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HOT INFLUENCES IN THE SELF-REGULATION OF EATING BEHAVIOR OF ADOLESCENTS AND YOUNG ADULTS

PhD Dissertation

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CHAPTER 1. Hot factors and self-regulatory processes in relationship with eating. Conceptual and empirical foundations.

INTRODUCTION

Food intake is an essential part of human live, as we have to eat in order to survive. However, humans' preoccupation with food goes far beyond nurturing needs. People grow up in different food cultures, where, as Paul Rozin (1996) notes "food progresses from being a source of nutrition, a sensory pleasure to being a social marker, an aesthetic experience, a source of meaning and metaphor and, often, a moral entity" (lines 5-11, pag. 18). We are virtually flooded with choices in stores, restaurants, gourmet markets, yet we often worry about having too much food, about whether we eat safe products, whether food choice sustain our health goals or whether they are too fat, not fat enough with the right fat, too sweet or salty, environmentally (un)friendly and so on. As Roberts notes in an 1998 article in The New York Times, we are facing a" new food anxiety" which leads us to "cut our emotional ties to the table" with food ending up "fueling our worst fears".

Arguably, this "food anxiety" is rooted in the alarming rates of obesity and cancer, which are steadily increasing across Europe and United States and are closely connected to lifestyle factors, including eating patterns. Today, diet-related related diseases are the leading cause of mortality worldwide (WHO, 2008). In 2011, the proportion of overweight and obesity rates, which are closely associated with metabolic and cardiovascular disease, fell between 7.6% (Romania) and 24.6% (Great Britain) (Eurostat 2011). In 2010, the European Organization for Economic Cooperation and Development (OECD) placed Romania among the states with the highest mortality burden due to stroke or ischemic heart disease (between 150-250 deaths per 100 000 population) and all cancers (between 128 and 246 per 100 000 population). Though the ties connecting dietary patterns with chronic disease are far from being thoroughly understood and go beyond the purpose of the present dissertation, the burden that these statistics add to the health conscious individual makes "normal eating " a difficult quest. Immersed in an "obesogenic environment" (Egger & Swinburn, 1997) or a "pathoenvironment" (Ravussin, 1995) where there is a virtually endless array of unhealthy food temptations (like fast-food, highly processed sweets and beverages etc.), many individuals, especially in the Western culture have to face what has become the classic conflict between indulging in unhealthy foods and probably experiencing food guilt and anxiety or resisting temptations (and thus experiencing pride or, on the contrary, frustration) (see also MacInnis &

Patrick, 2006; Patrick, Chun, MacInnis, 2009).

"Eating right" has, therefore, become a major challenge of our times. Not surprisingly, a growing body of psychology research has been devoted to understanding what are the variables that help individuals manage to successfully eat a healthy diet, for instance, even when they repeatedly are confronted with numerous situations in which a delicious food treat (most often unhealthy) is on offer (Rotham, Baldwin, & Hertel, 2004). Thus, the study of **self-regulation** or the abilities to set right goals, resist when faced with immediate urges and adapt the behavior as a function of these goals, might be the key to helping individuals eat healthily and enjoy food.

However, it is now well known that self-regulation is easier said than done. Part of the problem is that, individuals are not 'cold' decision makers and action implementers, but emotional beings. Our interaction with foods is more than an act driven by physiological needs, like in other beings, but a social act, a source of pleasure and of comfort. Food is an emotional experience. So how do individuals manage or fail to eat right when faced with affect-laden triggers, or 'hot' factos is a central question of this research.

1.2. "Hot' theories of self-regulation in relationship to eating

1.2.1. Definition of "hot" factors

Emotions are associated with impulsive or automatic response tendencies, and the traditional view is that emotion and self-control are antagonists. However, a perennial obstacle in integrating theories of emotion and affect in the self-regulation framework is that not all emotional phenomena follow the same path. It might be that the type of emotion and/or affect comprises diverse responses that follow different causal principles and serve different functions in the process of self-regulation (Baumeister, Vohs, DeWall, Zhang, 2007).

We propose, however, that besides their different impact on subsequent behavior, these subjective processes share the distinct features of affective experiences. In other words, regardless of the fact that they are either distinct emotions[1] (fear and guilt in our case), hot cognitions (such as worry)[2], or visceral states (such as hunger, see also Loewenstein, 2004), they all share the two fundamental dimensions of valence and arousal (cf. Suri, Sheppes, & Gross, 2012). The first, valence, represents the pleasantness or unpleasantness, goodness or badness or the intrinsic attractiveness or aversiveness evoked by the event, object or the situation (Frijda, 1986). The

1 Short-term, conscious feelings accompanied by physiological changes, like arousal

2 We define the concept of "worry" as a chain of thoughts and images, which are affect-laden and relatively uncontrollable (Borkovec, Robinson, Pruzinsky, & Dupree, 1983), conventionally regarded as a "hot cognition" .

second, arousal, represents the degree of activation associated with the evaluation of the specific event, object or situation. Typically, the valence-arousal space has been used in categorizing different emotional states, on a four quadrant space of positive valence-high arousal, positive valence-low arousal, negative valence-high arousal, negative valence-low arousal (e.g. Merabian, 1996). Moreover, all affect-laden experiences from the previous examples are associated with propensity towards action whether it is goal-congruent (in the case of worry or guilt) or goal-incongruent (like fear or hunger), therefore they actively intervene in the process of eating self-regulation. For these reasons, and based on the "valence-arousal space" and "propensity towards action" criteria of we define **"hot factors"** as *affect-laden experiences, conscious or non-conscious, positively or negatively valenced, accompanied by some degree of arousal and associated with behavioral drives (approach/avoidance).*

1.2.2. Hot factors, self-regulation and eating

Besides their accent on the process-like features of self-regulation and the centrality of goals, many theories emphasize self-control as a central prerequisite of self-regulation (e.g. The discounting model of impulsiveness, Ainslie, 1975; Dual-process models of self-control – Mischel, Shoda, & Peake, 1988; The strength model of self-control – Baumeister & Heatherton, 1996 etc.). Typically, self-control is defined as the overriding or the inhibition of automatic, habitual or innate behaviors, urges, emotions or desires that would otherwise interfere with goal-related behavior (cf. Muraven, Shmueli, Barkley, 2006). The boundaries between self-control and self-regulation are not clearcut, as some authors use self-regulation and self-control interchangeability (e.g. Baumeister, Bratslavsky, Muraven, & Tice, 1998).

1.2.2.1 Cybernetic Control Theory (CCT) (Carver, 2004; Carver & Scheier, 1990, 1998)

The CCT has been more or less been equated with the self-regulation perspective, mainly because it was one of the first self-identified self-regulation theories (De Ridder, & de Wit, 2006). It highlights the centrality of goals, which guide most of human behaviors. The process of self-regulation, therefore, consists in specifying goals, monitor progress towards goal attainment and act in ways so as to reduce discrepancies between the actual state and the desired end-state. Goals also serve as reference values for the feedback control, which is the central self-regulatory process described by CCT. Negative and positive emotions also play a central role in the CCT, as they are functional dimensions in the self-regulation process and directly signal the progress towards or

away from the goal (Magen & Gross, 2010). The authors argue for a two bipolar dimensions of affect, correspondent to the approach and avoidance systems of self-regulation (Carver, 1998). Negative emotions signal a poor progress towards goal, whilst positive ones are messages for a good progress towards the end states. In this case for example, the negative emotions of the person who wants to loose weight and fit into her old jeans again is a sign that the 'job' of loosing weight is not going all to well. However, it might also lead to goal disengagement, if the person's expectancy of being able to reduce the discrepancy is negative

The CCT largely ignores the role of incidental affective states (not related with the goal of self-regulation) which have a major impact in self-regulation. For instance, studies focuses on the role of incidental emotions on eating (Heatherton, Striepe, & Wittenberg, 1998; Macht, 2008, for a review; Wallis & Hetherington, 2004) arguing that especially negative emotions tend to slow down goal progress, with vulnerable individuals (especially restrained eaters or emotional eaters) indulging more easily in unhealthy temptations. The evidence regarding positive emotion is, however more mercurial, as there is no pattern regarding their role in self-regulation. For instance, a study of Cools, Schotte and McNally (1992) shows that in a manner similar to negative emotions, positive ones also tend increase food intake among restrained eaters. The same pattern was observed by Macht, Roth, and Ellgring (2002), who compared the effects of different emotion inductions on liking for chocolate and chocolate consumption among men. On the contrary, positive emotion induction was associated, in other studies with more pleasure derived from healthy as compared to unhealthy foods (Lyman, 1982; Macht, 1999; Macht, Roth, & Ellgring, 2002).

1.2.2.2. The strength model of self-control (Baumeister et al., 1994; Baumeister & Heatherton, 1996; Baumeister, & Tice, Zell, 2007)

The model put forth by Baumeister highlights the assumption that self-control is an effortful endeavor and requires strength or willpower. The model posits three basic assumptions regarding self-control, namely: a) self-control strength is necessary for the executive component of behavior (decision making, planning initiating/inhibiting actions); b) self-control strength is heavily dependent on a finite “pool” of resources of self-control that one possess at a certain point c) any act of self-control depletes the resources and has a negative impact on subsequent self-control attempts.

The negative effects of stress were documented as significantly influencing eating behavior, with people eating more than the usually would after episodes of psychological stress. On the contrary, positive emotions are believed to have a restorative effect after acts of self-control, leading

to improvements in self-regulatory capacities. Also, the model assumes that negative emotion influence self-regulation not only by depleting self-control resources but also by influencing evaluations of self-efficacy (Tice et al., 2001). Other possible mechanisms involve a shift in prioritization of goals (the motivation to down-regulate negative emotion becomes more important that the achievement of a distal goal) and motivated escape from aversive self-awareness, which will be discussed in the following sections.

*1.2.2.3. Dual-process models of self-control (*Gerard, Gibbons, Houlihan, Stock, & Pomery,2007; Loewenstein, 2000; Meltcafe & Mischel, 1999; Stratch & Deutsch, 2004)

The dual models of self-control generally posit that regulation of behaviors draws upon two systems of information-processing: a "hot" system, concerned with impulses, and automatic dimensional evaluations (good/bad, pleasant/unpleasant etc.) and a "cool", deliberative system, mainly involved with executive functions associated to goal-striving. They also assert that self-control is typically part of the cool cognitive or reflective system that guides goal-directed behavior and requires a person's volitional control or willpower in order to be effective. The cool system is seen as having evolved to serve long-term self-regulatory purposes which, by means of executive functions (e.g., reasoned judgments, strategic action plans), is able to override prepotent impulses and habits (De Ridder et al., 2012).

1.2.2.4. Counteractive Control Theory (Fishbach, & Trope, 2005; Trope & Fishbach, 2000)

. The distinction between goal-related processes versus temptation-related processes in further documented by other authors (Fishbach, & Trope, 2005; Trope & Fishbach, 2000), for instance, which posit that self-control is actually a systematic and asymmetric response towards goal or temptation, which can take either the form of mental representations or behavioral actions. The main proposition of this perspective is that counteractive control is meant to resolve the tension between high-order (long-term goals) and low-order (short-term temptations) motives, by asymmetrically shifting their motivational strength (Fishbach & Converse, 2010). Thus, self-regulation processes advanced by different taxonomies might be grouped in two broader categories: *temptation-focused processes* and *goal-focused processes.* These two categories can be further broken down into either behavioral strategies or cognitive ones (usually targeted to altering the psychological meaning of either the goal or the temptation) (Fishabch & Converse, 2010).

This is analogue with the approach/avoidance orientation, in which people might behaviorally

approach high-order goals and, at the same time, keep their distance from the temptations. Diners would usher waiters to clean-up their plates in order to avoid continuously picking at their half-eaten food that has already satiated them. Similarly, dieters would be motivated to pile-stack fruit and vegetables in their grocery basket (goal-directed behavior) while cleaning up the cupboards of unhealthy snacks, so as to avoid giving in to temptation (Fishbach & Converse, 2011

1.3. The working model for the present thesis

The working model for the present thesis is presented in Figure 1. Each path of influence is explained in detail in the following subsections.

