski, & Maes, 2002). While coping behavior is influenced by both types, research has found that when avoidance coping strategies were used, the resulting coping behavior was more dependent on internal factors (Lazarus & Folkman, 1987). Accordingly, only internal coping resources will be studied within this paper, which determine an individual’s level of resilience. *Resilience* refers to “the capacity and dynamic process of adaptively overcoming stress and adversity while maintaining normal psychological and physical functioning” (Wu et al., p. 1, 2013), leading to differences in how individuals cope with stress.

## **2.2 Stress and Food Choice**

Several studies have examined how stress can influence food choice. The study by Oliver & Wardle (1999) for example, investigated whether the types of food consumed by students differed when stress was experienced. Relying on self-reports, they found that for both males and females snack-type foods and foods high in energy were consumed more often. Steptoe, Lipsey, & Wardle (1998), who relied on the diary self-reports of nurses and teachers, found an increase in intake of fast food meals as main effect of stress. Both Oliver & Wardle (1999) and Steptoe, Lipsey, & Wardle (1998) give “ease of-“ or “non-required” preparation as possible explanations for the change towards such food types in stressful periods, hinting towards convenience as important motivation. However, both studies do not explicitly link stress to an increase in high-fat foods, while this link has found to be strong in a variety of other studies (Barrington et al., 2014; Baum & Posluszny, 1999; Ng & Jeffery, 2003). A reason could be that within the two studies, participants had to choose from a rather non-comprehensive list of food groups in which “high-fat” foods in specific was not included (Oliver & Wardle, 1999; Steptoe, Lipsey, & Wardle, 1998). In contrary, a study who did actually use a comprehensive list of food groups is the study by Barrington et al. (2014). They assessed the amount and frequency consumed of 120 foods and found that higher perceived levels of stress led to an increase in fast-food and high-fat snacks intake. In addition, they found that with higher levels of stress the overall energy consumed consisted for a larger percentage of fat, thereby decreasing the percentage of energy consumed consisting of carbohydrates. This can be seen as problematic as weight gain results more often from high-fat diets compared to high-carbohydrate diets (Baum & Posluszny, 1999). However, while the

study by Barrington et al. (2014) measured food intake extensively, a rather narrow perspective on stress was used by measuring perceived stress with a single item only. A study who found similar effects but which measured perceived stress somewhat more extensively by using four items is that of Ng & Jeffery (2003). They found a link between higher perceived stress and higher fat intake as well, but did not include any other food types in their study like Barrington et al. (2014) did. Together, these studies thus portray clear linkages between stress and less healthy food choices, often consisting of snack-type foods high in fat.

Overall, there tends to be a focus in literature on the more prominent “life events” while such a focus does not take into account the more ongoing minor stress events happening in an individual’s daily life, which have actually been found to be a better predictor of psychological- and health outcomes (Kanner, Coyne, Schaefer, & Lazarus, 1981; Lazarus & Folkman, 1987). This study will therefore be focusing on such minor stressors. Moreover, previous research often does not make a distinction in the type of stress experienced (i.e. the different types of stressors) but rather takes a general perspective to stress (Barrington et al., 2014; Ng & Jeffery, 2003). Steptoe, Lipsey, & Wardle (1998) did take a somewhat broader view by distinguishing between work- and home related hassles, but did not in further detail study the effects of the different stressors on food choice. Literature on the individual stressors and their relation to food choice do exist, however, to date no comprehensive studies researching the stress – food choice relationship exist which include a broad variety of stressors concurrently. This can be regarded as a serious gap in literature as according to Lazarus & Folkman (1987), next to assessing stress in its *degree*, it is of high importance to also study the different *sources* causing stress in order to find the underlying factors which make people more or less sensitive to stress. This is supported by Schneiderman et al. (2005) who state that the stress response is influenced by characteristics of the stressor, thus pointing towards multiformity of the effects of the stressors. Accordingly, this study will take a first step in filling this gap by bringing together insights from a broad variety of literature about a total of eight domain-specific stressors and their influence on food choice. The study further contributes by zooming into one of the stressors part of the mental health domain (i.e. anxiety and depression), which has been chosen as (1) it functions as a more general proxy for mental health and (2) the severeness of the vicious circle individuals with anxiety and depression can end up in when using poorer food choice as a stress-coping strategy.

## 2.3 Domain-Specific Stressors

In this section, literature will be reviewed about a total of eight stressors reflecting both internal- as well as external stressors, including: sedentary behavior, sleep quality, loneliness, need to belong, work-life balance, perceived stress, daily hassles, and anxiety and depression. These stressors are subdivided under four domains to which they are related, including the lifestyle-domain, the mental health-domain, the social-domain, and the work-domain. These four domains have been selected as they cover a diverse range of factors which influence the experienced stress, with some being more related to the individual (i.e. the lifestyle- and mental health domains) and others being more related to also external factors and pressures (i.e. the social- and work domains).

### 2.3.1 Lifestyle

**Sedentary behavior.** The first stressor which will be examined is *sedentary behavior*, which reflects time spend sitting and can be categorized as an external stressor. It includes behaviors such as sitting at work, watching screens such as TV, and sitting in the car (Owen et al., 2011). Mixed findings exist in literature about the relationship between sedentary behavior and stress. The paper by Teychenne et al. (2019) reviewed the methodology and results of 26 studies to further explore the relation between sedentary behavior and stress. Their overarching conclusion was that no sufficient evidence existed for the sedentary behavior – stress association, as a lot of contradicting results existed in the reviewed literature and a large number of studies did not find significant associations (Teychenne et al., 2019). However, while sedentary behavior in itself may not be that directly related to stress, the study by Dutheil, Bergouignan, Tremblay, & Panahi (2018) reviewed a variety of studies which investigated the relation between sedentary *activities* and stress. Based on a variety of significant associations they found in these studies they concluded that the problem might not be the sedentary behavior itself, but the accompanying stressful stimulation that comes with such sedentary activities such as a poor sitting position, stressful job settings and the depletion of cognitive effort (Dutheil et al., 2018). Accordingly, their review suggests sedentary behavior is related to stress, though possibly indirectly. In regard to the association between sedentary behavior and diet there is clearer evidence. A systematic review by Pearson & Biddle (2011) reviewed 53 studies which analyzed this association. Their overall conclusion was that the studies showed a clear association between sedentary behavior and diet, with sedentary behavior often being linked to a less healthy diets including more intake of snack-type foods which were high in energy (Pearson & Biddle, 2011). This review, accompanied

by the study by Dutheil et al. (2018), suggests that higher levels of sedentary behavior negatively influences food choice (i.e. leading to less healthy/poorer food choices).

**Sleep Quality.** A second external stressor part of the lifestyle domain is “sleep quality”. What composes sleep quality can differ per individual, but in a general sense *sleep quality* “includes quantitative aspects of sleep, such as sleep duration, sleep latency, or number of arousals, as well as more purely subjective aspects, such as “depth” or “restfulness” of sleep” (Buysse, Reynolds, Monk, Berman, & Kupfer, p. 194, 1989). Compared to sedentary behavior, more evident associations between stress and sleep quality exist in literature (Åkerstedt et al., 2012; Almojali, Almalki, Alothman, Masuadi, & Alaqeel, 2017; McEwen, 2006; Wells & Cruess, 2006), in which lowered sleep quality is often referred to as “sleep deprivation” (McEwen, 2006; Wells & Cruess, 2006). The relation between stress and sleep quality goes both ways; poor sleep quality can result in allostatic overload (McEwen, 2006), thus adding to stress, as well as stress leading to poorer sleep quality (Almojali et al., 2017). The same holds true for sleep quality and food choice; food choice, or “diet”, influences sleep quality (Campsen & Buboltz, 2017; Lindseth, Lindseth, & Thompson, 2013), as well as sleep quality influencing food choice (Weiss et al., 2010; Wells & Cruess, 2006). However, direction of causality between the two concepts can be difficult to determine (Godos et al., 2021; St-Onge, Mikic, & Pietrolungo, 2016). Some studies which hypothesized the direction of causality from sleep quality to food choice are that of Wells & Cruess (2006) and Weiss et al. (2010). The study by Wells & Cruess (2006) analyzed the changes in food choice due to lowered sleep quality for a sample of college students. They found that, when students experienced sleep deprivation, they were more likely to turn to less healthy food choices (Wells & Cruess, 2006). Weiss et al. (2010) found similar results for adolescents, but provides more detailed insights into the food choice changes; female participants who slept shorter portrayed a significant increase in fat intake and a decrease in carbohydrates intake compared to female participants who slept longer. Moreover, short sleep resulted more often in consumption of snack-type foods (Weiss et al., 2010). This is in accordance to the previously discussed studies which investigated the relation between stress and food choice (Barrington et al., 2014; Baum & Posluszny, 1999; Ng & Jeffery, 2003). Thus, according to these studies, a lowered sleep quality may negatively affect food choice.