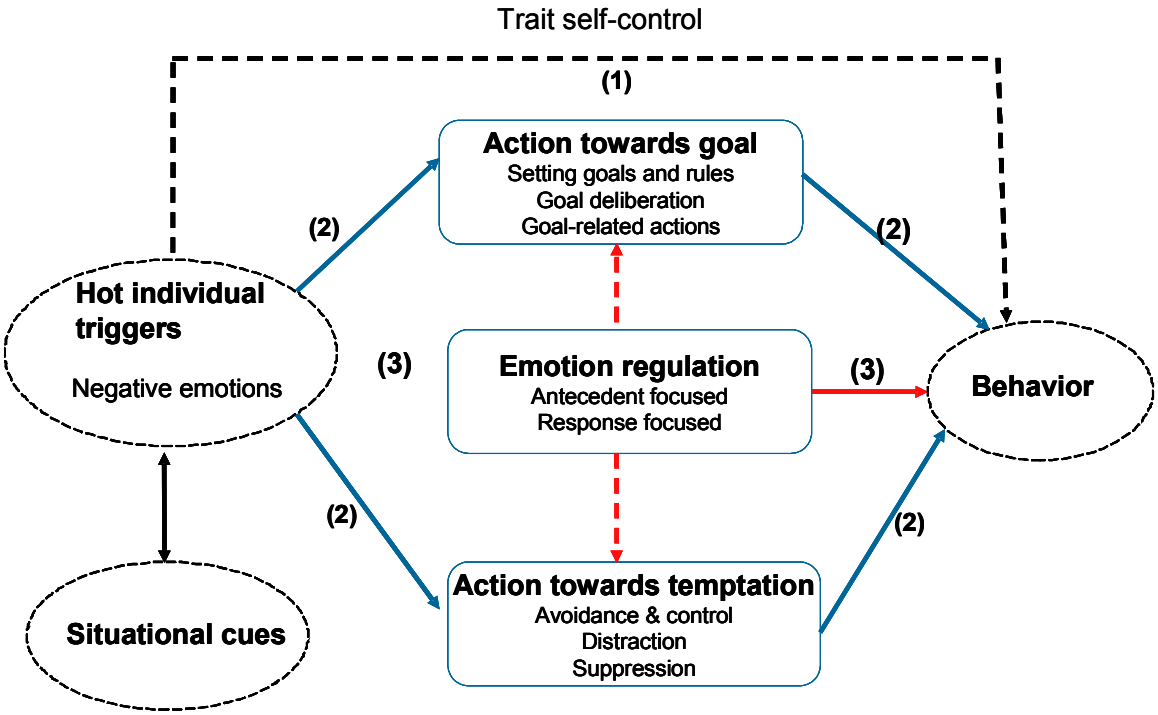

Figure 1. The working model for the present thesis

1.3.1. The influence of automatic affective reactions towards food on food intake is moderated by self-control *(Path 1)*

It is reasonable to assume that the processes by which automatic affective reactions influence eating, in the context of eating-related stimuli, are fundamentally different from other types of affect-laden experiences, such as emotions. For instance, automatic affective reactions (such as liking and disliking something) are simple and rapid and may guide online behavior even when full-blown emotions may be too slow or complex to have the same influence on self-regulatory

processes (Baumeister et al., 2007). The same stands for situations in which individuals' capacity for self-control are dispositionally low (see also Friese, Hofmann, & Schmitt, 2008). In this respect, a study of Freise (2008) employed an implicit measure of affective reactions towards potato chips (Single Category Implicit Attitude Test -SC-IAT; Karpinski & Steinman,2006). As expected, trait self-control moderated the impact of automatic affective reactions on eating behavior. The implicit measure predicted potato chips consumption well for participants low in trait self-control.Similar patterns emerged in other self-control 'ingredients' like inhibitory control (general capacity to inhibit prepotent responses; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000) , executive attention (i.e., the domain-free ability to control attention, Engle, 2002) and automatic affect downregulation (Hofmann, Friese, & Roefs, 2009) in relationship to automatic affective reactions towards candy and candy consumption.

1.3.2. Hot cognitions towards food trigger self-regulatory processes and subsequent behavior (*Path 2*)

Worry, defined as a chain of thoughts and images which are affect-laden (Borkovec, Robinson, Pruzinsky, & DePree, 1983) might substantially influence subsequent self-regulation attempts. Regardless of whether it is pathological or it is within the 'normal' range, worry has both positive and negative outcomes. Dispositional worry, which is the tendency to have uncontrollable negative cognitions concerning the possibility of future negative events (Pruzinsky, & Borkovec, 1990), is related to performance deficits, deficient problem solving, and a lower ability to remain focused on a task (e.g. Tallis, Eysenck, & Mathews, 1991In relationship to eating, anticipatory-affect laden experiences, such as worry, received less attention, especially in normal-weight individuals. However, several studies have revealed that people with eating disorders, such as bulimia or anorexia nervosa, have pervasive weight and food concerns (Goldfein, Walsh, & Midlarsky, 2000; Gowers & Shore, 2001; Jacobi, Paul, De Nutzinger, & Dalme, 2004) which become habitual and automatic (Williamson, Muller, Reas, & Thaw, 1999) and further bias attention, memory and judgments regarding food-related stimuli. This, in turn, contributes to maintenance of this eating disorder, as typical cases of eating dysregulation (Heatherton & Baumeister, 1991).

However, normal worry can be viewed as a helpful strategy that may facilitate performance in goal striving. For example, when trait anxiety is ruled out, worry has still been found to be associated with adaptive coping strategies such as problem solving and information seeking (e.g.,

Davey et al.,1992).The question as to whether worry might 'fuel' other self-regulatory processes for goal striving, and whether under normal circumstances (for individuals without clinical trait anxiety) it actually serves as 'proactive coping' (Greenglass, 2002) is largely unknown.

1.3.3. The role of incidental full-blown emotion on food intake depends on emotion regulation strategies (*Path 3*)

Food, more than other stimuli, elicits positive affective emotional responses that promote ingestion, especially for sugary or high-caloric foods, or aversive affective responses that signal rejection, with both types of reactions having strong adaptive values (Rosenstein & Oster, 1988). Emotional eating, which was most commonly defined as 'the tendency to overeat in response to negative emotions such as anxiety or irritability' (van Strien et al., 2007, pag 106) was also a largely studied correlate of dysbalanced eating. O'Connor, Jones, Conner, McMillan, and Ferguson (2008) found that stressed emotional eaters had a higher caloric intake than unstressed and non-emotional eaters, while other studies found no support for this moderating role of emotional eating (Adriaanse, de Ridder, & Evers, 2011; O'Connor & O'Connor, 2004). The same observations, regarding the link between negative emotion and eating, were also observed in normal-weight, healthy individuals (Macht, 1999; Macht & Simons, 2000). These results suggest that emotional eating is not an isolated phenomenon. There is also research linking explicit expectancies of negative emotion downregulation as a result of eating comfort foods (Tice, Bratlavsky and Baumeister, 2001).

From this point onward, it made sense to hypothesize that by instructing individuals to use emotion regulation strategies that prove successful and require less mental resources, the 'spared' resources can be devoted to proper control of food intake (Evers, Stok, & De Ridder, 2010). A good framework of emotion regulation that would allow for the testing of cognitive load hypothesis is the Process Model of Emotion Regulation (Gross, 1998; Gross & Thompson, 2007). According to this model, emotion may be regulated at five points in the emotion-generative cycle: (a) selection of the situation, (b) modification of the situation, (c) deployment of attention, (d) change of cognitions, and (e) modulation of experiential, behavioural, or physiological responses (Figure 1).

1.4. Self-regulation of food intake in adolescents

Adolescence is a period of important changes in the youngsters' life (pubertal changes, increased influence of peer group, cognitive and emotional changes etc.) that may prove critical in setting lifestyle trajectories with enormous long term implications for adult health. These

trajectories include early patterns of behavior in the realms of exercise; nutrition; the use of tobacco, caffeine, alcohol, and other mood-altering substances. Adolescence is the period for establishing the paths of further education, major life roles, relationships, and working toward long-term productive goals. Accordingly, adolescence is an important period for the study and development of preventive interventions designed to head off the development of more serious problems in adulthood (Steinberg, Dahl, Keating, Kupfer, Masten, & Pin, 2006).

The 2012 Health Behavior in School-Aged Children (HBSC) report that in Romania, only 46% of the adolescents aged 11-15 years-old have breakfast daily, as compared to a 62% representing the European average consumption in the same age group. There is a steady decrement between 11-15 years old (from 53% at 11 to only 40% at 15) The relationship inverses when we look at energy drinks consumption: while there are 31% Romanian adolescents who report having soft drinks daily, the European mean is around 10% lower (22 %). A decrease in healthy eating habits is evident here too, when we look at data from 11 to 15 years old adolescents: while 47% of 11 years-old Romanian youngsters report having fruits daily, only 35% of 15-years old have fruits in their daily eating routines. There are also gender differences in eating routines, with girls reporting to have higher fruit intake (45% girls versus 36 % boys) and fewer soft and energy drinks (26% girls versus 33% boys).

This leads to avenues for research in the field of self-regulation of eating in adolescents. Specifically, it documents the importance of studying why do adolescents eat what they eat. Second, since self-regulation improves while dietary habits tend to decline, one needs to look also at other factors, that might affect eating in adolescents, such as 'hot' as well as interpersonal influences (see also the Protoype Willingness Model; Gibbons, Gerrard, Blanton & Russell, 1998). Leaving interpersonal influences aside, which undoubtley have major influences on any risk or health protective behavior in this age group, literature focusing on hot factors has documented both the role of emotional eating as well as of impulsive eating when faced with palatable foods.

Overeating is also stimulated by the ready availability of food rich in fats and sugar , which are appealing from an evolutionary point of view because they can be rapidly converted into energy (Nesse & Berridge, 1997) . Therefore, this particular foods stimulate the reward systems in the brain and reinforce the eating behavior (Erlanson-Albertsoon, 2005). Adolescents might be particularly vulnerable to these palatable food cues, since they experience these urges more intensely (Pechman et al., 2005) and their capacities for self-control are low (Thompson, 1994).

CHAPTER 2. Outline and research aims of the present thesis

The present thesis is articulated on four main arguments emerging from the literature in the area of self-regulation and eating. The first one posits that people eat under the influence of emotional states in order to increase hedonic experiences and reduce distress (Baumeister et al., 2007). Also, the palatability of foods, especially of unhealthy ones has a great deal of influence over people's food cravings and intake (Pollan, 2008). Therefore, studying the way individuals manage these hot factors while attempting to regulate food intake, is highly relevant in trying to understand both normal but also dysbalanced patterns of food intake .

Second, research shows inconsistent results regarding eating under hot states (Greeno & Wing, 1994; Macht, 2008)) Although different mechanisms underlying this relationship have been studied, there was no attempt to study them against each other, in relationship with the same eating habits (like unhealthy snack intake, fruit intake, etc.). This is in part because research focused mainly on incidental emotions, neglecting the role of goal-related ones.

Third, previous research put little emphasis on self-regulatory processes at the interface with hot factors (usually operationalized as concrete emotions), while focusing mainly on other individual characteristics (like cognitive load, attention-spam, trait emotional or restrained eating, previous dieting etc.). These traits, although important in understanding self-regulation, tell us little about how different hot factors interact with goal-related self-regulatory processes in influencing eating.

Next, research has to focus more on studying hot factors at the interface with self-regulatory processes in adolescents, given that they are especially prone to engage in health-risk behaviors (Steinberg & Cauffamn, 1996). Also, a taxonomy of self-regulatory processes in relationship with eating is needed, in order to effectively test these interrelationships in this particular group.

Therefore, **a first objective** of the present thesis was to adapt and validate an eating-related self-regulation scale for adolescents (Study 1). In order to test for self-regulation strategies adolescents use themselves, in an initial phase, different strategies were assessed by the means of concept mapping (Kane & Trochim, 2007). The strategies emerged in the Romanian sample were merged with strategies that adolescents from three other countries mentioned and aggregated with strategies derived from the scientific literature. The emerging scale (25 items) was translated and validated in a sample of 1500 Romanian adolescents.

The **second objective** of the present thesis was to investigate the relationship between food-

related appetitive responses and self-reported snack intake, as a function of trait self-control. We evaluated automatic affective reactions towards food stimuli as proxies for appetitive responses by using the implicit Go/Non-Go Association Task (Nosek & Banaji, 2001). Gender differences in appetitive responses were investigated along with the three-way interaction effect of automatic affective reactions, self-control and gender.

Further on, **a third objective** was to test whether worry about eating (as a hot factor) triggered self-regulatory processes in adolescents and whether these were predictive for unhealthy snack intake (Study 3). In order to investigate this relationship, the scale validated in study 1 (TESQ-E) was used. This study was meant to bring insight on how goal-related hot factors influence eating and further, whether there are any gender differences in this dynamic relationship (See Path 2, Section 1.5.2.). Also, it was meant to test eating-related self-regulation, as opposed to Study 1, in which general self-control served as a proxy for self-regulation. The relationship between food worry, self-regulation processes, gender and unhealthy snack intake was assessed by using the moderated mediation analysis (Preacher, Rucher & Hayes, 2001).

The **fourth objective** was to systematically investigate negative emotions stemmed in non self-referent (Study 4) versus self-referent emotional contexts (Study 5), in relationship with eating regulatory processes and ad libitum snack intake. Two core processes were experimentally assessed in regard to this relationship: emotion regulation and self-monitoring of food intake (see Path 3, Section 1.5.3). Study 4 was focused on analyzing the relationship between non self-referent negative emotions and food intake after employing either reappraisal or suppression of emotional expression. Negative emotional states were induced by watching two distressing short clips and emotion regulation strategies were varied across groups. Study 5 tested the same relationship, but in the context of self-referent negative emotions. The consequence of using different emotion-regulation strategies on self-monitoring was also tested. In order to induce self-referent negative emotions, I used a standardized protocol of stress manipulation, which simulates a social situation in which the individual feels inadequate and rejected.

The structure of the present thesis follows the logic of the objective exposed previously. Therefore, I aimed to validate a reliable instrument that would allow for tapping different self-regulatory processes. Further investigations focused on how trait self-control and goal-related self-regulatory processes (as assessed by TESQ-E) interacted with two types of hot factors: automatic affective reactions and food worry in explaining unhealthy snacking in adolescents (Studies 2,3). The focus was shifted in the following two studies, from adolescents to young adults. This time, the

analysis was concentrated on another type of hot factors, namely negative emotions, in relation to different self-regulatory processes, like emotion regulation and self-monitoring (Studies 4,5).

The present dissertation combines different methodological approaches and different types of samples to thoroughly address these objectives. First, literature review, focus-groups with adolescents and subsequent analysis of results with the concept mapping procedure allowed for the validation of TESQ-E scale. Second, this scale was tested in a cross-sectional design. Experimental studies were used in order to allow for causal inferences regarding the relationship between negative emotions, emotion regulation and eating, as well as the relationship between appetitive responses to food and unhealthy snacking. Both self-reported as well as direct measures of unhealthy snack intake were used as outcomes across the studies.

CHAPTER 3. Validation of the Tempest Self-Regulation Questionnaire for Eating in Adolescents (TESQ-E) in Romanian adolescents[3]

3.1. INTRODUCTION

Previous research has documented a variety of strategies that people may employ in self-regulating their (eating) behavior. Only one study aimed to investigate strategies that adolescents use to regulate their eating behavior (Kalavana, 2010), but this study describes so-called self-regulation *cognitions* rather than actual strategies that can be employed to improve self-regulation performance. Other categorizations examining strategies typically employed by adolescents simply distinguish between 'short-term' and 'long-term' self-regulation (Moilanen, 2007) (See Chapter 1 and Chapter 5 for more discussion on self-regulatory processes in adolescents). It is obvious, thus, that there is a need to have an instrument which allows us to assess the strategies that adolescents employ in regulating their eating behavior (Stok et al., 2012).

The present research aims to fill this gap and describes the development and validation of the *Tempest Self-regulation Questionnaire for Eating* (TESQ-E) that assesses self-regulation strategies for dealing with food in adolescents.

3 Part of this chapter was published in Craciun, C., Taut, D., & Baban, A. (2012). Self-regulatory strategies for eating behaviour in children and adolescents. A concept mapping approach. *Cognition, Brain, Behaviour, 16*(1), 49-66. The co-authors of the paper agreed with presenting part of the article in the present chapter.

3.2. METHOD

3.2.1. Development of Tempest Self-Regulation Questionnaire for Eating (TESQ-E)

The questionnaire was developed in an iterative process of four steps, combining bottom-up and top-down approaches, in four countries: Romania, Netherlands, Denmark and Portugal. The first step consisted in a systematic literature review, documenting different scales aimed to assess self-regulation in adolescents as well as key self-regulatory processes with role in healthy/unhealthy eating. The review showed that there were no instruments aimed to tap on self-regulation strategies in adolescents

The next step consisted in focus groups with youngsters in the four countries, which aimed to assess what are the strategies that adolescents themselves think about in relationship with eating. This was done by using the Concept Mapping (Kane & Trochim, 2007) approach, described below (for a detailed analysis of the results see Craciun, Taut, & Baban, 2012; but also Stok, de Vet, de Ridder, & De Wit, 2012).

The *first phase* aimed to generate statements from the participants. Two focus questions were used: (1) "Things that are important to me in order to ensure healthy eating are…" (2) "Things I find important for healthy eating and being in control of my eating behaviour are…". Each student could generate several statements that answered the two focus questions.

The *second phase* aimed to organize the statements based on their content and also on their importance related to the theme. Statements that had emerged in the first phase of the study were written on cards and presented to the participants. These had the task of sorting the statements according to themes and to priority.. The individual task was to organize all statements in five piles from 1 (least important) to 5 (most important) and then write them all down on a form they have received. The second question was which statements belong together based on meaning and content. The individual task was to arrange the statements in piles according to themes and give each pile a name which best represented the formed cluster.

The *third phase* of the concept mapping procedure consisted in discussing the findings together with the participants.

Next, all emerging items were grouped under overarching, informed by labels provided by the participants in the study. Further on, strategies were assigned to approaches by using the theoretical framework of self-regulation proposed by Fishbach and Converse (2011).

The 24-item scale was translated and retroverted by two researchers fluent in both Romanian

and English. Ambiguous items and/or translations were discussed until a consensus regarding the translated form was reached. The items in English, as well as in Romanian are depicted in Annex 1.

3.2.2 Measures

TESQ-E assessed self-regulation strategies for healthy eating with 24 items as outlined in Annex 1.

Snacking habits were assessed with six items from the self-reported habit index (SRHI) (Verplanken & Orbell, 2003), comprising the three core elements of habits (i.e., frequency, automaticity, and identity).

The Power of Food scale (child/adolescent version) assesses the extent to which adolescents are influenced by the mere presence or availability of food (Lowe, Butryn, Didie et al., 2009).

Delay of gratification was assessed by presenting individuals with a (hypothetical) choice about a monetary reward in exchange for their participation in the study, either a small immediate reward (30 RON) or a larger delayed reward (50 RON one week later; cf. Wulfert, 2002).

Trait self-control was assessed with the brief version of the Self-Control Scale (Tangney et al, 2004). This scale consists of 13 items on self-control, including such items as “I find it hard to quit bad habits” (reversed) and “I wish I had more discipline”.

Dietary intake was assessed with four single items on the average daily intake of sugar-sweetened beverages, snacks, fruits and vegetables as prototypical (un)healthy foods that adolescents may (or may not) consume

Frequency of breakfast was assessed by asking on how many days per week, participants generally ate breakfast.

Body Mass Index (BMI) Weight and height were reported by the participants, from which BMI could be calculated. Because in adolescents, BMI is strongly influenced by age and gender, BMI was categorized. For this categorization age- and gender-specific cut-off points for overweight and obesity provided by Cole et al., (2000) were used.

The Family Affluence Scale (FAS) was used as an indicator for socio-economic status (SES). The Family Affluence Scale (Currie et al., 2008) includes four items asking about family wealth.

3.2.3. Description of the sample

Schools were selected that represented variety in rural and urban regions as well as high and low SES areas. Participants were asked to complete the survey in one session in class. Completing the questionnaire took approximately 30 minutes. Schools were allowed to choose between computer-based or paper-and-pencil questionnaires. All participants to the survey came from 14 schools (76 classes) from which 11 schools are placed in urban areas (3 towns) summing up 89% of the respondents and the rest are in rural areas. A total of 1401 children and adolescents (aged 10-17, $M = 13.33$, $SD = 1.85$) took part at the survey. From the total sample, 683 (49%) were boys and 716 (51%) were girls.

3.3. RESULTS

Exploratory and confirmatory factor analyses indicated a three-factor 2nd order structure (actions towards temptations, change of psychological meaning of temptation and action towards goal), each with two independent strategies. Actions towards temptations factor comprises two original strategies: Avoidance of temptations and controlling temptations. Change psychological meaning of temptations factor comprises two original strategies: Distraction and suppression. Action towards goal strategy comprises two original strategies: Goal setting and goal deliberation. Each of the 6 strategies includes 4 items, thus a total of 24 items make up the TESQ-E questionnaire. The EFA and CFA were run in a sample of 11.000 respondents, including the Romanian sample. Therefore, we decided not to re-run the factor analysis on the Romanian data as well, given that hypothesized factor structure was confirmed.

3.3.1. Reliability and test-retest stability

In order to examine the test-retest reliability of the TESQ-E, a sample of 140 Romanian adolescents (mean age = 13.29, SD = 2.37; 57.1% girls) were asked to complete a survey assessing the TESQ-E twice with four weeks in-between. Mean scores were computed for avoiding temptations (Cronbach's $\alpha = .72$), controlling temptations (Cronbach's $\alpha = .72$), distraction (Cronbach's $\alpha = .78$), suppression (Cronbach's $\alpha = .80$), goal and rule setting (Cronbach's $\alpha = .76$) and goal deliberation (Cronbach's $\alpha .= 70$).

The TESQ-E was assessed at baseline and again four weeks later. Test-retest reliabilities ranged from .55 to .74. All correlations were significant at $p < .001$. According to Cohen (1988), a correlation larger than .50 represents a large effect size. All test-retest reliabilities thus reflect strong

correlations. The correlations between baseline and four weeks later were r = .55 and r = .57 for avoiding and controlling temptations, respectively. Test-retest reliabilities were .71 and .66 for distraction and suppression, respectively. For goal setting and goal deliberation, test-retest reliabilities were r =. 74 and r =.71 respectively. Thus, the results demonstrate that the test-retest reliabilities were satisfactory.

3.3.2. Descriptive information and correlations between the TESQ-E subscales

As the hypothesized factor structure was confirmed and reliability was satisfying, i.e. Cronbach's Alpha > .7, it made sense to calculate summated scales (averages) for each of the six TESQ-E subscales. Table 1 presents the means, standard deviations, and correlations of the TESQ-E subscales.

All TESQ-E strategies were applied sometimes by adolescents (all mean scores between 2.25 and 2.62). All TESQ-E strategies correlated strongly to very strongly, with bivariate correlations ranging from .56 to .71.

Repeated measures ANOVA with Bonferroni post-hoc testing was conducted to compare the use of TESQ-E strategies. Significant differences existed between the use of the strategies ($F(5,1369) = 75.68$, $p < .001$, $\eta^2 = .22$). Goal and rule setting and goal deliberation were used most often, followed by controlling temptation and suppression, whereas avoiding temptation and distraction were used least often. Twelve out of the fifteen differences between the six strategies were significant. Exceptions included avoiding temptation and both distraction and suppression, and controlling temptation and goal deliberation. Effect sizes of the significant differences ranged very small to medium (Cohens' *d* ranged from .09 to .37).

Table 1. Means, Standard Deviations and Correlations between the TESQ-E subscales (n = 1,401)

	1	2	3	4	5
Avoidance (1)		.639	.635	.653	.564
Controlling temptation (2)			.595	.644	.646
Distraction (3)				.714	.629
Suppression (4)					.637
Goal setting (5)					
Goal deliberation (6)					

	M	2.27	2.51	2.25	2.32	2.62
	SD	.97	1.01	1.00	1.00	1.03

Note. All p's < .001

3.3.3. Associations between background characteristics and TESQ-E subscales

Six multiple linear regression analyses with each of the TESQ-E strategies as dependent variable and age, gender, immigrant status, family affluence and overweight status as independent variables were conducted, to evaluate the association between background characteristics and TESQ-E strategy use .

Age was negatively associated with all six strategies, with older adolescents applying the strategies less frequently. Age was most strongly associated with controlling temptations and goal deliberation.

Subsequently, age was broken down into four categories (10 and 11-year- olds, 12 and 13-year-olds, 14 and 15-year-olds, and 16 and 17-year-olds). ANOVA with Bonferroni post-hoc comparisons were computed to analyze to what extent TESQ-E strategies showed a continuous decline with age. The strategies showed a fairly decline with age. However, the differences between age group 14/15 and 16/17 were insignificant in connections with all strategies.

Gender was positively associated with all six TESQ-E strategies. Girls applied the TESQ-E

3.3.4. Predictive validity

To determine whether the TESQ-E is related to eating behavior, bivariate correlations between the TESQ-E subscales and weight-related considerations, snacking habits, power of food, and dietary intake (breakfast frequency, fruit intake, vegetable intake, soft drink consumption and snack consumption) were computed (Table 2)

Table 2. Correlations between TESQ-E subscales and eating behaviors

TESQ-E	Snackig habits	Breakfast frequency	Fruit intake	Vegetable intake	Soft drink intake	Snack intake	Power of Food
Avoidance	-.175	.121	.120	.152	-.193	-.281	-.076[c]
Controlling temptations	-.199	.159	.151	.184	-.203	-.272	-.059[b]
Distraction	-.113	.083[c]	.185	.171	-.138	-.241	-.023[a]
Suppression	-.207	.108	.177	.163	-.157	-.287	-.095[c]
Goal setting	-.199	.156	.285	.234	-.139	-.210	-.005[a]

Goal deliberation	-.096	.100	.144	.127	-.112	-.221	.030[a]

Note. All *p's* < .001 except for a: not significant, b: significant *p's* < .05, and c: significant *p's* < .01

3.3.5. Discriminant validity

Table 4 present the correlations between TESQ-E strategies and two discriminant measures: delay of gratification and self-control. The correlations between TESQ-E and delay of gratification are modest, with only three significant relationships. The relations with self-control are generally higher, from small to medium, which suggests that while the constructs are related, they are nevertheless different.

Table 4. Zero-order correlations between TESQ-E subscales and two related self-regulation constructs.

TESQ-E	Delay of gratification	Self-control scale
Avoidance	.048	.176**
Controlling temptations	.057*	.247**
Distraction	.019	.120**
Suppression	.058*	.226**
Goal setting	.063*	.204**
Goal deliberation	.018	.137**

Note: * $p < .05$; ** $p < .01$

3.4. DISCUSSION

The aim of the present study was to validate a questionnaire which assesses self-regulatory processes related to eating in adolescents. The process of validating the TESQ-E was necessary, as we have little insight and no instruments of assessing the way adolescents deal with unhealthy foods in their environment.

In the Romanian sample, the results show that TESQ-E reliably taps into six specific self-regulation strategies (De Vet et al., submitted), which, in turn, aggregate into three overarching approaches This is in line with the hypothesized theoretical model, of Fishbach and Converse (2011), which was took as a reference for the present study. Also, the reliability and stability coefficients of the scale were good. Although the intercorelations between scales were high, the analyses revealed that the strategies are, nevertheless, theoretically distinct.

The six strategies showed a meaningful pattern of association with different behavioral outcomes such as unhealthy snacking, breakfast consumption, but also fruit and vegetable intake,

suggesting that adolescents who use these strategies to a larger extent, also eat more fruit and vegetables, have breakfast more often and consume less unhealthy snacks and soft drinks. This is an important finding which shows that TESQ-E effectively discriminates between those who are careful at their eating habits and adolescents less inclined to do so.

The TESQ-E scale has a good discriminative validity, with mild to moderate correlations between related measures, such as delay of gratification and self-control. Thus, the ability to delay gratification is only one side of the self-regulation 'coin', and taps more on inhibitory control (Posner & Rothbart, 2007).

Regarding the association between demographic factors and TESQ-E subscales, the results show that there are high negative associations between all strategies and age. This suggests that, as they grow older, adolescents are less inclined to use self-regulation strategies compared to younger ones, which watch their eating behaviors more carefully. Possible explanation may reside in more influence of parents in the eating patterns of younger adolescent, which may translate into more willingness to eat healthily. Also, even though older adolescents are better able to self-regulate they may be less willing to do so when it comes to food regulation. A similar pattern has been observed in previous research showing that obesity prevention programs are more effective for children versus preadolescents (Stice, Shaw, & Marti, 2006). Girls are more active users of self-regulation strategies in controlling their food intake, which is not at all surprising. Thus, previous research shows that there are gender differences in food intake (Rolls, Fedoroff, & Guthrie, 1991) ad these differences may be attributed to girls being more health-conscious than boys (Wardle et al., 2004).

Concluding, the present study showed that TESQ-E is a reliable instrument for addressing self-regulatory strategies in relationship to eating, in Romanian adolescents. This is a first step towards the systematic investigation of the way adolescents use these strategies in navigating in the obesogenic environment.