### **2.3.2 Social Relationship**

**Loneliness.** People have certain desires to form social relationships. When a gap exists between the desired social relationships and the actual social relationships, we speak of

*loneliness* (Perlman & Peplau, 1984). As loneliness can be both objectively and subjectively assessed according to Perlman & Peplau (1984), it may be regarded as both an external as well as internal stressor. Several studies have shown that loneliness is connected to stress (Segrin, McNelis, & Pavlich, 2018; Segrin & Passalacqua, 2010; Yarcheski, Mahon, & Yarcheski, 2011), thus making “loneliness” a serious stressor and potential influencer of health. The study by Lauder, Mummery, Jones, & Caperchione (2006) mentioned social aspects such as inclusion and support as important mediators between loneliness and health-related behaviors (Lauder et al., 2006), whereas the study by Segrin & Passalacqua (2010) found loneliness to be a mediator between social support and health outcomes and health behaviors again mediating the relation between loneliness and health. While somewhat different sequences of relations, both studies suggest that low degrees of such social aspects and loneliness impact someone’s health behavior. Loneliness can also lower an individual’s self-regulation capacity in terms of feelings, thoughts, and behavior (Hawkey & Cacioppo, 2010). It thereby points to “self-regulation” as mediator between loneliness and health, with failure in self-regulation being associated with obesity (Heatherton & Wagner, 2011). The study by Lauder, Mummery, Jones, & Caperchione (2006) adds to this connection by finding that individuals who reported to be more lonely were more likely to be overweight and obese, which they say may be in part due to lowered self-regulation capacity. This is supported by Saine & Zhao (2021) who demonstrated that loneliness induced higher preference- and consumption of unhealthy food, and was mediated by self-regulation. Following this research, it thus seems that higher levels of loneliness negatively influences food choice.

**Need to Belong.** A second stressor of the social relationship domain is “need to belong”. *Need to belong* refers to the idea that “people have a fundamental, strong, and pervasive motivation to form and maintain at least a certain minimum number of social relationship” (Baumeister, p. 124, 2011). As with loneliness, this stressor measures the extent to which individuals perceive to be connected to others (Mellor, Stokes, Firth, Hayashi, & Cummins, 2008), but is more categorized as internal than loneliness (Baumeister, 2011). While distinct concepts, several studies indicated associations between loneliness and need to belong (Lim, Allen, Furlong, Craig, & Smith, 2021; Mellor et al., 2008; Reichl, Schneider, & Spinath, 2013). This overlap therefore suggests that stress resulting from need to belong will influence food choice in a rather similar way (i.e. negatively).

### 2.3.3 Work

**Work-Life Balance.** When employed, one is confronted with demands from both work and one's personal life, which can be conflicting. The external stressor *work-life balance* refers to the challenging act of trying to manage and balance the demands from both these domains (Sen & Bakht, 2013). With high demands, an individual has to exert much effort for providing an adaptive response which requires sufficient time to recover (Geurts et al., 2007). In the case of no sufficient recovery, "negative load reactions" can occur in the form of strain or stress by exceeding one's capacity of effort regulation, which can spill over to the other domain (i.e. work or personal life) (Geurts et al., 2007). Not much is known on the exact effects of stress caused by work-life balance on food choice. However, in their study, Devine et al. (2006) found that food choices were often used as coping strategy to deal with the stress caused by the challenge of integrating both work and personal life demands, which often led to nutritionally poor food choices such as fast food. Moreover, the challenge of balancing the work and life demands requires time and effort, which leaves less time and effort for preparing nutritionally rich meals (Devine et al., 2006). Accordingly, this suggests that a low work-life balance negatively affects food choice.

### 2.3.4 Mental Health

**Perceived Stress.** *Perceived stress* may be regarded as an internal subjective measure of the degree to which an individual judges events to be stressful (Cohen, Kamarck, & Mermelstein, 1983). It differs from most of the other stressors in that it is based on subjective evaluation, compared to more objective assessments. Perceived stress provides insights into the extent to which individuals regard their lives as uncertain, overloading, and out of control (Cohen et al., 1983). Prior research demonstrates linkages between perceived stress and food choice, with higher levels of stress often negatively impacting diet (Errisuriz, Pasch, & Perry, 2016; Khaled, Tsofliou, Hundley, Helmreich, & Almilaji, 2020; Nastaskin & Fiocco, 2015). Nastaskin & Fiocco (2015) investigated whether perceived stress among under graduates was associated with fat intake, and found that higher levels of perceived stress led to greater fat intake compared to lower levels of perceived stress. Their study also refers to the previously discussed "coping mechanism" as possible explanation for why the undergraduates changed food choices as result of the perceived stress (Nastaskin & Fiocco, 2015). Within a systematic review by Khaled, Tsofliou, Hundley, Helmreich, & Almilaji (2020) more support is found for the finding that perceived stress is related to higher fat intake, as almost all of the reviewed studies examining fat consumption reported increases in fat intake when levels of

perceived stress were higher. Furthermore, Errisuriz, Pasch, & Perry (2016) found that students who reported higher perceived stress were consuming more foods high in energy and with low nutritional quality, and that these foods were often in the form of a quick and easy source of energy. This finding again hints to the importance of “convenience” when stress is perceived, as discussed before (Oliver & Wardle, 1999; Steptoe et al., 1998). According to these studies, it seems that food choice is negatively influenced by higher levels of perceived stress.

**Daily Hassles.** *Daily hassles* can be conceptualized as “the irritating, frustrating, distressing demands that to some degree characterize everyday transactions with the environment” (Kanner et al., p. 3, 1981), and is categorized as an external stressor. They happen on a rather continuous basis, and can be regarded as the more “minor” stressors or events happening in everyday life such as upcoming deadlines, small arguments and work-related worries (Serido, Almeida, & Wethington, 2004). As such, they can influence an individual on an ongoing basis, which is supported by the finding that such hassles influence aspects of health more than the often studied life events (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Kanner et al., 1981). One way daily hassles can affect health is through food choice (O’Connor, Jones, Conner, McMillan, & Ferguson, 2008; Zenk et al., 2014). The research by Zenk et al. (2014) revealed an increase in the probability of consuming snack-type foods when the number of daily hassles increased. However, only female participants were included in their study. O’Connor, Jones, Conner, McMillan, & Ferguson (2008) included both males and females in their research, and found that snack-type foods were consumed more when hassles were experienced, and that for females in particular these snack-type foods were characterized by high sugar and fat. Accordingly, these studies and the finding that daily hassles have a relatively large influence on health aspects suggest that an increase in daily hassles negatively influences food choice.

**Anxiety and Depression.** The third and last stressor part of the mental health domain, which will also be zoomed into in the remaining of this study for which it will be discussed slightly more extensive, is the internal stressor “anxiety and depression”. While seen as an individual stressor, this stressor may also be regarded as a proxy for mental health, as it assesses an individual’s psychological distress which is a dimension of mental health (Headey, Kelley, & Wearing, 1993). *Anxiety* is a state in which a person’s mood is influenced by the possibility that negative events will occur (Barlow, 2004). *Depression* is “a negative affective state, ranging from unhappiness and discontent to an extreme feeling of sadness,



pessimism, and despondency, that interferes with daily life” (“APA dictionary of psychology,” n.d.). While separate phenomena, the two states both reflect mental disorders and have several overlapping aspects as revealed by the literature review by Stavrakaki & Vargo (1986). This overlap is further supported by other research of which some see depression as a heterogeneous illness which encompasses a variety of subtypes such as that of anxiety (Raison & Miller, 2001; Van Praag, 2005), for which they will be put together under one stressor. Both mental disorders are linked to stress by a variety of studies.

An extensive review by Tennant (2002) of several studies researching stress and depression highlighted the evident relation between the two constructs, and indicated that different types of stress can cause different depressive symptoms. Moreover, Hammen (2003) who reviewed several studies about the connection between stress and depression concluded that the relation between stress and depressive symptoms is especially apparent in women, with women reporting more stressful events being more likely to be depressed than women reporting less stressful events, which is also supported by the review of Tennant (2002). Furthermore, Van Praag (2005) who sees anxiety as a sub-type of depression, argues that stress can especially cause specific depressive-features in the form of aggression and enhanced anxiety levels. The between-subject study by Grillon, Duncko, Covington, Kopperman, & Kling (2007) further supports this by finding that exposure to stress stimulates anxiety.

Apart from the more general associations between stress and states of anxiety and depression, there has also been research on how individuals with higher levels of anxiety and depression tend to cope with stress (Daniels & Holtfreter, 2019; Mahmoud et al., 2012). The study by Mahmoud, Staten, Hall, & Lennie (2012), who used a large sample of students, found that higher levels of anxiety and depression were significantly related with the use of maladaptive coping strategies. This is also supported by Daniels & Holtfreter (2019) who likewise used a sample consisting of university students and included a variety of maladaptive coping strategies in their study. Since “poorer food choice” belongs to the sub-category of avoidance coping, part of the maladaptive coping strategies, it would thus be expected according to the above studies that there is a positive relation between individuals with higher levels of anxiety and depression and the use of poorer food choice. This is supported by Fernstrom, Krowinski, & Kupfer (1987) who studied a group of depressed outpatients for four months and found that anxiety and depression were often related to the consumption of snack-type foods which are high in fats and energy. Moreover, the cohort study by Liu et al. (2007) found significant relations between depression and snack-type foods such as ready-to-eat food

and fast-food in a sample of college students. Accordingly, these studies seem to indicate that food choice is negatively affected by anxiety and depression. For an overview of the discussed literature per stressor, please see Table 1.

On top of the above discussion, there is more to unpack in why studying anxiety and depression in particular and its relation to food choice is of importance. How stress is dealt with, i.e. which coping strategies are used, influences the effects on aspects such as health and well-being (Lazarus & Folkman, 1987). According to research, maladaptive coping strategies have been found to be significantly related to decreased well-being, with heightened states of anxiety and depression in specific (Mahmoud et al., 2012; McC Miller, Surtees, Kreitman, Ingham, & Sashidharan, 1985). This means that individuals with higher levels of anxiety and depression can get locked into vicious circles when using maladaptive coping strategies to cope with stressful events. When connecting this to “poorer food choice” as a maladaptive coping strategy, this notion is particularly further supported for depression by other studies (Akbaraly et al., 2009; Sánchez-Villegas et al., 2012). For example, El Ansari, Adetunji, & Oskrochi (2014) found significant associations between the consumption of foods categorized as unhealthy (e.g. cookies, fast food, snacks, and sweets) and symptoms of depression in a sample of undergraduates. The cohort study by Sánchez-Villegas et al. (2012) adds to this by finding significant associations between the consumption of fast-food and heightened risks of depression in a diverse sample. Furthermore, Akbaraly et al. (2009) found a clear association for women between the consumption of processed foods (such as fried food and chocolate) and higher risks of depression. Together these findings found in previous studies point towards the importance of disrupting this vicious circle of using poor food choice as maladaptive coping strategy, and promote the use of adaptive coping strategies instead. This is also supported by Thompson et al. (2010) who found that adaptive coping strategies are an effective means in lowering the use of maladaptive coping strategies and decreasing symptoms of depression. Therefore, and in combination with anxiety and depression functioning as a proxy for mental health in a broader sense, this particular stressor will be the focus of the remainder of this study, and will be further investigated within the empirical study.

**Table 1***Stressors – Food Choice Literature Review Overview*

Stressor	Author	Methodology	Sample	Main Findings
Sedentary Behavior	Pearson & Biddle (2011)	Systematic review of 53 studies	-	The reviewed studies showed a clear linkage between sedentary behavior and less healthy diets often consisting of snack-type foods high in energy.
Sleep Quality	Wells & Cruess (2006)	Self-report in the form of diaries	College students	Students who experienced sleep deprivation were more likely to turn to less-healthy food choices.
	Weiss et al. (2010)	Cross-sectional cohort	Adolescents	Shorter sleep was related to an increase in fat intake and a decrease in carbohydrates, often in the form of snack-type foods.
Loneliness / Need to belong	Lauder, Mummery, Jones, & Caperchione (2006)	Surveys	Adults	Individuals who reported to be more lonely were more likely to be overweight and obese.
	Saine & Zhao (2021)	Experiments	Lonely & non-loney individuals	Loneliness can lead to a higher preference- and consumption of- unhealthy food.
Work-life balance	Devine et al. (2006)	Interviews	Parents	Nutritionally poor food choices were often used as coping strategy to deal with stress caused by the challenge of integrating both work and personal life demands.
Perceived stress	Nastaskin & Fiocco (2015)	Surveys	College students	Higher levels of perceived stress led to greater fat intake.
	Khaled, Tsofliou, Hundley, Helmreich, & Almilaji (2020)	Systematic review	-	Perceived stress was related to higher fat in most reviewed studies.
	Errisuriz, Pasch, & Perry (2016)	Surveys	College students	Higher perceived stress was associated with the consumption of foods high in energy and low nutritional quality.
Daily hassles	Zenk et al. (2014)	Surveys	Adult females	An increase in daily hassles was related to an increase in consuming snack-type.
	O'Connor, Jones, Conner, McMillan, & Ferguson (2008)	Self-report in the form of diaries and surveys	Adults	An increase in daily hassles was related to an increase in consuming snack-type foods. For females in particular these snack-type foods were characterized by high sugar and fat.
Anxiety and depression	Fernstrom, Krowinski, & Kupfer (1987)	Surveys	Depressed outpatients	During depressive episodes participants showed an increase in desire for food high in fat and carbohydrates.
	(Liu et al., 2007)	Surveys	College students	Depression is related to the intake of snack-type foods, especially in the form of fast food and ready-to-eat.

## **2.4 Coping Resources: Cognitive Emotion Regulation, Mindfulness, & Impulsiveness**

As discussed, individuals differ in how they cope with stress which can be in part explained by varying levels of resilience according to the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984). What determines an individual's level of resilience can be explained by a variety of factors part of, among others, developmental, genetic and psychological mechanisms (Wu et al., 2013). The latter, psychological mechanisms, includes factors such as cognitive processes and personality traits (Wu et al., 2013). Three potential conditioning variables part of these two factors, one cognitive process (i.e. cognitive emotion regulation) and two personality traits (i.e. mindfulness and impulsiveness), will be explored and discussed. These three have been chosen as they were in the interest of the research by having clear linkages with aspects of mental health (Greeson, 2009; Gross & Muñoz, 1995; Sharma, Markon, & Clark, 2014).

### **2.4.1 Cognitive Processes**

Cognitive processes, or the ways in how people think, differ per individual and greatly affect the experienced emotions and displayed behaviors. This suggests that such processes influence how individuals deal with stress, meaning that the effects of stressors on one's food choice is dependent on an individual's cognitive processes. One such a cognitive process which will be discussed next is "cognitive emotion regulation".

**Cognitive Emotion Regulation.** Several forms of self-regulation exist, with one of them being the regulation of our emotions. A variety of emotion regulation strategies can be applied to influence (1) which emotions are experienced, (2) how they are experienced, and (3) how they are expressed (Gross, 2001). Here, there will be focused on "cognitive emotion regulation" (CER). *CER strategies* rely on cognitive resources and are characterized by the more conscious processes which involve thinking (Jermann, Van Der Linden, D'Acremont, & Zermatten, 2006). CER strategies broadly include five adaptive strategies (i.e. refocus on planning, positive refocusing, acceptance, putting into retrospective, and positive reappraisal) and four maladaptive ones (i.e. self-blame, catastrophizing, blaming others, and rumination), with the latter ones increasing the chances of negative effects such as in the form of anxiety, depression, and hazardous behaviors (Garnefski, Kraaij, & Spinhoven, 2001). Regulating our emotions properly (i.e. with adaptive strategies) can become challenging when stressful events are experienced, which may increase the use of maladaptive CER strategies. This seems paradoxical as benefits can be gained when emotions are successfully controlled under stressful experiences (Raio, Orederu, Palazzolo, Shurick, & Phelps, 2013). A possible reason

for this is that stress may deplete cognitive resources and can provoke a negative mood, which impairs frontal control responsible for the cognitive aspects of regulating the self (Heatherton & Wagner, 2011). Failure in proper self-regulation in general is often associated with obesity as was already highlighted previously (Heatherton & Wagner, 2011). However, not much research examines the relation between *cognitive emotion* forms of self-regulation and avoidance coping strategies and/or food choice. A possible explanation for this could be that avoidance coping is a more behavioral manner of emotion regulation, and CER is its psychological equivalent, thus being two sides of the same coin instead of one leading to the other. So, while it is believed that there is some degree of interplay between the two, the lack of research about CER and avoidance coping/food choice suggests that CER may not be a suitable conditioning factor in the current study.

#### **2.4.2 Personality Traits**

Diverse personalities can lead to significant differences in perceptions, evaluations, and coping strategies of the same stressors (Lecic-Tosevski, Vukovic, & Stepanovic, 2011; Vollrath, 2001). As such, it would be expected that the influence stressors have on one's food choices is dependent on an individual's personality traits. Two such personality traits are "mindfulness" and "impulsiveness" (Wu et al., 2013). To further improve the understanding of how mindfulness and impulsiveness may influence how stress is dealt with, the two traits will be linked to the widely studied "Big Five Personality Traits" (i.e. "Big Five" in short). The Big Five is a taxonomy model aiming to identify and operationalize five broad categories of personality traits, and has received a substantial amount of attention in research (John, Naumann, & Soto, 2008). The model's five traits include: extraversion, agreeableness, openness, conscientiousness, and neuroticism. Research has studied how the traits relate to stress and concluded that the most optimal personality profile to cope with stress contains high levels of conscientiousness and low levels of neuroticism, and that personality profiles containing low levels of conscientiousness and high levels of neuroticism are poor in coping with stress (Vollrath & Torgersen, 2000). *Conscientiousness* indicates a "socially prescribed impulse control that facilitates task- and goal directed behavior, such as thinking before acting, delaying gratification, following norms and rules, and planning, organizing and prioritizing tasks" (John & Srivastava, p. 121, 1999). Furthermore, conscientiousness is negatively related to the use of avoidance coping strategies, meaning individuals with lower levels of this trait tend to use avoidance coping more. *Neuroticism*, on the other hand, means "negative emotionality, such as feeling anxious, nervous, sad, and tense" (John & Srivastava,

p. 121, 1999). Neuroticism has been found to be correlated to event proneness (Schneiderman et al., 2005) and avoidance coping strategies (Byrd O'Brien et al., 1996; Vollrath, Torgersen, & Alnæs, 1995), which is in line with Costa & McCrae (2008) who picture a neurotic person as someone who is poor in handling stress.

**Mindfulness.** *Mindfulness* is a skill aimed at reducing our reactivity to experiences, whether these experiences are neutral, positive, or negative (Germer, 2004). It is strongly related to paying attention to- and being aware of our experiences and accepting them as they come along, all as a way to increase our well-being and limit suffering (Germer, 2004). Accordingly, a connection and some degree of overlap between mindfulness and the previously discussed conditioning factor CER exists, with CER being more characterized by an adaptive nature of altering how one responds to emotional stimuli through the use of a variety of strategies, while mindfulness is a more stable mental condition and about relating how emotional stimuli are appraised (Chambers, Gullone, & Allen, 2009; Roemer, Williston, & Rollins, 2015). Mindfulness can help individuals become more aware of their dietary choices by recognizing the signs of hunger and satiety (Mason et al., 2010). Moreover, it can enhance self-regulatory control and lower emotional reactivity (Mason et al., 2010), which is relevant for food choices considering the previously discussed link between self-regulation failure and obesity (Heatherton & Wagner, 2011).