CHAPTER 4. Resisting everything except temptation? Dispositional self-control, gender and automatic affective reaction towards foods set the tone for how much adolescents indulge in unhealthy snacking

4.1. INTRODUCTION

4.1.2. Hot factors, self-control and eating

It was suggested that a possible factor that moderates the impact of hot factors on the ability to delay gratification or to resist to immediate temptation is the capacity to self-control (Rodrigues, Mischel, & Schoda, 1989; Stratch & Deutsch, 2004). Self-control can be defined as the ability to override or to inhibit ”undesired behavioral tendencies” (such as impulses) and to refrain from acting on them (Tagney et al.,2004, pag. 4; Hofmann, Friese, & Strack, 2009). This poses special problems for adolescents, given that research shows that they are more impulsive and less able to self-control (Pechman, Levine, Loughlin, & Leslie, 2005).

In the eating domain, the relationship between self-control and the ability to resist to food temptations has gained empirical support, especially in adult populations. The work of Baumeister and his colleagues provides evidence for the role of self-control and depletion of self-control resources on choosing a healthy versus unhealthy snack (see Baumeister et al., 2005. In a similar vein, Friese and Hofmann (2009) showed in a study that trait self-control moderated the influence of automatic affective attitudes towards potato chips and alcohol on subsequent chips and alcohol consumption.

In all, there is evidence based on adult studies, suggesting that the ability to resist to food temptations is moderated by self-control resources. Research focusing on children and adolescents has only investigated the ability to delay the gratification (thus to resist to immediate temptation) without taking into consideration the strength of impulses towards temptation or the overall capacities for self-control. Automatic affective reactions are considered to be a proxy of impulses and can be assessed by implicit measures, such as IAT or GO/No-Ho Association Test (see Hofmann et al., 2010; Nosek & Banaji, 2011)

4.1.3. Gender and eating patterns

Surveys from Western countries show gender differences in food consumption, nutrient intake and attitudes towards food. Women are more concerned about healthy diet and more often classify foods according to the assumed nutrient content than men (Fagerly & Wandel, 1999; Prattala et al.,

2006). Among students, it was also shown that women use label information regarding fat contents and low-fat foods (Shannon, Story, Fulkerson, & French, 2002). Also, women are more likely to follow a diet in order to loose weight (e.g.), or to eat in response to boredom, guilt or sadness (Beardsworth et al., 2002; Wardle et al., 2004). The same stands for adolescent girls, who eat more fruit and vegetables in comparison to boys (Lien, Lytle, & Klepp, 2001; Reynolds et al., 1999), snack less often (Nu, MacLeod, & Barthelemy, 1996) and are also more likely to be on a diet or to use weight management strategies (Currie et al., 2008; 2012). These differences in the observed eating patterns have been largely attributed to social pressures to keep a slim figure for women (e.g. Markey, 2010).

4.1.4. Overview and aims of the present study

The present study investigates the role of automatic affective reactions, as proxies of impulses towards certain food, in estimating eating behavior and the role of trait self-control in moderating this relationship in adolescents. Building upon previous work, we infer that at low levels of self-control, automatic affective reactions towards certain food items are better estimates of eating behavior than at high levels of self-control. Also, the present research aims to look at the gender differences in automatic affective reactions towards food and see whether the hypothesized path is different in boys versus girls.

4.2. METHOD

4.2.1. Participants

A total of 571 children and adolescents recruited form three large schools in Cluj-Napoca, started to fill in the online questionnaires. Parents of all participants were informed about the purpose and the procedure of the study. Passive consent was asked from the parents (parents who did not agree with their child participation at the research returned a signed form to the teachers). Also, verbal informed consent was asked from the youngsters before implementing the study. Out of the initial pool of 571 participants, 204 (131 girls and 73 boys), aged 10 to 19 (M = 15.17, SD = 2.30), had valid GNAT data that could be matched with other scales, and were retained for further analyses. The rest of the participants either refused to complete the GNAT trials, were short on time, failed to finish the GNAT or their data could not be processed (see below criteria for data processing).

4.2.2. Instruments

4.2.2.1. The Go/no-Go Association Test (GNAT)

a) Trial blocks

The GNAT was executed with an Inquisit3 Web license, which was downloaded and conducted on the computers at each school. The general alignment and the instructions given can be taken from Figure 1. Each GNAT consisted in two blocks: one pairing the target with a pleasant attribute and the second pairing the same target with an unpleasant attribute. The categorization task comprised 24 pictures with 6 pictures for each of the following categories: healthy foods (fruits), unhealthy foods (processed snacks), pleasant items (flowers) and unpleasant items (spiders). Adolescents were instructed to press the space-bar as fast as possible whenever they saw a food or an item from the two evaluation categories (spider or flower). There were four resulting blocks: fruit + flower versus spider (noise), fruit + spider versus flower (noise), snack + flower versus spider (noise), snack + spider versus flower (noise). Each block consisted of 54 trials. All blocks were presented in a randomized order and the task of the practice-trials was also randomly selected. The distracter trials (noise) consisted in items belonging to the opposite evaluation category (for instance when "flower" was the signal, "spider" was the noise and vice versa).

The food pictures of healthy snacks (fruit items) and unhealthy snacks were chosen from the pictures displayed in the Food Frequency Questionnaire, which was filled in before the GNAT (see the following sections). One important fact to note is that all pictures of spiders and flowers were standardized in a 448x336pxl array.

b) Response deadline

Figure 1 depicts the temporal sequence of GNAT. Each item was presented for a maximum of 750 ms after the introductory part of the task block. Participants could interrupt or go the next target item by pressing the space-bar. If a correct categorization was made, a green "O" was presented for 350ms; if the categorization was incorrect, a red "X" appeared for 550ms. The response deadline was 750ms according to the recommendations of Nosek and Banaji (2001) who suggested that reaction times falling in the 500-850 ms response deadline interval were sufficient to detect automatic responses to the target object.

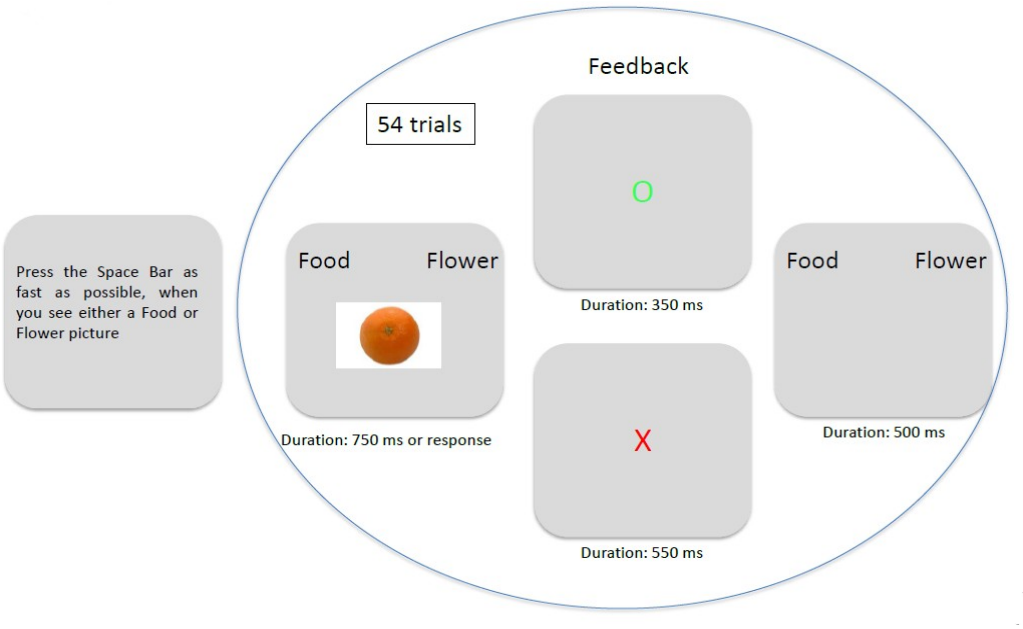

Figure 1. Temporal sequence of GNAT

c) Data processing

In order to evaluate the data, sensitivity scores (d's) and response latencies were computed for each block. Additionally, data were randomly split in half to assess reliability of the measures. Moreover, the data of all spider and flower pictures and the data of the targeted pictures of each kind of food were processed.

4.2.2.2. Food Frequency Questionnaire

The frequency with which children consume specific foods was assessed with a food frequency questionnaire (FFQ). Participants were asked to state how often they consume food items on a 7- point rating scale. Portion sizes were given by presenting images of the food item Responses were scored on a seven-point scale with never (1), less than once (2), once a week (3), two to four times a week (4), five to six times a week (5), every day once a day (6), every day more than once a day (7). The food items were selected on the basis of three criteria: 1) foods that are likely to be consumed as snacks, 2) foods that can be classified as healthy/unhealthy and 3) foods that adolescents can choose on their own. One important thing to note is that the images of fruit an other sweet and salty snacks used in the FFQ were identical with the fruit/unhealthy snacks stimuli used in the GNAT.

Self-control was assessed by using the 13-items version of the Self-control scale (Cronbach's $\alpha = .68$) (Tagney et al., 2004).

4.2.3. Procedure

Data were collected during regular class-hours, with the agreement of the school principle and the teacher. All data were anonymous and participants were identified by a personal unique identity code

4.3. RESULTS

4.3.1. Preliminary analyses

Table 1 displays the means, standard deviations (SD) and zero-order correlations between automatic affective reactions, self-reported consumption of different food categories and dispositional self-control.

Automatic affective reactions towards healthy food (PAHsnack) appeared to be inversely correlated with unhealthy snacks consumption *(r* = -18, $p < .05$), while there was no significant correlation between fruit consumption and the corresponding attitudes (*r* = .01, *ns*). Therefore we retained for further analyses the PAHsnack in relation to self-control and unhealthy snacks consumption.

4.3.2. Gender differences in automatic affective reactions towards healthy versus unhealthy snacks

In order to test for gender differences in automatic affective reactions towards healthy/unhealthy snacks, we ran two independent sample t-tests. The results reveal that girls endorse more positive affective reactions towards healthy snacks (*M* = .55, SD = 1.05) compared to boys (*M* = .14, SD = 1.03), $t(202) = 2.56$, $p < .01$. However, no gender differences emerged in automatic affective reactions towards unhealthy snacks (*M*girls = -.46, *SD* = 1.03; *M*boys = -.56, SD = .96), $t(202) = .65$, ns.

4.3.3. Self-control and gender in the relationship between positive affective attitudes towards healthy snacks and unhealthy snack consumption

We further investigated whether the relationship between affective reaction towards healthy snacks and unhealthy snack consumption varied as a function of gender and trait self-control. Before running the multiple regression analysis, we centered the scores of positive affective attitudes and self-control, as recommended by Aiken and West (1991) and dummy-coded the 'gender' variable. All two-way and the three way by-product were calculated as the multiplicative

products of these centered and dummy coded variables. Table 3 displays the results of the multiple regression, with self-reported unhealthy snack consumption as a criterion.

Table 3. Summary of multiple regression for variables predicting unhealthy snack consumption

Predictor	**ΔR^2**	***B***	**SE *B***	***β***
Step 1	.08**			
PosAff_Hsnack		-.27	.13	-.15*
Self-control		-.25	.25	-.07*
Gender		.83	.31	.19**
Step2	.10**			
PosAff_Hsnack		-.21	.16	-.12
Self-control		-.55	.30	-.16
Gender		.83	.31	.20**
PosAff_Hsnack x Gender		-.14	.27	-.05
PosAff_Hsnack x Self-control		.01	.23	.00
Self-control x Gender		1,00	.57	0.16
Step3	12**			
PosAff_Hsnack		-.18	.16	-.10
Self-control		-.47	.30	-.13
Gender		.86	.31	-.20**
PosAff_Hsnack x Gender		.06	.27	-.02
PosAff_Hsnack x Self-control		-.34	.30	-.11
Self-control x Gender		1.16	.57	.18*
PosAff_Hsnack x Self-control x Gender		.91	.47	.20*

Note: $N = 202$; *$p < .05$; **$p < .01$ (Two-tailed test)

PosAff_Hsnack = positive affective attitudes towards healthy snack

The model in which we included positive affective attitudes towards healthy snack together with self-control and gender and all two-way and the three way interaction predicted 12% in variance of unhealthy snack consumption, $F(7,174) = 3.20$, $p = .003$ ($f^2 = .13$) suggesting a medium effect size. The two-way interaction between self-control and gender as well as the three-way interaction were significant in the regression analysis, all ts > 1.93, $ps < .05$.

The three way interaction revealed that the relationship between positive affective reactions towards healthy food and unhealthy snack consumption was modulated by the interaction between gender and self-control. Further investigation of this interaction showed that at low levels of self-control (-2 SD under the mean), there was a significant two-way interaction between gender and positive affective reactions towards healthy food in predicting unhealthy snack, B = -0.52, $t(20)$ = -2.18, $p < .05$. As shown in Figure 3 (Panel A), the simple slope was significantly different from zero only in boys (β = 2.44, t (20) = -6.45, p < .0001), suggesting that lower positive affective reactions are predictive for unhealthy snack consumption in boys but not in girls (β = -1.06, *ns*). Also, at high levels of self-control (+2 SD above the mean), the interaction between positive affective reactions and gender was only marginally significant, B = 5.00, $t(22)$ = 2.40, p = .09. Although it did not reach the threshold for conventional significance (p < .05), the same trend was evident as in the low-self-control group: higher positive affective reactions were related to unhealthy snack consumption in boys rather than in girls (Fig. 3, Panel B).

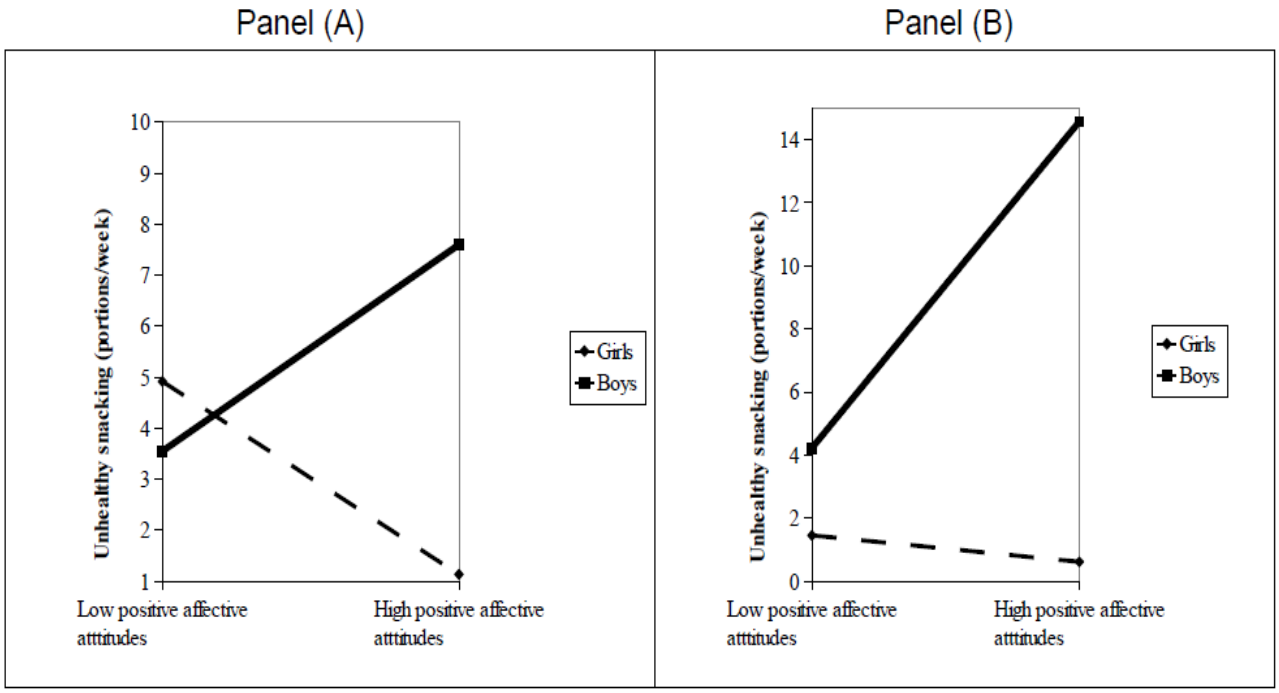

Figure 3. Interaction of PAHsnack and Gender at low and high levels of trait self-control

4.4. DISCUSSION

The present research investigated the role of self-control in moderating the effect of automatic affective reactions towards foods and self-reported food consumption. Past research has

documented the fact that individuals high in self-control are better able to contain their impulses as compared to those low in self-control (Baumeister et al., 1995; Tagney et al., 2004). We also looked at gender differences in impulse strength towards healthy versus unhealthy snacks, given that girls usually display healthier eating habits as compared to boys (Currie et al., 2012). Moreover, in order to effectively test the idea that automatic affective reactions, as proxies of impulses, have different impact on eating behavior, we employed a measure that would account for individual differences in the strength of impulsive tendencies towards food temptations (Friese & Hofmann, 2009).

The preliminary analyses showed that adolescents who hold very positive reactions towards fruit are not necessarily likely to eat more fruit but they are less likely to eat unhealthy snacks. At this point, explanations for why this was the case are highly speculative. Conversely, the inverse relationship between positive affective reactions towards healthy snacks such as fruit and the consumption of unhealthy snacks, might be accounted by a 'distancing effect'. Adolescents who endorse more positive reactions towards healthy snacks might also try to 'distance' themselves from unhealthy food items, which would be mainly reflected in their negative affective reactions towards unhealthy items. As stated before, this explanation is highly speculative, given that we did not compare directly the affective reactions towards healthy versus unhealthy food items, which would require a different implicit measure (such as a two category IAT). We rather looked into the affective reactions towards unique food categories, which did not allow for comparisons.

In line with our expectations, girls endorsed more positive affective reactions towards fruit than boys, which is in line with previous research documenting that they also eat greater amounts of fruits and vegetables as compared to boys at the same age (Lien et al. 2001). Also, not surprisingly, we found no difference in affective reactions towards unhealthy foods, which are generally favored by adolescents regardless of gender (Wardle et al., 2001).

Our results show that trait self-control moderates the relationship between affective reactions and unhealthy food consumption in boys but not in girls. In boys with lower levels of self-control, the more positive are the affective reactions towards healthy foods (fruits), the higher was the consumption of unhealthy foods, like crisps, chocolate or cookies. Unexpectedly, the relationship was not significant in girls with low or high levels of self-control. We would have assumed that that the effect of affective reactions towards food would be mainly dependent of self-control for girls, given that they tend to deliberately regulate food intake to a larger extent than boys. However, this study employed a measure of general, trait-like self-control and not a measure of eating-specific self-regulation. Although previous research has found main effects of trait self-control on different

types of self-regulatory behaviors (e.g. Schmeichel & Zell, 2007), it might be that this measure is not sufficiently sensitive to tap into domain-related self-regulatory processes, like eating. Another explanation might be that boys don't care so much about controlling eating, which is why their eating patterns and attitudes about food might be non-diferentiated (see Stok et al., 2011 for similar results).

4.4.1. Conclusion

Despite these shortcomings, the present research is the first one that investigates individual differences in automatic affective reactions towards healthy/unhealthy snacks, self-control and snack consumption in adolescents. Although previous work has focused on adult population, little was known as to whether the relationship between affective reactions, self-control and snacking behavior stands also for a younger population. We brought evidence that self-control moderates the impact of automatic affective reactions especially for boys. This relationship was accounted taking into consideration individual differences in impulse strength (positivity of affective reactions) and gender differences, showing that in male adolescents the translation of impulses in actual behavior is especially dependent of self-control.

CHAPTER 5. The role of food worry, self-regulation and gender in adolescents' unhealthy snacking: A moderated mediation analysis[4]

5.1. INTRODUCTION

Childhood and adolescence have been shown to represent relevant time periods when health habits are formed. Eating healthy as a child or adolescent predicts ones' adult eating habits (Martens, van Assema, & Brug, 2005; Shepherd et al., 2006). Moreover, previous research shows that unhealthy eating patterns are initiated during the transition period from childhood to adolescence (Song, Schuette, Huang, & Hoerr, 1996), making this an important intervention point. Also, it is well known that unhealthy eating patterns like eating sweets or having a high cholesterol diet is associated with the risk of developing a wide range of health problems such as cardiovascular diseases, diabetes or obesity (Story, Neumark-Sztainer, & French, 2002). In turn, developing healthy habits like eating five portions of fruit and vegetables a day can play a crucial part for

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having and enjoying health (Chapman, Armitage, & Norman, 2009).

5.1.1. Self-regulation and self-regulatory strategies (SRS)

Holding on to a healthy diet is a difficult task, as children and adolescents are exposed to an obesogenic environment where sweets and junk food are easily available everywhere. As a result, youngsters have to develop efficient strategies in order to deal with these unhealthy food temptations. These skills of refraining from "falling into temptation" while trying to reach a self-set goal (i.e. healthy eating) make the very core of self-regulation (Vohs & Baumeister, 2004).

In spite of differences in the literature regarding the number or the level of abstraction (see for example Abraham, Michie, Whittington, & McAteer, 2008; Maes & Karoly, 2005) of these self-regulation strategies, there is an agreement, however, regarding a major distinction between processes related to goal setting and those involved in active goal striving (e.g. Gollwitzer, 1990; Mischel, Cantor, & Feldman, 1996).. Fisbach and Converse (2011) differentiate between strategies used for goal attainment and strategies aimed at decreasing the influence of temptations that may compete with a goal. In this respect, there is a considerable amount of work dedicated to studying 'cooling down' strategies, by making temptations less appealing and 'heating up' goals, that is making goals more important (Metcalfe & Mischel, 1999). Also, there is evidence to support that adolescents persist more on an academic task when using mental contrasting (conjoint mental elaboration of the desired future and the present reality) and implementation intentions, both strategies in the service of goal attainment (Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011). This broad distinction of goal-focused and temptation-focused approaches can be further broken down into either behavioral action (towards the goal or the temptation) or changing the psychological meaning (of the goal or the temptation) (Fishbach & Converse, 2011).

5.1.2. Gender differences in food worry and in the self-regulation of eating

Regarding healthy eating habits, girls seem to better self-regulate as compared to boys (Kochanska, Coy, & Murray, 2001; Stifter & Spinrad, 2002). Thus, they are more likely than boys to report avoiding high-fat foods, eating fruit and fiber, and limiting salt. They also are more likely to diet and attach greater importance to healthy eating (Wardle & Cooke, 2005; Wardle et al., 2004). The factors that account for these gender differences are numerous. Girls experience more food-related conflict than boys, in that they like fattening foods but believe they should not eat them. Media images contribute to this 'food guilt', as they emphasize the importance of slimness even in

early adolescence. Nonetheless, it has become common knowledge that girls experience more dissatisfaction with their body weight and shape than boys do (Rolls, Fedoroff, & Guthrie, 1991). Indeed, one of the numerous studies on the topic showed that gender differences in weight related worries are evident even in the 11-years old population and significantly increase by mid-adolescence (Sweeting, & West, 2002).

Although there is substantial evidence linking food preoccupation and diet in particular and eating-related behaviors in adolescents, there is also a controversial if and when these concerns are counterproductive in terms of health benefits In the present research, we linked food worry with adaptive self-regulation approaches (for instance, items subsumed under action towards temptation refer to unhealthy temptations such as sweets, high-calorie foods) and to the habit of unhealthy snaking. Thus, in this context, food worry was assumed as having a functional, adaptive role.

5.1.3. Aims of the present research

The present study explores the relationship between eating self-regulatory approaches (SRA) and eating habits (unhealthy snacking), as well as the role of gender and food worry in this relationship, in a sample of preadolescents and adolescents. The main question is whether a worry-SRA-snacking relation exists, and if so, what role does gender play. We hypothesised that food worry acts as a precursor of SRA which, in turn, influences snaking patterns. Also, we expect that this relationship is gender-specific, with girls being more likely to use SRS in order to regulate snaking. Thus, this gender difference in the use of SRS could further account potential differences in patterns of unhealthy snaking. To our knowledge, there is no prior study that addresses the sequential chain worry-SRA-snaking and the potential role of gender. Also, this is the first study that systematically investigates self-regulation strategies in relation to behavioral outcomes (snaking) in adolescents, by using a recently validated instrument aimed to address the lack of tailored self-regulation instruments for this specific population.

5.2. METHOD

5.2.1. Participants

A total of 1500 children and adolescents took part in the study, with ages ranging between 10 and 17 years old (M = 13.62, SD = 2.13), out of which 50.8% were girls. Participants were recruited from 14 schools and 76 classes coming from 3 towns and 3 rural areas situated in the North-Western part of the country. These were selected on a quasi-random basis, so as to cover both rural

and urban, as well as high and low socio-economic areas. The approval for conducting the study was obtained from the school inspectorate as well as from parents. The participants filled in measures of SC, eating SRC and eating habits during their class hours. The average BMI was 19, *SD* = 0.3.

5.2.2. Instruments

For measuring *eating self-regulatory strategies,* the TESQ-E (Tempest Self-Regulation Questionnaire for Eating) (de Vet et al., 2012) was filled out by the participants (see Study 1 for psychometric data).

Food worry was assessed by using 7 items from the Food Worry Questionnaire (Rozin, Bauer, & Catanese, 2003) which assesses attitudes and behaviors towards foods as well as possible concerns regarding health and diet. The questions included three frequency measures on a 5-point Likert scale (e.g." I am concerned about being overweight" *1- strongly disagree 5-strongly agree*) and four forced-choice answers between two alternatives (e.g. free association between the item "food" with either "health" or "pleasure") tapping on "default ways of thinking" about food-related issues (Rozin et al., 2003).

Finally, *unhealthy snacking*, was tested with one item "How many snacks do you eat on an average day? You can count as one snack the following: one handful of munchies, whine gums, biscuits, cookies, a cake or a candy".

5.2.3. Analytic strategy

SPSS 17 was used in order to analyze the data. The main analyses were based on procedures recommended by Preacher, Rucher and Hayes (2007) and by using the MODMED macro (Version 1.1; Model 3). We tested three separated moderated mediator models with food worry as an independent variable, self-regulation approaches (action towards temptation, changing the psychological meaning of temptation and action towards goal) as mediators and unhealthy snaking as a dependent variable. We considered gender as a moderator of the relationship between SRA and unhealthy snaking.

5.3. RESULTS

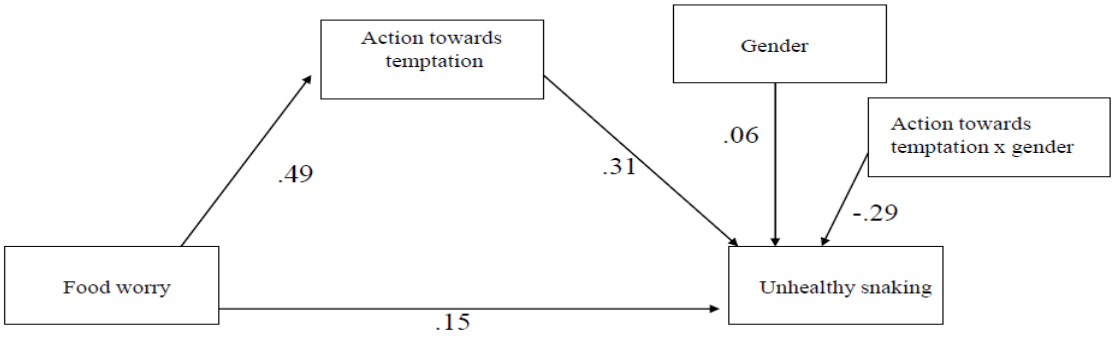
Table 1 provides the descriptive statistics for the three SRA, unhealthy snaking as well as for the food worry items.