To improve the understanding of how mindfulness may influence food choice when stress is experienced, the broader stress-coping behaviors associated with mindfulness will be explored by linking mindfulness to the Big Five. Research found positive relations between mindfulness and conscientiousness, and negative relations between mindfulness and neuroticism (Giluk, 2009). As discussed, this indicates an optimal personality profile to cope with stress (Vollrath & Torgersen, 2000), with little use of avoidance coping (Byrd O'Brien et al., 1996; Vollrath et al., 1995). This points towards mindfulness being a useful coping resource by potentially heightening resilience in the face of stress. This is supported by research which found higher levels of mindfulness to be positively related to the use of adaptive stress-coping strategies, and negatively with the use of maladaptive stress-coping strategies (de la Fuente, Mañas, Franco, Cangas, & Soriano, 2018; Keng, Choo, & Tong, 2018). Furthermore, Weinstein, Brown, & Ryan (2009) found that more mindful individuals particularly used less maladaptive strategies in the form of avoidance coping. Thus, mindfulness is directly and indirectly (i.e. through linkages with the Big Five) negatively related to avoidance coping, which is further related to poor food choices as discussed

previously (Hasking, 2006; McEwen, 2008; Paxton & Diggens, 1997). In combination with the associations between mindfulness and food choices discussed earlier, this suggests that being more mindful lowers the negative influence of stress on food choice.

**Impulsiveness.** *Impulsiveness* refers to “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individuals or to others” (Moeller, Barratt, Dougherty, Schmitz, & Swann, p. 1784, 2001). According to this definition, impulsiveness broadly includes three elements: (1) rapid, unplanned reactions (before full information processing), (2) little attention for negative consequences, and (3) little attention for long-term consequences (Moeller et al., 2001). Furthermore, an impulsive person is often chaotic and has little self-control, particularly over his or her emotions (Forzano & Logue, 1995; Vollrath & Torgersen, 2000). This may make impulsive individuals more vulnerable to turning to unhealthy food choices, which is supported by research which found women who were more impulsive to consume more calories than less impulsive women (Georgii, Goldhofer, Meule, Richard, & Blechert, 2017). The same was found by Guerrieri, Nederkoorn, & Jansen (2007), but they add to this that the increase in calories resulted from eating more chocolate candy. Moreover, the study by Honkanen, Olsen, Verplanken, & Tuu (2012) found that the level of impulsiveness influenced the consumption of unhealthy snacks, with higher levels leading to more snacking.

To better understand how impulsiveness may influence food choice under conditions of stress, impulsiveness can be linked to the Big Five to explore stress-coping behavior on a more general level. Research found negative relations between impulsiveness and conscientiousness, and positive relations between impulsiveness and neuroticism (Lange, Wagner, Müller, & Eggert, 2017; Vollrath & Torgersen, 2000). As discussed this indicates a non-optimal personality profile to cope with stress (Vollrath & Torgersen, 2000), with much use of avoidance coping (Byrd O’Brien et al., 1996; Vollrath et al., 1995). This points towards impulsiveness being a dysfunctional coping resource by potentially lowering resilience in the face of stress. This is supported by research which found impulsiveness to have significant correlations with maladaptive coping strategies (Auerbach & Gardiner, 2012; Vollrath & Torgersen, 2000), and especially in the form of avoidance (Lee-Winn, Townsend, Reinblatt, & Mendelson, 2016). Thus, impulsiveness is directly and indirectly (i.e. through linkages with the Big Five) positively related to avoidance coping. Accordingly, and in combination with the associations between impulsiveness and less healthy food choices, this suggests that

higher levels of impulsiveness will enhance the negative effects of stress on food choice.

It has been decided to further analyze the potential conditioning effect of impulsiveness as moderator in the empirical study for the following reasons. First, existing research indicated that CER was not a suitable conditioning factor. Second, since anxiety and depression is the stressor of interest, focusing on impulsiveness is a more logical choice than focusing on mindfulness, considering that anxiety and depression were positively related to the use of maladaptive coping strategies (Daniels & Holtfreter, 2019; Mahmoud et al., 2012), which were also positively related with impulsiveness. In addition, individuals with depressive features in the form of anxiety often demonstrate traits part of neuroticism (Headey et al., 1993; Van Praag, 2005), which has strong linkages to impulsiveness.

## **2.5 Conceptual Framework**

As previously mentioned and extensively explained in section 2.3.4, “anxiety and depression” is the stressor which will be further studied throughout the remainder of this paper. Through the execution of an empirical study, the stressor’s influence on food choice will be investigated in which additional potential moderating effects will be studied by the inclusion of “impulsiveness”. Food choice will be assessed by using “poorer food choice” as dependent variable to clearly and directly illustrate the possible effects on food choice, as well as to directly use the Transactional Model of Stress and Coping to interpret and understand the effects. Importantly, within the empirical study *poorer food choice* refers to the increase in consumption of snack-type foods, considering (1) the frequent associations between such foods and being less healthy (Barrington et al., 2014; O’Connor et al., 2008; Oliver & Wardle, 1999; Pearson & Biddle, 2011; Weiss et al., 2010; Zenk et al., 2014) and (2) the specific linkages between states of anxiety and the consumption of such foods existing in other studies (Fernstrom et al., 1987; Liu et al., 2007). Poorer food choice will be assessed using a behavioral measure (i.e. the stress-induced food intake test) to provide insights into actual behavior, instead of relying on self-reports such as surveys, dairies and phone calls like a large share of existing studies does (O’Connor et al., 2008; Oliver & Wardle, 1999; Steptoe et al., 1998; Wells & Cruess, 2006; Zenk et al., 2014) and which are prone to imprecise measurement and biases (Donaldson & Grant-Vallone, 2002; Oliver & Wardle, 1999). Together, the variables result in the conceptual model as depicted in Figure 1.

As explained by the Transactional Model of Stress and Coping, the making of poorer food choices as result from stress can be regarded as a form of maladaptive avoidance-coping behavior, and functions as the “transaction” between an individual and the environment (i.e.



the experienced stress in the form of anxiety and depression) (Lazarus & Folkman, 1984, 1987). Following the reviewed literature in section 2.3.4, it would be expected that the relation between individuals with higher levels of anxiety and depression and the use of poorer food choice as stress-coping strategy is positive. Accordingly, the first hypothesis which will be tested within this study is:

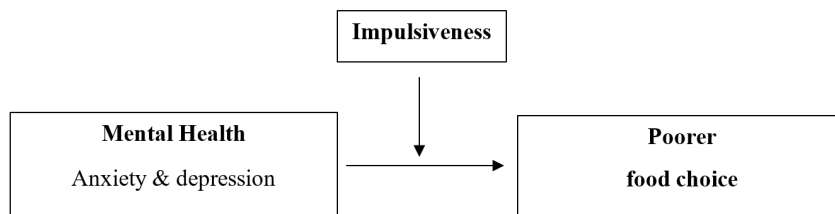
*H1: Anxiety and depression is positively related to poorer food choice.*

To further see whether impulsiveness is a dysfunctional coping resource, this variable will be studied as a potential moderator. As would be believed from the discussed literature in section 2.4.2, individuals who display higher levels of impulsiveness are more inclined to use poorer food choice as form of avoidance coping strategy. This leads to the second hypothesis which will be explored:

*H2: With higher levels of impulsiveness, the strength of the relationship between anxiety and depression and poorer food choice increases.*

**Figure 1**

*Conceptual Model*



### 3. Methods

#### 3.1 Research Design

##### 3.1.1 Participants

In the current study, a quantitative methodological approach was applied on data collected by a previous study which was about mindful eating interventions (see Janssen et al. (2018) for more details). This led to data for 65 healthy participants located in or near Nijmegen. The sample consisted of 53 females (81.5%) and 12 males (18.5%). Furthermore, the participants were aged between 19 and 53 years, with most participants falling within the 19-24 range (44.6%). However, the mean age fell above this range with a value 31.9. The body mass index (BMI) of the participants was also assessed. According to Voedingscentrum (n.d.), the BMI scores for individuals between the age of 19 and 69 years can be classified into four groups: (1) <18.5 = underweight, (2) 18.5 until 25 = healthy weight, (3) from 25 until 30 = overweight, and (4) 30 or higher = serious overweight (obesity). According to this classification, 24 participants had a healthy weight (36.9%), 28 participants were overweight (43.1%), and 13 participants were serious overweight (20%), with the average BMI being 26.29. For a clear overview of the sample characteristics, see Table 2

**Table 2**

*Demographics*

Demographic	Value	Frequency	Percentage
Gender	Male	12	15.8%
	Female	53	81.5%
Age (years)	19-24	29	44.6%
	25-34	12	18.5%
	35-44	10	15.4%
	45-53	14	21.5%
BMI	Underweight	0	0%
	Healthy weight	24	36.9%
	Overweight	28	43.1%
	Serious overweight	13	20%

*Note.*  $N = 65$ .

##### 3.1.2 Study Design & Procedure

**Study Design.** The study made use of a pre-intervention and post-intervention measurement, followed by a one-year follow up measurement. The current study made use only of data collected during the post-intervention measurement. During this post-

intervention, data was experimentally collected at one point in time during a testing day. The testing day consisted of several parts (i.e. experiments) with the primary outcome measure being in the form of functional Magnetic Resonance Imaging (fMRI), assessed through a testing session. A secondary outcome measure, and likewise the interest of the current study, was in the form a stress-induced food intake test which took place after the fMRI, and consisted of the Socially Evaluated Cold Pressor Test (SECPT) followed by a food intake test. The aim of this secondary outcome measure was to test whether participants consumed more calories from unhealthy foods when put under stress. Importantly, hunger was not assessed prior to the testing day to not emphasize this aim. The fMRI testing session lasted three and a half hours resulting in approximately equal hunger for all participants for the remainder of the experiment (i.e. the stress-induced food intake test).