Table 1. Descriptive statistics (means, standard deviations and intercorelations for the self-regulation approaches, food worry and snaking

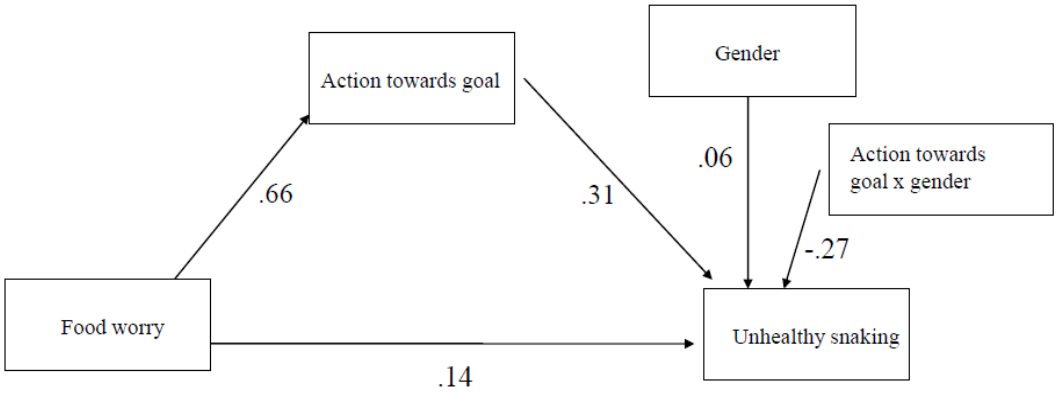
	Action towards temptation	Changing the psychological meaning of the temptation	Action towards goal	Food worry	Unhealthy snaking (portions/day)
Means (SD)	2.38 (.89)	2.28 (.92)	2.57 (.89)	2.85 (.98)	2.40 (1.41)
Action towards temptation	-	.75	.73	.34	-.30
Changing the psychological meaning of the temptation		-	.75	.40	-.25
Action towards goal			-	.44	-.23
Food worry				-	-.19
Unhealthy snaking (portions/day)					-

Note: **p* < .05, ***p* < .01.

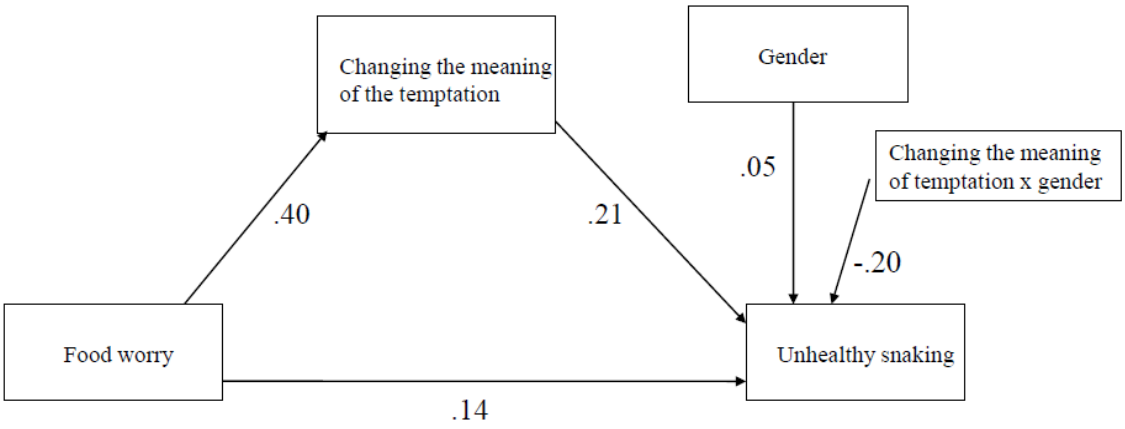
In Figures 1-3 one can notice that the relationship between worry and the use of SRA is very robust, with coefficients ranging from .40 to .66, *t*'s between 5.58 and 8.44, all significant at $p < .001$. In comparison, the relationship between the use of SRA and unhealthy snacking is still significant, although more modest with all coefficients ranging from.21-.31, *t*'s ranging from 1.08 to 1.98, *p*'s < .05. As predicted, the interaction between gender and the three SRA (action towards goal, action towards temptation and changing the meaning of temptation) were significant with all t's > |3.11|, *p*'s < .002 (see Figure1).



Panel A



Panel B.



Panel C

Figure 1. Moderated mediation model with gender as a moderator of the relationship between food worry and unhealthy snacking and action towards temptation (A), action towards goal (B) and changing the meaning of temptation (C) as mediators.

In-depth analysis of the joint effects of SRA and gender on snaking, based on the hierarchical

regression analysis with centered predictors and their product term revealed, as expected, that the relationship between SRA and snaking is stronger for girls than for boys (all indirect effects for girls > -.07, *p*'s < .001; all indirect effects for boys < .02, *p*'s > .46). Figure 4 illustrates this relationship, with the interaction between action towards temptation x gender as an example (the direction of the other two interactions is identical). Simple slope computation reveals that the interactive effect of action towards temptation and gender was significantly different from zero for girls, $t(1360) = -5.56$, $p < .001$, but not for boys, $t(1360) = -.88$, *ns*. As Figure 4 shows the use of SRA (here action towards temptation) has a stronger linear relation with reduced unhealthy snaking in girls rather than in boys. Also, additional independent sample *t*-tests reveal that there is a significant gender difference in the use of all three SRA, all *t*'s (1370) < -3.85, *p*'s < .001, with girls having higher scores on action towards goal ($M_{girls} = 2.71$, $SD = .88$ versus $M_{boys} = 2.43$, $SD = .89$), action towards temptation ($M_{girls} = 2.48$, $SD = .88$ versus $M_{boys} = 2.29$, $SD = .89$) and changing the meaning of the temptation ($M_{girls} = 2.38$, $SD = .91$ versus $M_{boys} = 2.18$, $SD = .91$).

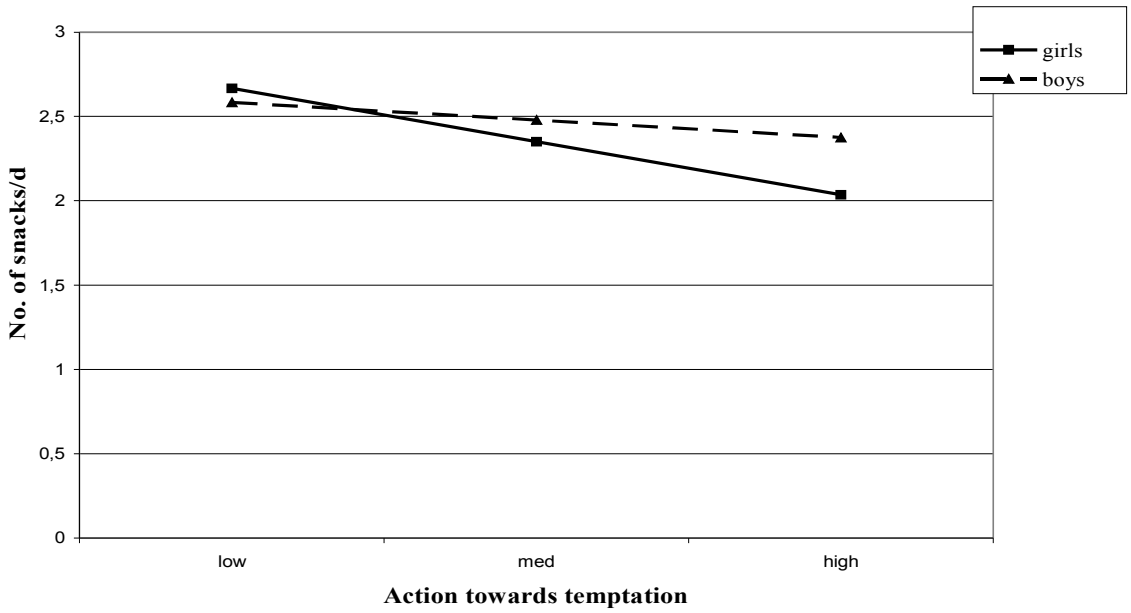


Figure 2. Joint effect of action towards temptation and gender on unhealthy snacking

5.4. DISCUSSION

The present study has examined the relationships between food-related worry, self-regulation

approaches – action towards goal, action towards temptation and changing the meaning of the temptation- and unhealthy snaking and gender. The results show that, as expected, SRA partially mediate the relationship between worry and unhealthy snaking, suggesting that adolescents try to regulate their snack intake as a result of a real food-related preoccupation. This finding is intuitive and has a strong empirical support: there is no self-regulation in the absence of a specific goal or concern which could make the object of self-regulation attempts (De Ridder, & de Wit, 2006; Carver & Scheier, 1998; Rasmussen, Wrosch, Scheier, & Carver, 2006).

However, interestingly, gender is the factor that influences self-regulation efforts in reaching the desired goal (controlling unhealthy snaking) in individuals who worry about their food intake. This means that girls, rather than boys, display a stronger relationship between SRA- reduced unhealthy snaking, and seem more likely to actively try to use actions towards goals and towards temptation. They are also better at controlling temptations than boys are. This relationship holds true for all three SRA investigated (action towards goal, action towards temptation, changing the meaning of temptation), which suggests a robust effect. The present results indirectly support previous literature, showing that girls seem to be more active users of both maladaptive strategies in order to control weight such as vomiting, using pills, fasting (Currie et al., 2012; Mackey, & LaGreca, 2007), as well as more adaptive ones like reducing portion sizes or skipping unhealthy snacks (in the present study). However, for other types of behaviors, which are culturally ascribed to men rather than to women (e.g. exercising) the aforementioned relationship might prove stronger for boys than for girls (Lewinsohn, Seeley, Moerk, & Striegel-Moore, 2002).

One limitation of the study refers to the employment of a cross-sectional study design. Thus, the present results should be interpreted with caution as no temporal relationship between worry-SRA-snaking can be established for sure. Longitudinal studies could further explore the temporal sequence of the mechanisms that lead to healthy or unhealthy eating. Also, it would be interesting to assess whether different self-regulatory strategies are more predictive for different types of behavior.

All in all, the present study is the first to systematically investigate the interplay between adaptive worry, different SRA and self-reported unhealthy snaking. Results indicate that worry plays an important role in 'activating' self-regulatory mechanisms, which, in turn, are more or less efficient or connected to the actual behavior, as a function of gender. The robust effects, displayed across SRA converge to the idea that interventions should be gender-specific and should aim to strengthen the implementation of self-regulation strategies in order to adopt healthy eating habits

and refrain from unhealthy ones.

CHAPTER 6. Emotion, emotion regulation strategies and food intake

6.1. INTRODUCTION

The relationship between emotional experiences and eating has been extensively researched over the years. Given the variability of results, it remains difficult to predict how emotions will affect eating in a specific group of persons (Greeno & Wing, 1994). For instance, emotions can increase food intake in one group of persons, e.g. restrained eaters (those who chronically control food intake in order to loose or maintain weight), but decrease food intake in another group, e.g. non-restrained eaters (Herman & Polivy, 1975). Most people, when stressed, seem to loose their appetite, but there is also common knowledge that other people eat more when feeling sad or anxious (Rutledge & Linden, 1998).

Different mechanisms have been advanced as possible explanations for the relationship between negative emotions and overeating. One of the most well-known explanation came with the empirical observation that certain types of distress (e.g., ego threat) are more effective in inducing eating disinhibition than others (e.g., physical threat) (Heatherton & Baumeister, 1991; Heatherton, Herman, & Polivy, 1991; Herman & Polivy, 2004). Thus, restrained (but also some non-restrained eaters) will eat more when facing negative emotions arose from social stress situations, as an attempt to escape negative-self awareness (Wallis & Hetherington, 2004). The mechanisms behind this observed phenomenon are detailed in the next section.

6.1.1. Self-regulation and self-monitoring of food intake in social stress situations

The role of social stressors in relation to eating behaviors is a relatively new research avenue, though a significant body of research links adaptive interpersonal functioning with health and maladaptive social circumstances with disease and premature mortality (Salovey, 2000). Thus, certain types of distress (e.g., social stress) seem to be more effective in inducing eating disinhibition than others (e.g., physical threat) (Herman & Polivy, 2004). These results have been accounted by the Escape Theory (Heatherton & Baumeister, 1991), which proposes that especially ego threatening stressors shift attention from the negative self-awareness to the immediate environment. Wallis and Hetherington (2004) found that restraint and emotional eaters tended to eat

more chocolate in response to an ego threatening Stroop colour-naming task, in comparison to the control group. Similarly, anticipation of giving a speech in front of an audience or failure at an easy task (ego-threat) significantly increased restrained subjects' eating, whereas anticipation of a physical threat (electric shock) did not hold the same effects (Heatherton, Herman, & Polivy, 1991). Baumeister, DeWall, Ciarrocco and Twenge (2005) reported the similar results also for non-restrained eaters: participants who were socially excluded (they were told that no other peer wanted to work with them) ate more cookies than those who were told that their confederates chose to work with them (Experiment 2). The effect was explained as a proof that social exclusion leads to ego-depletion, "a state in which the self does not have all the resources it has normally" and which leaves the self less able or willing to function optimally (Baumeister & Vohs, 2007, pag 2).

One type of "regulation costs", identified in the literature refer to the negative role of distress on self-monitoring (Royal & Kurtz, 2008). Viewed from this perspective, a regulatory depletion effect can occur because depleted individuals suspend the monitoring process of the standard for comparison and focus more on the unfolding concurrent task. As a result, depleted individuals exhibit poorer performance on the subsequent tasks compared with non-depleted individuals who maintain the monitoring (Wan & Sternthal, 2008). Royal and Kurtz (2010) showed that high-emotional eaters in high-stress situations overestimated how much they ate during the experiment relative to those in the low-stress condition.

Much of the literature devoted to the relationship between emotions and eating, indirectly accounts overeating to failure in finding adequate ways to manage negative emotions. This suggests that there may be a third factor – namely the way individuals regulate their negative emotions- that may account for the depletion effects and the observed over-eating (Evers, Stok, & de Ridder, 2010)

Following this argument, our perspective shifts from focusing on acute emotions as a cause of overeating, to looking at the way people regulate their negative emotions as a more plausible pathway to eating behavior, as shown in the next section.

6.1.2. Emotion regulation and food intake

Emotion regulation (ER) encompasses efforts through which people alter the experience and/or expressions of their emotions (Gross & Thompson, 2007). Conceptually, two different forms of emotions regulations strategies can be distinguished: cognitive reappraisal and expressive suppression (Gross & John, 2003). Reappraisal is predominantly an antecedent strategy since it encompasses an evaluation of the meaning of the situation in order to change the emotional impact when the situation occurs. In contrast, suppression is a response strategy since it entails the

suppression of behaviors that are associated with the emotional response during the emotion-triggering situation. The two strategies appear to differ in the required amount of self-regulatory resources. In particular, cognitive reappraisal seems to alter the primary appraisals of emotional stimuli without the need of sustained self-regulatory effort over time (Gross & Levenson, 1993; Richards & Gross, 2006). Conversely, behavioral suppression involves active efforts to inhibit predominant responses, leading to comparably greater "resource depletion" than reappraisal (Baumeister, 2003).

Accordingly, not the fact that people experience negative emotions, but rather the way how they cope with it, may determine the impact on eating behavior (Evers et al., 2010). Specifically, the more 'costly' emotion regulation in terms of consuming self-regulatory resources is, the more people might be vulnerable to increased food consumption as a secondary regulation strategy. In line with this assumption, Vohs and Heathertorn (2000) showed that dieters consumed more food after they were instructed to suppress their emotions compared to those who were told to express their emotions freely. Conversely, Mischel (1996) showed that reappraisal decreases immediate food consumption within children. Recently, Evers et al (2010) tested the impact of both regulation strategies within a forced food consumption situation. In line with the resource depletion notion, they found that suppression was associated with a significant higher amount of comfort food intake in comparison to reappraisal (Study 3). Interestingly, whereas suppression appeared to be clearly maladaptive, reappraisal did not enfold an additional protective influence, as compared to non-guided emotion regulation.

6.1.3. Overview of the present studies

The present studies aim to systematically investigate the role of fear and negative affect and ER on food intake. The first study focuses on disentangling the relationships between non ego-threatening negative emotions (arose from watching distressing movies) and food intake. We also argue that a forced consumption setting such as a taste test paradigm, which requires participants to eat different food items in order to evaluate taste and structure as well as describe their perception of the food, may not comprehensively reflect the impact of emotion regulation on food intake. If the primary regulation strategy- reappraisal- is successful, people might not be tempted to eat in the first place. However, if people are forced to eat, the advantage of reappraisal might be diminished. We expect that the natural coping sequence is such that when confronted with a negative stimulus that induces negative affect, people try to regulate it. If they use an effective (or adaptive) emotion regulation, the likelihood that they will need to use eating as a secondary emotion regulation

strategy is comparably low. Moreover, in real-life situations, we rarely get the chance to first reappraise a negative event before we are actually confronted with it, as in laboratory settings where participants first receive instructions to reappraise an emotional event and only confront it afterwards. In order to test the theoretically assumed sequence (1) negative stimulus, (2) negative affect, (3) emotion regulation (ER), (4) secondary coping response (eating yes/no)) in a more ecologically valid way, ER instructions need to be given after the negative event has started to unfold. We employed this sequence in Study 1 in order to test the theoretically assumed sequence of events in a more ecologically valid manner.

The second study, takes a step forward and examines whether the same emotions rose from ego-threatening situations (a public examination) have an effect on food intake as well as on other outcomes such as deployment of effective SR (in particular monitoring as a SR strategy) and on subjective assessments of physiological states (hunger).

We also aim to investigate the potential mechanisms trough which emotion and ER influence food intake, across the two studies. Specifically, we assume that reappraisal and suppression might influence eating via two potential routes: either the 'emotional one' (e.g. Heilman et. al., 2010) referring to differences of ER in alleviating negative or positive emotions (Gross, 2002) or the "cognitive route", which refers to different levels of effort –cognitive load and ego depletion- required in elicitation of suppression versus reappraisal. Thus, the research not only point to if ER alter the impact of negative emotions on food intake but also to how they intervene in this relationship between negative emotions and eating.

6.2. Study 4. Reappraise the situation but express your emotions: Impact of emotion regulation strategies on ad libitum food intake

6.2.1. The Present Study

The present study investigates comparatively the effect of ER on food intake, in a laboratory study. In order to examine the impact of negative emotions and emotion regulation strategies on food intake, participants were exposed to comfort food (chocolate and crisps) while watching a fear-inducing movie. We expect that reappraisal is more adaptive than suppression or non-guided emotion regulation (control condition) resulting in a decreased likelihood of eating in the first place. Hence, participants enacting suppression as ER should be more likely to eat and they should

consume a greater amount of food as compared to reappraisors. We also wanted to see whether ER potentially different effects on eating are more related to "emotional route", as described in the previous section, or to the "cognitive" one. We expect that reappraisal lead to less food intake compared to suppression and no instruction condition, by alleviating more effectively the negative emotion (fear) and thus influencing food intake via the emotional route.

In order to examine the impact of negative emotions and emotion regulation strategies on eating, participants were exposed to two types of comfort food (salty and sweet) after watching a fear-inducing movie. The present study aims were threefold.

First, extending previous research by using a "non-forced" food consumption paradigm, it was tested whether people use eating as a secondary coping strategy when ER is ineffective. Assuming that suppression is a maladaptive ER whereas reappraisal is an adaptive ER, suppression in comparison to reappraisal should lead to an increase in the likelihood of eating.

Second, the non-forced eating setting allows for a clearer pinpointing of the effect of maladaptive ER by providing a distinction between the occurrence of eating (yes/no) and the amount of food consumed as a coping response. Hence, we propose that participants enacting suppression as ER are more likely to eat. According to previous research, suppression should also lead to a greater amount of food consumption as compared to reappraisal.

Third, in order to produce a more ecologically valid experimental setting, the ER instructions were given after the negative event had started to unfold. To our knowledge, this is the first study that employs this procedure in relation to a behavioral outcome.

6.2.2. METHOD

6.2.2.1. Participants

Undergraduate students from Babes-Bolyai University (N=165, 153 women), aged 19-48 years old (M = 22.96, SD = 5.44), took part in the study. All participants were of a normal weight range (BMI < 30) with an average BMI of 20.79, SD = 2.84. The mean level of the DEBQ scales (Van Strien et al., 1986), restrained eating (M = 2.89, SD = 1.07), emotional eating (M = 2.03, SD = .89), and external eating (M = 2.92 , SD = .70), were within the normal range. Participants were randomly assigned to one of the three experimental groups defined by ER strategy instruction: cognitive reappraisal (n = 58), suppression (n = 60), or no ER instruction (n = 48).

The experiment was approved by the Ethical Board of Babes-Bolyai University. Also, all participants were informed about the procedures and gave informed consent prior to the experiment.

6.2.2.2. Materials and procedure

Participants were informed that the study would investigate the effectiveness of different ER strategies in alleviating negative emotions. In order to ensure reasonably standardized levels of satiety, they were asked to refrain from eating 3 hours prior to the experiment, which is a low deprivation level (cf., Schupp and Renner, 2011). Upon their arrival (T1), participants filled in the General Negative Affect (NA) and Fear scales from the PANAS-X (Watson and Clark, 1999) as a baseline measure of emotion. Moreover, dietary restraint and the tendency to eat more when cognitive restraint of eating is disrupted by psychological, sensory, or emotional challenges were assessed with the Restraint, Emotional, and External Eating scales from the DEBQ (Van Strien et al., 1986). Each participant received two bowls: one filled with potato chips and one with chocolate. Each bowl was filled with 125 grams of the respective snack. Participants were told that the food represented an incentive for participation in the study and they were encouraged to feel free to help themselves. The food bowls were presented unobtrusively at the beginning of the procedure in order not to raise suspicions about the real purpose of the experiment. It is important to note that none of the participants ate either the chips or the chocolate while watching the movie clips (during this time the experimenter was present in the room). Thus, the unobtrusive introduction of palpable food was successful because no participant ate before the ER instruction and none of them articulated suspicion about the purpose of the food manipulation.

In a first phase, a 4-minutes movie clip from 'Silence of the Lambs' (Demme, 1991) was shown to reliably elicit fear (Gross and Levenson, 1995) without ER instruction. This allowed participants to become familiar with the experimental setting while ensuring a comparable 'emotional baseline' with a more ecologically valid experimental setting.

After watching the first clip, participants were given instructions for emotion regulation, following Richards and Gross (2000) standard scripts. They were then informed that they would be shown another movie and instructed to either suppress or reappraise the emotions experienced while watching the clip. The control group, however, received no instruction prior to watching the movie clip. The second clip was a 3'30'' minute scene from 'Dancer in the Dark' (2000) (Windeløv and Von Trier, 2000) that depicted a violent execution excerpt, shown to reliably elicit high levels of fear in a separate pilot-test (N = 10). Following the second movie clip, the experimenter left the room and participants filled-in the post-questionnaires (T2) including the subscales of the PANAS-X, a translated version of the Emotional Regulation Questionnaire (ERQ; Gross and John, 2003), in

order to assess enacted emotions regulation strategies, measurements of hunger, and demographic data (gender, age, height, and weight). The items from the ERQ were adapted for the purpose of the present study and participants were instructed to assess the extent to which they used suppression and/or reappraisal while watching the second movie clip. Participants were left alone with the food for about 20 to 25 minutes, interval in which they had to fill in the post-questionnaires. None of them left the room earlier,

The food bowls were weighed at both the beginning and the end of the experiment. An index of food intake (for both food categories) was created by subtracting the final weight from the initial. For ease of interpretation, all subsequent analyses report food intake in grams (raw scores). Results are reported separately for the two types of food and the total food consumption (sum score) because preferences for sweet and salty food may differ across participants when in an emotional state (cf., Van Strien, 2010) or for differences in caloric value.

6.2.3. RESULTS

6.2.3.1. Manipulation check: Induced negative emotion

Experienced fear and negative affect were subject to a 3 (ER instruction condition: suppression, reappraisal, control) x 2 (time: before vs. after movie clip) ANOVA, with time as a within-subject variable. The main effect of time was significant, indicating that both fear, $F(1, 156) = 1.50$, $p < .001$, $\eta p^2 = .90$, and negative affect , $F(1, 156) = 99.43$, $p < .001$, $\eta p^2 = .38$, increased after watching the movie (Fear: $M_{before} = 7.18$, $SD = 2.39$; $M_{after} = 9.31$; $SD = 3.95$; Negative affect: $M_{before} = 12.80$, $SD = 4.06$. $M_{after} = 17.57$; $SD = 6.61$). Neither the main effect for condition, nor the interaction between time and condition were statistically significant, all *F's* < .73, *p's* < .76, for fear and negative emotions, respectively. Thus, the manipulation was equally successful in inducing a heightened negative emotional state in all three conditions and a comparable negative emotional state was observed across the three emotion regulation instruction groups at T2, see also Figure 1, left panel (A).

Also, no ER instruction condition differences in self-reported hunger $F(2, 162) = .53$, $p = .58$ ($M = 2.94$, $SD = 1.61$) or in habitual restrained, emotional, or external eating behavior, all $F(2,154) < 1.3$, all *p's* < .28, were observed.

6.2.3.2. Manipulation check: Enacted emotion regulation strategies

Enacted ER strategies (suppression, reappraisal) reported after watching the movie clip were

analyzed using a MANOVA with a 3-level between subjects factor (ER instruction condition: control, suppression, reappraisal). The multivariate effect for enacted ER strategies was significant with $F(4, 318) = 4.10$, $p < .003$, $\eta p^2 = .04$. The three conditions differed in the extent to which they used both suppression, $F(2, 318) = 4.61$, $p < .01$, $\eta p^2 = .05$ and reappraisal, $F(2, 318) = 4.51$, $p < .01$, $\eta p^2 = .05$, in order to control their emotional experiences. Bonferroni contrast analyses effects showed that participants in the reappraisal group used cognitive reappraisal more than those in the control group ($p < .05$) but to the same extent as those in the suppression group (ns.). Conversely, participants in the suppression group used expressive suppression to a larger extend than the reappraisal and the control group (p's $< .05$), suggesting that the experimental manipulation was effective.

6.2.3.3. Eating vs. non-eating: Impact of emotions and emotion regulation

Overall, 100 out of 165 participants (61%) ate crisps, chocolate, or both, whereas 65 participants (39%) did not eat from the offered food samples. No difference between crisps and chocolate consumption was found: 22 participants (13%) ate only crisps, 22 participants (13%) ate only chocolate and 55 participants (33%) ate both.

To examine whether the amount of negative emotion experienced predicted whether participants ate or not, two separate logistic regression analyses were conducted with fear and negative affect scores (at T2) as predictors of eating status (eating vs. non-eating). The results show that neither fear, nor negative affect at T2 predicted eating vs. non-eating. This holds true for total food, $\beta = -.02$, $p > .35$, sweet snacks (chocolate), $\beta = -.02$, $p > .28$, and salty snacks (crisps), $\beta = -.03$, $p > .17$, respectively. Likewise, changes in fear and negative affect (T1-T2) did not predict eating versus non-eating, all β's $< .06$, p's $> .10$, for total food, chocolate, and crisps.

In order to test the effect of the different emotion regulation instruction on eating (eating vs. non-eating), a chi square test of independence was performed yielding a significant effect for the emotion regulation condition with χ^2 (2, N =165) = 25.56, $p < .001$. As Figure 1 (Panel B) shows, 75% of the participants in the suppression condition and 74.5% in the control condition started to eat. Conversely, only 34.5% of the reappraisal condition ate from the sweet and salty snacks. A similar pattern of result was also found for the sweet snacks (χ^2 (2, N =165) = 18.25, $p < .001$) and for the salty snacks (χ^2 (2, N =165) = 12.07, $p = .002$).