**Procedure.** As mentioned, the stress-induced food intake test started with the SECPT, for which the procedure was generally adopted from Schwabe, Haddad, & Schachinger (2008) and Schwabe & Wolf (2010). During the SECPT, a participant had to place their hand in a bin filled with cold ice water (0-2 °C). This was done to experimentally create stress which, importantly, was not told to the participant upfront. The maximum amount of time participants held their hand in ice water filled bin was 3 minutes, and was unknown to the participant. Furthermore, the participant did not meet the researcher administering the SECPT prior to the experiment. This researcher was acting very neutral (and even a bit unpolite), and told the participant about the presence of a video camera in the room which recorded their facial expressions (i.e. the “socially evaluated” part of the SECPT (Schwabe et al., 2008)). To ensure stress induction, several things were assessed during the test, which included: blood pressure, mood ratings, heart rate, and cortisol. According to these assessments, stress induction was indeed confirmed (not reported here). After the SECPT was completed, the participant was taken to a comfortable room by a friendly researcher whom the participant had previously met.

After 20 minutes following the SECPT, the food intake test was performed. Participants were placed individually in a room in which a nature documentary was displayed. At the start of the documentary, the participants were instructed they could eat some left-over food which would be thrown away otherwise later that day. What a participant had eaten and how much of it was then measured and stored to assess potential stress-induced eating behavior.

### **3.1.3 Ethics**

The study and the design of the experiment were in accordance with the Declaration of Helsinki (Association, 2013), and approved by- and in accordance with the institutional guidelines of the local ethics committee in the CMO region of Arnhem-Nijmegen.

Furthermore, all participants had given written informed consent prior to taking part in the study and they received a monetary compensation for the time spent in the lab according to local guidelines (i.e. 10 euros per hour for scanning and 8 euros per hour for behavioral testing) (Janssen et al., 2018). The obtained data will be handled with care and used for scientific purposes only.

## **3.2 Measures**

The following sections will explain when and how the constructs included in the conceptual model (i.e. poorer food choice, anxiety and depression, and impulsiveness) were assessed and measured.

### **3.2.1 Poorer food choice**

In the experiment, “total calories” was used as a proxy to measure “poorer food choice”, with total calories referring to the total calories consumed from five food items (i.e. m&ms, winegums, chips, cocktail-nuts, and raisins) which were in the form of snacks. According to the definition by "Cambridge English Dictionary," (n.d.) a “snack” is “*a small amount of food that is eaten between meals, or a very small meal*”, and as made clear by the review by Hess, Jonnalagadda, & Slavin (2016), snacks can be in a broad variety of forms ranging from for example candy and chips to cereals and fruits. Accordingly, all food items used in the experiment fell under the “snack” category.

One component of the experiment consisted of watching a nature documentary during which the food intake test took place. As explained before, participants were instructed there was left-over food they could eat while watching the documentary. The food was placed in bowls and included five different snack-type food items: m&ms (5.24 kcal/gram), winegumes (3.4 kcal/gram), chips (5.38 kcal/gram), cocktail-nuts (5.2 kcal/gram), and raisins (3.45 kcal/gram). For each participant, the total amount of calories eaten was calculated. This was done by weighting the bowls before and after the experiment, to assess how much they had eaten of each snack in grams. These amounts were then used to calculate the number of calories consumed per each of the five snacks by multiplying the eaten grams with the calories per gram for each snack. To finally calculate the total amount of calories, the number

of calories consumed for each snack were summed up which resulted in a “total calories” score for each participant.

### ***3.2.2 Anxiety and depression***

Anxiety and depression was assessed by means of the Hospital Anxiety and Depression Scale (HADS) by Zigmond & Snaith (1983). The scale was originally developed to, in the form of a self-assessment, measure the levels of anxiety and depression in individuals in a hospital setting (Zigmond & Snaith, 1983). The HADS consisted of 14 items; seven to measure anxiety and seven to measure depression. The statements presented in the items were mainly focused around assessing mood states. Items for anxiety included among others: “I feel tense or ‘wound up’”, “I feel restless as I have to be on the move”, and “I can sit at ease and feel relaxed”. Items for depression included among others: “I still enjoy the things I used to enjoy”, “I feel cheerful”, and “I have lost interest in my appearance”. All items were measured on a 4-point scale with answer options varying per item, but being generally in the form of how often the participant experienced the statement presented in an item (e.g. answer options from “most of the time” to “not at all”). For the full questionnaire, please see Appendix A1.

Scores could be calculated for anxiety and depression individually, with scores between 0 to 7 indicating no presence of anxiety and/or depression, scores between 8 to 10 indicating potential presence of anxiety and/or depression, and scores between 11 to 21 indicating the presence of anxiety and/or depression (Zigmond & Snaith, 1983). However, in the present study the combined/summed-up score for anxiety and depression as proxy for mental health was used in the main analysis.

### ***3.2.3 Impulsiveness***

How impulsive participants were was assessed with the Barratt Impulsiveness Scale (BIS-11) by Patton, Stanford, & Barratt (1995). The BIS-11 mainly reflects subjective aspects and aims to measure impulsiveness by appraising an individual’s longer term personality traits. Moreover, the BIS-11 has been widely used in clinical research contexts such as suicidality and a variety of disorders like substance use and depression (Stanford et al., 2009). The BIS-11 originates from the BIS-10, which was created to measure impulsiveness and has been revised several times. This is partly due to the original scale’s correlation with anxiety measures, for which it was also checked whether multicollinearity existed between the BIS-11 and the measure for anxiety and depression in the analysis. Through identifying a factor structure, the original BIS-10 which included 34 items resulted in the BIS-11 consisting of 30

items, meaning four items were dropped from the original questionnaire (Stanford et al., 2009). The items are sub-divided into six first-order- (e.g. self-control, cognitive instability, and attention) and three second-order (motor, attentional, and non-planning) impulsiveness subfactors. For each of the 30 items, participants had four answer options: “rarely/never”, “occasionally”, “often”, and “almost always/always”. Some exemplary items which were included in the questionnaire are: “I plan tasks carefully”, “I save regularly”, and “I buy things on impulse”. For the full questionnaire, please Appendix A2.

Scores could be calculated for each subfactor. However, for simplicity and data reduction, the current study made use only of the total impulsiveness score, thus not paying further attention to the subfactors of impulsiveness. According to Stanford et al. (2009) individuals scoring between 52 and 71 score “normal” on impulsiveness, individuals scoring 72 or higher should be regarded as “highly impulsive”, and scores lower than 52 often reflect “over-controlled” individuals.

## 4. Results

The following chapter will include the results of the analysis. To see whether anxiety and depression had a significant positive relation with poorer food choice (i.e. hypothesis 1) and whether impulsiveness was a significant moderator (i.e. hypothesis 2) was tested by executing a multiple regression analysis with the inclusion of an interaction term. Before running the multiple regression analysis, the variables “anxiety and depression” and “impulsiveness” were mean-centered first to limit multicollinearity. After that, an interaction term was created with the two mean-centered variables to check for moderation. For all analyses, an alpha level of .05 was used to determine significance. Note that within this chapter total calories refers to poorer food choice. Before reporting the results of the multiple regression analysis, some descriptive statistics will be discussed first.

### 4.1 Descriptive Analysis

#### 4.1.1 Descriptive Statistics

A pre-liminary assessment of the constructs was performed first. According to the statistics, the participants scored an average of 8.54 on anxiety and depression combined ( $M = 8.54$ ,  $SD = 5.02$ ), with a somewhat lesser mean for depression ( $M = 2.71$ ,  $SD = 2.52$ ) compared to anxiety ( $M = 5.83$ ,  $SD = 3.21$ ). Moreover, the participants had a mean of 62.47 on impulsiveness ( $M = 62.47$ ,  $SD = 8.53$ ), and consumed an average of 330.28 calories ( $M = 330.28$ ,  $SD = 265.62$ ) (see Appendix B1). An additional Independent Sample *t*-Test was performed to test whether the unequal number of males and females in the sample could result in biased outcomes. The results of this test are presented in Appendix B2. According to the test, no significant mean differences for males and females were in place for the three constructs with  $t(63) = 1.31$ ,  $p = .766$  for anxiety and depression,  $t(63) = -1.14$ ,  $p = .788$  for impulsiveness, and  $t(63) = -1.44$ ,  $p = .861$  for total calories, meaning that the unequal male-female sample distribution is somewhat less problematic.

The classification schemes discussed earlier (Patton et al., 1995; Zigmond & Snaith, 1983), made it possible to group the participants on the anxiety and depression and impulsiveness variables (see Table 3). According to classification by Zigmond & Snaith (1983), for anxiety 48 participants fell in the “no presence” range (73.8%), 11 in the “potential presence” range (16.9%), and 6 in the “presence” range (9.2%). For depression, 61 participants fell in the “no presence” range (93.8%), 4 in the “potential presence” range (6.2%), and none in the “presence” range (0%) according to their classification. The level of impulsiveness was assessed according to the classification by Stanford et al. (2009), with 5

participants scoring “over-controlled” (7.7%), 47 scoring “normal” (72.3%), and 13 scoring “highly impulsive” (20%).

**Table 3**

*Descriptive Statistics*

Variable	Value	Frequency	Percentage
Anxiety	No presence	48	73.8%
	Potential presence	11	16.9%
	Presence	6	9.2%
Depression	No presence	61	93.8%
	Potential presence	4	16.2%
	Presence	0	0%
Impulsiveness	Over-controlled	5	7.7%
	Normal	47	72.3%
	Highly impulsive	13	20%

*Note.*  $N = 65$ .

Furthermore, comparison of the five different food items participants could consume during the experiment showed that on average participants consumed most calories from (1) chips ( $M = 108.58$ ,  $SD = 138.71$ ), (2) M&Ms ( $M = 86.40$ ,  $SD = 118.03$ ), (3) cocktail-nuts ( $M = 48.93$ ,  $SD = 84.60$ ), (4) winegums ( $M = 48.65$ ,  $SD = 72.18$ ), and least from (5) raisins ( $M = 37.71$ ,  $SD = 70.17$ ) (see Appendix B3).

#### ***4.1.2 Univariate & Bivariate Analysis***

Before turning to the main analysis, it was first checked whether the variables were normally distributed and if any outliers were present which could possibly lower the population representativeness (Hair, Black, Babin, & Anderson, 2019). To assess normality, an acceptable range of -2 to +2 for skewness and kurtosis was used (George & Mallery, 2010). Anxiety and depression had a value of .62 and -.10 for skewness and kurtosis respectively. Impulsiveness had a skewness value of .07 and a kurtosis value of -.19. Lastly, total calories had skewness and kurtosis values of .86 and .22 respectively. Accordingly, for each variable the skewness and kurtosis values fell between the acceptable range, thus indicating a normal distribution for all three variables. Outliers were detected by the use of boxplots. Anxiety and depression showed one outlier which had an unusual high score of 23 (see Appendix B4). However, according to Hair et al. (2019) outliers may be classified as “extraordinary observations” and can be kept in the analysis when they meet the research objectives. Since one of the research objectives of this study is to test whether individuals who have higher



anxiety and depression levels consume more unhealthy foods, it was decided to classify the outlier as an extraordinary observation and keep the outlier in the analysis as it is in line with the objectives of the research. The boxplot of impulsiveness showed no outliers. Lastly, one outlier was present for total calories, with a participant consuming an unusual high amount of total calories (1080.53) (see Appendix B5). As with the anxiety and depression outlier, this outlier is in line with the research objectives, to which it was determined to classify the outlier as an extraordinary observation as well and keep the outlier in the analysis.

Moreover, it was checked whether multicollinearity was present between the variable impulsiveness and “anxiety and depression” together, as well as “anxiety” and “depression” separately. Checking this was not only relevant for the regression analysis, but also because the measure used in the current study to assess impulsiveness (i.e. the BIS-11) originated from the BIS-10 which showed great overlap with anxiety measures. According to the Correlation Matrix, the correlation between impulsiveness and anxiety and depression had a value of .20 and was non-significant ( $p = .117$ ). Moreover, impulsiveness had a non-significant correlation of .19 ( $p = .125$ ) with anxiety and a non-significant correlation of .15 ( $p = .243$ ) with depression. Thus, no multicollinearity between the variables was present.

## **4.2 Assumptions Multiple Regression Analysis**

### **4.2.1 Linearity**

Linearity between the independent variables and dependent variable was assessed by means of a scatterplot in which the standardized residuals (ZRESID) were plotted against the standardized predicted values (ZPRED). A random pattern resulted and all values fell between the acceptable range of -3 and +3 (see Appendix C1). Hence, the linearity assumption was met.

### **4.2.2 Constant Variance of Error Terms**

Constant variance of error terms (i.e. homoscedasticity) was again checked for by looking at the scatterplot. Similarly, no clear pattern was present in the residuals, thus indicating homoscedasticity and meeting the assumption.

### **4.2.3 Independence of Error terms**

The third assumption, independence of error terms, was assessed by analyzing the mean and standard deviation of the standardized predicted value in the residuals statistics table. The mean value of 0 and standard deviation of 1 pointed towards independence of error terms, meaning the third assumption was met.

#### ***4.2.4 Normality of Error Term Distribution***

The fourth and last assumption, normality of error term distribution, was checked for graphically by looking at the histogram of residuals and normal probability (P-P) plot. As can be seen in the histogram and P-P plot (see Appendix C2 and Appendix C3) a small departure from normality was at stake with the distribution being slightly positively skewed. However, according to Hair et al. (2019) discrepancies from normality are especially a problem with small samples consisting of less than 50 participants. When sample size increases, a non-normal distribution becomes less of a problem. As the study's sample size consisted of 65 participants, the small departure from normality was not regarded as problematic for continuing the regression analysis. Nevertheless, caution should be taken that the outcomes and resulting conclusions may not reflect reality optimally (Ghasemi & Zahediasl, 2012).

### **4.3 Multiple Regression Analysis**

As all assumptions were sufficiently met, a multiple regression analysis was run to test the two hypotheses presented earlier. This was done by creating two models: model 1 which included "anxiety and depression" and "impulsiveness" as independent variables and "total calories" as dependent variable, and model 2 which also included the interaction effect of the two independent variables to check for moderation.

#### ***4.3.1 Regression and Model Fit***

**Model 1.** The  $R^2$  of  $<.001$  indicated that 0% of the variance in the dependent variable total calories was explained by the independent variables anxiety and depression and impulsiveness. When taking into account model complexity by looking at the adjusted  $R^2$ , the value even becomes negative ( $-.03$ ) indicating that the explanation of total calories by anxiety and depression and impulsiveness becomes neglectable. This may be explainable by the extremely low correlations between the independent variables and the dependent variable. According to the correlation matrix, anxiety and depression and total calories had a correlation of  $-.02$  ( $p = .896$ ), and impulsiveness and total calories had a correlation of  $-.01$  ( $p = .911$ ). Moreover, model 1 as a whole was deemed non-significant according to the F-test ( $F(2,62) = .01, p = .988$ ), thereby already rejecting H1 and H2.

**Model 2.** When the interaction term was added to the regression analysis, this resulted in a  $R^2$  of  $.01$  and an adjusted  $R^2$  of  $-.04$ . Moreover, the addition of the interaction term led to a non-significant  $R^2$  change of  $.01$  ( $p = .486$ ). Model 2 as a whole was also deemed non-

significant according to the F-test ( $F(1,61) = .49, p = .915$ ), thereby further supporting the rejection of H2.

### 4.3.2 Effects

The effects of the multiple regression analysis are presented in Table 4. As can be seen in the table, apart from the constant, none of the effects in neither model 1 and model 2 were significant. When the interaction term was added to the model, the standardized coefficient from anxiety and depression went from  $-.01 (p = .912)$  to  $-.03 (p = .827)$ , thus both indicating a negative non-significant effect with the dependent variable total calories. The same holds true for impulsiveness, from which the effect went from  $-.01 (p = .930)$  to  $-.03 (p = .800)$  when the interaction term was added. The interaction term was also deemed non-significant with a standardized coefficient of  $.09 (p = .486)$ .

**Table 4**  
*Effects of Multiple Regression Analysis*

<i>Predictors</i>	<i>Unstandardized B</i>	<i>Standardized B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Model 1					
Constant	330.28		33.47	9.87	.000
Anxiety and depression	-.76	-.01	6.85	-.11	.912
Impulsiveness	-.35	-.01	4.03	-.09	.930
Model 2					
Constant	325.28		34.35	9.47	.000
Anxiety and depression	-1.53	-.03	6.97	-.22	.827
Impulsiveness	-1.06	-.03	4.18	-.26	.800
Anxiety and depression * Impulsiveness	.60	.09	.86	.70	.486

*Note.* Dependent variable: total calories.

### 4.4 Additional Exploratory Analyses

As the multiple regression analysis testing the main model of interest did not find any significant relations, some additional exploratory analyses were executed in the form of simple linear regression analyses.

#### **4.4.1 Anxiety & Depression**

To test whether anxiety and depression individually significantly predicted poorer food choice (i.e. total calories), two simple linear regressions were run. First, it was analyzed whether anxiety predicted poorer food choice. The regression results indicated that anxiety explained 1% ( $R^2 = .01$ ) of the variance in total calories, and that the model was non-significant ( $F(1,63) = .71, p = .401$ ). Second, it was analyzed whether depression predicted poorer food choice. The regression results indicated that depression explained 1% ( $R^2 = .01$ ) of the variance in total calories, and that the model was non-significant ( $F(1,63) = .67, p = .418$ ). Accordingly, still no significant relations were present when testing the model for anxiety and depression individually.

#### **4.4.2 Chips**

It was checked whether there was a significant relation for the most eaten snack item (i.e. chips). Accordingly, a simple linear regression was run to test whether anxiety and depression significantly predicted calories consumed from chips. The regression results indicated that anxiety and depression explained 0% ( $R^2 = .00$ ) of the variance in chips, and that the model was non-significant ( $F(1,63) = .12, p = .730$ ). Correspondingly, changing the dependent variable to chips did not improve the model.

#### **4.4.3 Age & BMI**

As anxiety and depression had no significant relation with total calories as dependent variable, it was tested whether the demographics age and/or BMI as independent variables significantly predicted poorer food choice (i.e. total calories), and if they could potentially function as control variables in the executed multiple regression analysis. Accordingly, two simple linear regressions were run. First, it was analyzed whether age predicted poorer food choice. The regression results indicated that age explained 3% ( $R^2 = .03$ ) of the variance in total calories, and that the model was non-significant ( $F(1,63) = 1.95, p = .167$ ). Second, it was analyzed whether BMI predicted poorer food choice. The regression results indicated that BMI explained 2% ( $R^2 = .02$ ) of the variance in total calories, and that the model was non-significant ( $F(1,63) = 1.40, p = .241$ ). Hence, neither age nor BMI had relations with poorer food choice, thereby also ruling out the possibility of them as effective control variables.

Since none of the executed exploratory simple linear regression analyses showed significant predictions according to the F-tests, in combination with the extremely low  $R^2$  values, it was decided to not execute any more analyses (e.g. to check for possible moderation effects or other combinations of independent- and dependent variables).

## 5. Discussion

Building on the Transactional Model of Stress and Coping by Lazarus & Folkman (1984), the current study aimed to assess how a total of eight domain-specific stressors influenced food choice by focusing on “poorer food choice” as stress-coping behavior, and how this may be further dependent on conditioning factors. Two research questions were developed to explore this. Research question 1 was theory-guided and read; “*How do daily stressors influence food choice, and how are these effects further influenced by three conditioning factors?*”.

Following the literature review, all eight discussed stressors seem to influence food choice negatively, possibly through poorer food choice as stress-coping behavior. Note that for the stressors “sleep quality” and “work-life balance” this is assumed in case of a *lower* sleep quality and work-life balance. Since less evident studies existed about the relationships between food choice and the stressors sedentary behavior, cognitive emotion regulation, and work-life balance, this may suggest that their relative influence on stress-induced food choice is smaller. On the contrary, from the current literature it seems that especially the mental health stressors perceived stress, daily hassles, and anxiety and depression have a larger relative impact on stress-induced food choice. This may indicate that these stressors pose a larger risk for the use of poorer food choice as stress-coping behavior. In regard to the conditioning factors, the reviewed studies suggested that (1) cognitive emotion regulation is not a suitable moderator, (2) mindfulness reduces the negative influence of stress on food choice, and (3) impulsiveness increases this negative influence. This implies that while impulsiveness may lower an individual's resilience and stimulate maladaptive coping, mindfulness may be beneficial in improving resilience and stimulate the use of adaptive rather than maladaptive coping behaviors (de la Fuente et al., 2018; Keng et al., 2018). This is an important insight to take into account for stress management interventions, as mindfulness can be taught and learned.

Research question 2 was empirically-guided and read; “*How does anxiety and depression as internal stressor influence food choice, and how is this effect further influenced by impulsiveness?*”. Two hypotheses were tested to answer this question, the first one for the relation between anxiety and depression and poorer food choice and the second one for the potential moderation effect of impulsiveness. Note again that for the empirical study poorer food choice as measured by total calories was used to assess changes in food choice.

Following the results of the multiple regression analysis, there was no statistical evidence for hypothesis 1 nor for hypothesis 2 thus rejecting both hypotheses. This means that within the current study, anxiety and depression as internal stressor did not predict the use of poorer food

choice as coping strategy, and that impulsiveness did not have a moderating effect. Even when the relation with food choice was tested for anxiety and depression separately, no significant effects were found. A possible explanation for the absence of effects may be that only a small share of the participants scored high (i.e. “presence”) on the anxiety scale, and none of the participants scored high on the depression scale, which questions the validity of the results.

The absence of a relationship between stages of anxiety and depression and poorer food choice as was tested in hypothesis 1 is in contradiction with the discussed studies (Fernstrom et al., 1987; Liu et al., 2007). The study by Fernstrom et al. (1987) found that individuals with depression consumed more snack-type foods higher in carbohydrates and fats, which suits the characteristics of the food items used in the experiment. However, their study took place over a period of four months and included a sample of depressed outpatients. It could therefore be that the effects of anxiety and depression on food choice only become visible (1) over a longer period, and/or (2) under individuals who are in the higher depression- and anxiety categories, which may require a longitudinal study with a sample portraying high levels of anxiety and depression. Moreover, the study by Liu et al. (2007) found stages of depression to be related to the intake of snack-type foods, especially in the form of fast food and ready-to-eat food such as the snacks included in the experiment. However, their study used a sample of college students who are on average younger than the participants in the current study (20.4 versus 31.9), and who have been found to be often maintaining unhealthy diets consisting of much snacking (Dinger & Waigandt, 1997; Downes, 2015). Though age in itself was no significant control variable in the analysis, the dietary habits of college students may not suit the dietary habits of the sample used in the present study which may explain the difference in results.

When taking a somewhat broader view by looking at coping strategies on a more general level, another explanation for the lack of effects could be that other forms of maladaptive coping strategies were used. According to the literature, anxiety and depression had clear linkages with the use of maladaptive coping behaviors (Daniels & Holtfreter, 2019; Mahmoud et al., 2012). However, as mentioned, maladaptive coping strategies include a variety of sub-strategies. It could therefore be that other maladaptive coping behaviors such as smoking or lowered sleep quality were used to deal with the stress (Mcewen, 2008), which were not assessed in the current study. Another explanation may be again related to the fact that the studies by Mahmoud et al. (2012) and Daniels & Holtfreter (2019) both used samples consisting of students. Students may be regarded as an extra vulnerable group to experiencing

negative emotions such as anxiety and stress (Daniels & Holtfreter, 2019), which may make them less able to successfully cope with stress leading them to display more maladaptive coping behaviors than the sample used in the current study.

The current study also explored the influence of the personality trait impulsiveness through hypothesis 2, which was rejected. Previous research suggested that impulsiveness would influence food choice negatively (Georgii et al., 2017; Guerrieri et al., 2007; Honkanen et al., 2012), and that it would function as a moderator by lowering an individual's resilience under conditions of stress through the increased use of maladaptive coping strategies (Auerbach & Gardiner, 2012; Lee-Winn et al., 2016; Vollrath & Torgersen, 2000). The results which followed from the executed empirical study did not support this as impulsiveness showed no significant effects. A possible explanation for why impulsiveness *did* lead to poorer food choice in the studies by Georgii et al. (2017) and Guerrieri et al. (2007) is one equivalent to the one discussed earlier; both their studies used a sample consisting of college students who may have dietary habits non-representative of the sample used in the current study. Alternatively, and as also previously discussed already, other maladaptive coping strategies which were not assessed in the experiment could have been used by the participants. Which seems thinkable considering the linkages found between impulsiveness and maladaptive coping in research (Auerbach & Gardiner, 2012; Lee-Winn et al., 2016; Vollrath & Torgersen, 2000).

Together, the literature review and empirical study results add to the academic literature by acknowledging the idea that stress is a multi-dimensional construct, and that different stressors may lead to different effects. In a practical sense, this suggests that stressors have a different relative influence on food choice, and that some stressors may be more related to the use of other (maladaptive) coping behaviors. This has as practical implication for health organizations and policy makers that they should pay attention to- and make a distinction in- what specific factors causes stress and what type of coping behaviors are used. Moreover, conditioning factors such as personality traits must be taken into account to suit the situation of the individual. This may help such health organizations and policy makers to provide better targeted strategies and incentives to intervene in the stress-coping process, to help break the vicious circle which maladaptive behaviors often activate (Bruce & McEwen, 1998). With regard to stress-induced poor food choices in specific, special efforts should be invested in demotivating the picking of fatty snacks considering its clear associations with weight gain (Baum & Posluszny, 1999)

## 6. Research Limitations & Directions for Future Research

Several limitations apply. A more overarching limitation of the conducted empirical study is that the data did not fit the model well, which became visible in the extremely low R square values. A possible explanation could be that several other important variables which explained the dependent variable were not included in the model. Alternatively, it could be that the research design (i.e. in the form of an experiment) was rather poor, or is less suitable to study the paper's relations of interest. Previous research which used other forms of research designs often being in the form of self-reports through surveys and dairies did find significant effects (Devine et al., 2006; Fernstrom et al., 1987; Lauder et al., 2006; Liu et al., 2007; Nastaskin & Fiocco, 2015; O'Connor et al., 2008; Wells & Cruess, 2006; Zenk et al., 2014), which could potentially indicate that such designs are more suitable. This may also be explained by the fact that within the current study, stress was created experimentally through the SECPT which, while validated as a proper instrument (Schwabe et al., 2008; Schwabe & Wolf, 2010), may lead to a different form of stress than the stress experienced in a non-experimental setting. Moreover, the experiment was not completely in line with the conceptual framework. Within the conceptual framework, anxiety and depression was regarded as the factor causing the stress (through psychological distress). However, the experiment was more built around testing whether anxiety and depression caused poorer food choice under *conditions* of stress, thus not specifically regarding anxiety and depression as the stressor itself which may require different interpretations of the results.

Some other limitations specifically related to the chosen study design are the following. First, the sample used in the experiment consisted predominantly of females. Though the independent sample t-test showed no significant differences between the scores for males and females, this unequal distribution is no adequate representation of the population thereby lowering the study's external validity. Moreover, the validity of the results is questionable as (1) the sample included none depressed participants and only a small percentage of participants with high anxiety levels and (2) poorer food choice was measured as total calories consumed, which may shift the focus more towards change in amount of calories instead of change in food choice. In addition, participants were only provided with less healthy food options and no healthier food options, and measurement took place only once. Accordingly, it is questionable to what extent it could be assessed whether "poorer" food choices were made as there was no reference point. The choice for only including snack-type food items also lessens the generalizability of the study results to other food types. Following these limitations, future studies may alter and/or improve the experimental design



by for example using a more diverse sample, adding a baseline measurement, including more (control) variables, and including a broader variety of food options in terms of healthiness and food types.

Other future research recommendations not related specifically related to the research- or study design are the following. As no significant relations between anxiety and depression and poorer food choice were found in the analysis, future research may study whether relations do exist with other forms of maladaptive coping strategies which were not in the interest of the current study. Moreover, as the current study only empirically tested one stressor, it would be interesting for future research to study the other discussed stressors and assess their individual- as well as relative influence on food choice. As highlighted, this paper provides future research with a comprehensive theoretically-guided framework. Future studies have the opportunity to enrich this with empirical knowledge to create rich and comprehensive insights about which stressors in particular pose a risk for poor dietary choices. This, as from the literature review it would be believed that some stressors may be more influential than others. Particularly, exploring the stressors “perceived stress” and “daily hassles” part of the mental health domain may be an interesting avenue for future research. As highlighted in the introduction, individuals can end up in a vicious circle with worsening mental health when using poorer food choice as coping strategy. Perceived stress and daily hassles are likely to promote the continuation of this circle as previous studies clearly pointed towards the large relative negative influence both stressors had on food choices. Accordingly, future research may study these stressors to improve the understanding of the underlying mechanism supporting this vicious circle to find ways to intervene.

Likewise, only one conditioning factor was empirically studied. Future research may explore which other conditioning factors may enhance the use of poorer food choice under conditions of stress, to explore which individuals may be more vulnerable. A suggestion for this would be to study the five personality traits part of the Big Five as, according to research, these traits are believed to influence the stress response (Vollrath, 2001). Moreover, the literature review pointed towards mindfulness as useful tool to increase one’s resilience for coping with stress by reducing the reactivity to experiences and emotions, enhance self-regulatory control, and promote the use of adaptive- instead of maladaptive coping strategies (de la Fuente et al., 2018; Keng et al., 2018; Mason et al., 2010). Building on this, future research may explore the potential of mindfulness as instrument to discourage the use of poorer food choice as maladaptive coping strategy, which would be particularly useful for individuals deemed more vulnerable.

A study which may provide a suitable starting point for the suggested future research avenues is The Healthy Brain Study (HBS), as they have already collected a large amount of data about a variety of stressors and potential conditioning variables during a longitudinal cohort study (Fernández, 2021). Adding such empirical knowledge is of crucial importance for the individual to limit health concerns such as obesity and diabetes, as well as for society at large to help lower the financial burden poor diets cause (OECD, 2019).

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## Appendices

### Appendix A - Questionnaires

#### Appendix A1

##### *HADS Questionnaire*

Variable	Number of items	Items	4-point scale
Anxiety	7	I feel tense or 'wound up'	Most of the time – Not at all
		I get a sort of frightened feeling as if something awful is about to happen	Very definitely and quite badly – Not at all
		Worrying thoughts go through my mind	A great deal of the time – Only occasionally
		I Can sit at ease and feel relaxed	Definitely – Not at all
		I get a sort of frightened feeling like 'butterflies' in the stomach	Not at all – Very often
		I feel restless as I have to be on the move	Very much indeed – Not at all
		I get sudden feelings of panic	Very often indeed – Not at all
Depression	7	I still enjoy the things I used to enjoy	Definitely as much – Hardly at all
		I can laugh and see the funny side of things	As much as I always could – Not at all
		I feel cheerful	Not at all – Most of the time
		I feel as if I am slowed down	Nearly all the time – Not at all
		I have lost interest in my appearance	Definitely – I take just as much care as ever
		I look forward with enjoyment to things	As much as I ever did – Hardly at all
		I can enjoy a good boor or radio or TV program	Often – Very seldom



## Appendix A2

### *BIS-11 Questionnaire*

2 <sup>nd</sup> order factor	1 <sup>st</sup> order factor	Number of items	Items
Attentional	Attention	5	I don't "pay attention" I concentrate easily I "squirm" at plays or lectures I am a steady thinker I am restless at the theater or lectures
	Cognitive Instability	3	I have "racing" thoughts I change hobbies I often have extraneous thoughts when thinking
Motor	Motor	7	I do things without thinking I make-up my mind quickly I am happy-go-lucky I act "on impulse" I act on the spur of the moment I buy things on impulse I spend or charge more than I earn
	Perseverance	4	I change jobs I change residences I can only think about one thing at a time I am future oriented
Non-Planning	Self-Control	6	I plan tasks carefully I plan trips well ahead of time I am self-controlled I am a careful thinker I plan for job security I say things without thinking
	Cognitive Complexity	5	I save regularly I like to think about complex problems I get easily bored when solving thought problems I am more interested in the present than the future I like puzzles

## Appendix B – Descriptive Statistics

### Appendix B1

#### *Descriptive Statistics Constructs*

<b>Variables</b>	<i>M</i>	<i>SD</i>
Anxiety and depression	8.54	5.02
Anxiety	5.83	3.21
Depression	2.71	2.52
Impulsiveness	62.47	8.53
Total calories	330.28	265.62

### Appendix B2

#### *Independent Sample T-Test Male – Female Comparison*

<b>Variables</b>	Male		Female		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Anxiety and depression	6.83	4.61	8.92	5.07	1.31	.766
Impulsiveness	64.99	8.23	61.89	8.67	-1.14	.788
Total kcal	429.31	296.33	307.86	255.91	-1.44	.861

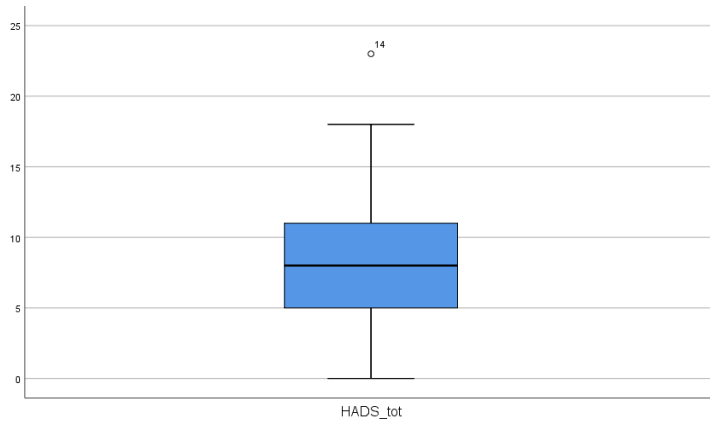
### Appendix B3

#### *Descriptive Statistics Snack Item Calories*

<b>Variables</b>	<i>M</i>	<i>SD</i>
Chips	108.58	138.71
M&Ms	86.40	118.03
Cocktail-nuts	48.93	84.60
Winegums	48.65	72.18
Raisins	37.71	70.17

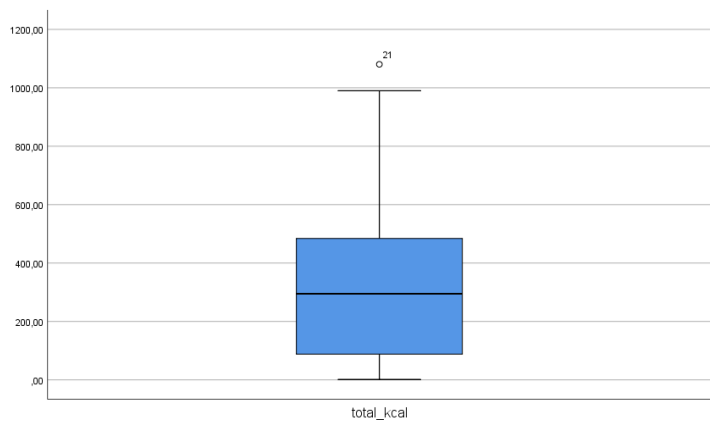
## Appendix B4

Boxplot Anxiety and Depression (HADS\_tot)



## Appendix B5

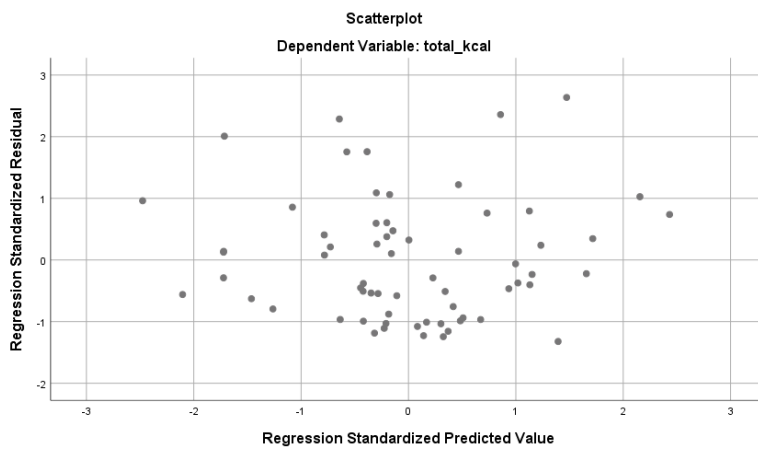
Boxplot Total Calories (total\_kcal)



## Appendix C – Assumptions Multiple Regression Analysis

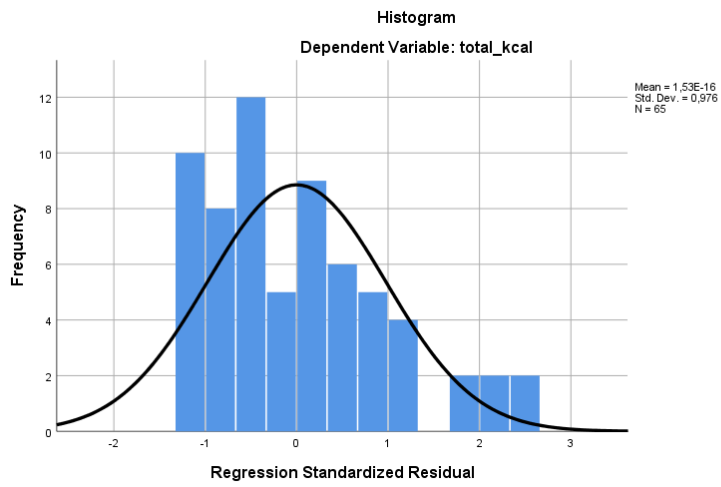
### Appendix C1

Scatterplot for Linearity



## Appendix C2

### *Histogram Standardized Residuals*



## Appendix C3

### *Normal Probability Plot*