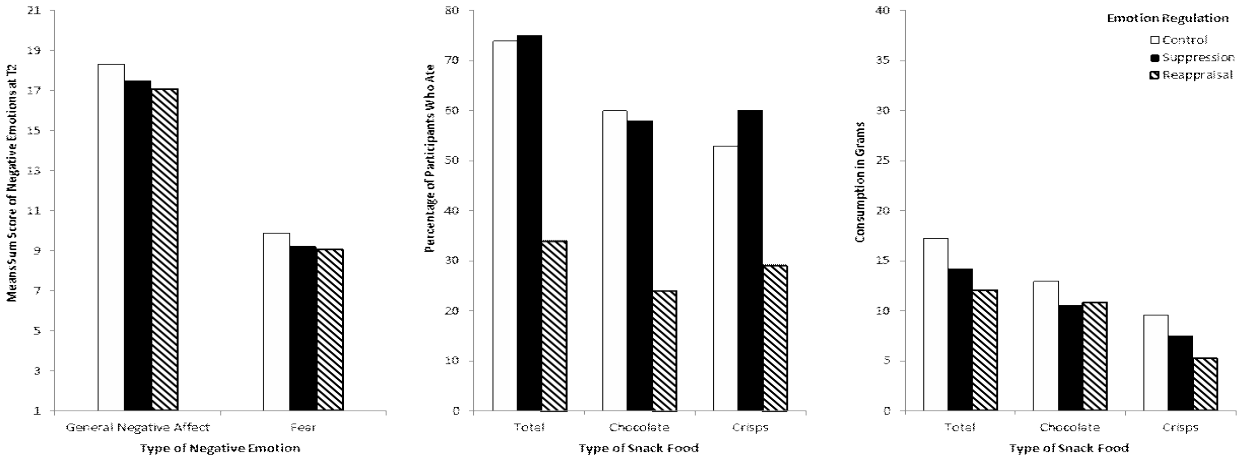


Figure 1. (A) Negative emotions (T2, N = 165), (B) percentage of participants who ate (N = 165), (C) amount of food consumed (for participants who ate) in the emotion regulation condition.

6.2.3.3.1. Control analyses

In order to ensure the reliability of the present results, additional control analyses were conducted. In a first step, it was tested whether the observed effect of the emotion regulation instruction condition was due to differences in the habitual eating patterns. Therefore, a logistic regression analysis was conducted with the dichotomous dependent variable 'eating status' (eating vs. non-eating) and 'ER instruction condition' (suppression, reappraisal, control) and the three habitual eating scales (DEBQ-Restraint, DEBQ-Emotional, and DEBQ-External Eating) as predictors. Again, 'ER instruction condition' was a significant predictor ($\beta < -.88$, $p < .001$), whereas none of the three habitual eating patterns were statistically significant, all β's < -.02, p's > .55. Thus, habitual eating such as restrained eating, emotional eating, or external eating did not predict who started to eat or who refrained from eating.

In a second step, the impact of the self-reported amount of emotion regulation was tested. A logistic regression was conducted with eating status (eating vs. non-eating) as the dependent variable and 'ER instruction condition' (suppression, reappraisal, control), 'self-reported suppression', and 'self-reported reappraisal' as predictors. Replicating previously reported results, the logistic regression yielded a significant effect for the 'ER instruction condition' with ($\beta < -.89$, $p < .001$). However, the self-reported amount of suppression and reappraisal did not contribute to explaining additional variance, all β's < -.07, p's > .12.

6.2.3.4. Amount of food intake: Impact of emotions and emotion regulation

In subsequent analyses, the amount of food consumed was examined. In line with previous research, the amount of consumed food was analyzed across all participants, irrespective of whether they ate or not. Again, a significant main effect of the factor 'ER instruction condition' (suppression, reappraisal, control) was found for all three different food amount scores: total food $F(2, 162) = 5.24$, $p < .001$, chocolate, $F(2, 162) = 3.10$, $p < .05$, and crisps $F(2, 162) = 4.59$, $p < .01$. As Bonferroni post-hoc analyses showed, reappraisers ate significantly less food in total ($M = 4.13$, $SD = 9.06$) and less crisps ($M = 1.53$, $SD = 3.15$ than either the suppressors (total amount: $M = 10.56$, $SD = 12.31$; crisps: $M = 4.48$, $SD = 6.25$) or the control group (total amount: ($M = 12.84$, $SD = 21.31$; crisps: $M = 5.12$, $SD = 9.60$), p's $< .05$. Moreover, they ate less chocolate ($M = 2.60$, $SD = 7.65$) as compared to the control group ($M = 6.16$, $SD = 9.48$), $p = .05$.

Extending previous research, the impact of emotions and regulation strategies on the amount of food intake in grams was analyzed for participants who began to eat each respective food item (see also Figure 1, Panel C). In contrast to previous research, participants were free to eat or not to eat in the present ad libitum food setting. Thus, analyzing only participants ($n = 100$) who actually began to eat provides more precise information about the actual amount of consumption.

In a first step, multiple regressions analyses were conducted to examine the impact of General Negative Affect and fear (at T2) on the amount of consumed food (crisps, chocolate, total food). The results show that neither General Negative Affect (T2) nor fear (T2) predicted the amount of food intake, with all β's $< |.69|$, p's $> .13$ for total food, chocolate, and crisps. Likewise, neither changes in General Negative Affect from T1 to T2 nor changes in fear predicted the total food, chocolate, or crisps intake, with all β's $< |.48|$, p's $> .22$.

In a second step, the impact of emotion regulation instruction on food intake was examined. Three ANOVAs with the dependent variable observed amount of food intake in grams and the three-level factor 'ER instruction condition' (suppression, reappraisal, control) were conducted. No significant effect for the factor 'emotion regulation instruction condition' emerged: total food intake, $F(2, 97) = .679$, $p = .509$; chocolate $F(2, 74) = .25$, $p = .77$; crisps $F(2, 75) = 1.52$, $p = .22$. Thus, given that participants began to eat, they consumed a comparable amount of food irrespective of the ER instruction condition or the type of available comfort food.

6.2.3.4.1. Control analyses

Additional ANCOVAs were conducted as control analyses with the three different measures

of the amount of food intake (total, chocolate, crisps) as dependent variables, respectively, and the between subjects factor 'ER instruction condition' (suppression, reappraisal, control). Using the three different habitual eating patterns as additional covariates yielded a virtually unchanged pattern of results: with a non-significant factor 'ER instruction condition', total food intake measured $F(2, 76) = .79$, $p = .45$; chocolate, $F(2, 56) = .32$, $p = .54$; crisps, $F(2,57) = .87$, $p = .42$; and the non-significant effects for the three covariates with all t's, < 1.50, p's $> .14$. Similarly, the self-reported amount of emotion regulation, as well as age, gender, or BMI as covariates were statistically non-significant.

6.2.4. DISCUSSION

With the present study, we extended previous research by allowing participants to choose not only how much they wanted to eat but also whether they wanted to eat at all (ad libitum food intake).. Also, this study is the first to investigate whether there are differences in the effectiveness between the two emotion regulation strategies (suppression, reappraisal) when they are employed at the same point in the unfolding of the emotional response. Focusing on the question 'Who began to eat?', the present results clearly show that participants in the reappraisal group were less likely to eat both chocolate and crisps, compared to the control and suppression groups. Among the reappraisal group, only 1/3 started to eat, whereas 3/4 among the suppression group and 3/4 among the control group started to eat. Thus, reappraising but expressing negative emotions seems to be a highly effective regulation strategy; whereas, suppression appears to be rather ineffective.

Consequently, across the total sample, including both participants who started to eat and those who did not, the amount of consumed food differed greatly independent of the emotion regulation condition. Within the reappraisal group, the amount of consumed food was on average significantly lower than in the suppression or control groups. On average, reappraisers ate 61% less than suppressors and 68% less than the control group. These results are consistent with findings from related studies suggesting that reappraisal, in comparison to suppression, is associated with reduced food intake in women (e.g., Evers et al., 2010) and a reduced desire to binge in women with binge eating disorder (Svaldi, Caffier, and Tuschen-Caffier, 2010).

However, a greatly different picture emerged when the impact of emotion regulation strategies on the amount of consumed food was analyzed for participants who actually ate from the respective food item. The present results show that reappraisers ate as much as participants in the suppression group or in the control group once they had begun to eat. Thus, the main difference between the

three emotion regulation conditions seems to be whether eating is employed as a secondary regulation strategy at all rather than the amount of food needed for secondary regulation as suggested in previous research (e.g., Evers et al., 2010).

Unexpectedly, reappraisers didn't show signs of decreased fear or general negative affect compared to the suppressors or the control group. Thus, the "emotional route" hypothesis is mostly improbable, as the experience of emotion remained unaltered in all three groups, irrespective of the ER strategy used. One possible explanation comes from recent studies (e.g. Sheppes, & Gross, 2011; Sheppes, Scheibe, Suri, & Gross, 2011) that put forward an interesting idea: ER efficiency depends not only on process specific timing, but also on the intensity of emotion. At higher levels of emotional intensity, the differences in effectiveness between the two ER are blurred. By using ER only for the second movie clip allowed for an intensification of negative emotions in all conditions, so reappraisal, employed relatively late in the emotion iterative phase was weakened by allocating more cognitive resources aimed to manage the already unfolding emotion. Tentative to regulate fear came costly for both suppressors and reappraisors.

This leads us to a second possible mechanism that would account for differences in food intake across conditions, namely the "cognitive" route. Though it was hard to modify high-intensity emotional information, factors that strengthen the process of reappraisal (e.g. fewer cognitive resources dedicated for managing emotional information compared to suppression) probably lead to increased control of food intake. Accordingly, the explanation for this result might be based on an ego depletion effect (Muraven & Baumeister, 2000): individuals in the suppression and control groups recruited increased cognitive control resources for managing emotions- equally ineffective- but which depleted subsequent self-regulatory resources.

Hence, the results suggest that the advantage of reappraisal is that people have the same emotional outcome (increase in negative affect) but with less reliance on maladaptive secondary regulation strategies such as eating, compared to suppressors or the control group. Therefore, the total 'net profit' is more favorable for reappraisal than for suppression or spontaneous emotions regulation since less reliance on secondary maladaptive coping is required in order to arrive at the same emotional outcome.

In the present study, the control group, which received no emotion regulation instruction, behaved in a highly similar way to the suppression group. Both groups were more likely to eat than the reappraisal group. Consequently, both groups consumed more food when all participants, irrespective of their eating status (eating vs. non-eating), were included in the analyses. .

6.3. Study 5. Feeding anxiety? Emotion regulation strategies predict self-monitoring of food and food intake in a social stressful situation

6.3.1. Aims of the Present Study

The present study investigates the impact of negative emotions and ER strategies on food consumption, adjacent hunger and self-monitoring of food intake, using a social stress paradigm (Trier Social Stress Test). We hypothesize that the suppression of negative emotions during a bogus interview has higher cognitive 'costs' in comparison to reappraisal, leading to participants to consume more food. Also, it would be associated with higher levels of hunger and impaired self-monitoring of food intake. The self-monitoring component added to the present research was based on two previous studies which showed that individuals under high cognitive load were less aware of how much they ate in comparison to those in a low cognitive load condition (Royal & Kurtz, 2010; Ward & Mann, 2000). Again, we expect that suppressors would perform worse at estimating their food intake compared to reappraisors because of higher cognitive demands of ER. To our knowledge, this is the first study that investigates the relationship between negative emotions incurred in a socially stressful situation, ER and ad libitum food intake.

6.3.2. METHOD

6.3.2.1. Participants

A total of 77 undergraduates from Babeş-Bolyai University, Department of Psychology (70 women), aged 21-53 (*SD*=6.11) were recruited for the study, supposedly "aimed to investigate the role of impression management on the performance in a job interview for a position as a psychologist in a large company". The mean body mass index was 20.90, *SD* = 3.37.

6.3.2.2. Procedure

All participants were asked to refrain from eating 3 hours prior to the experiment under the argument that fullness/hunger might interfere with performance at the interview. In reality, we tried to ensure that participants had comparable hunger baseline levels, without raising suspicion to the real goals of the study.

Participants were welcomed by the experimenter and thanked for their agreement to take part at the study. They were told that the "jury" still had some work to do with the data from previous interviews, so, while waiting (no more than 5 minutes), they were asked to fill-in the PANAS-X

scales, for another study (Watson & Clark, 1999). Afterwards, they were told that the jury was ready to meet them. Each of the participants randomly received a suppression, reappraisal or no instruction was given as to how to contain their emotional experience.

Upon their arrival in the laboratory, participants were subjected to an adapted version of the Trier Social Stress Protocol (Kirshbaum, Pirke, & Hellhammer, 1993), with the major difference that no physiological or biological measures were taken.

6.3.2.3. Instruments

Mood – was measured by using Positive and Negative Affective Scales and Specific Affect Scales of PANAS-X (Watson & Clark, 1999) as a pre-test and post-test measure of emotions.

Emotion regulation strategies- In order to check whether participants used ER strategies as instructed, or used some other strategies, they filled in the Emotion Regulation Questionnaire (Gross & John, 2003) after the stress induction procedure took place.

Body Mass Index (BMI) was calculated based on the weigh (in kilograms) and height (in centimeters) provided by the participants.

Dietary status. In order to control for previous diet attempts, participants were asked whether they were currently on a diet (medical or other).

Emotional eating item Emotional eating was assessed by using one question "Do you feel tempted to eat when you're under a negative emotional state (sad, bored, anxious)?(1/to a little extent; 5/to a large extent)

External eating item was formulated as follows: "Do you feel tempted to eat right away when you see something delicious in front of you?" (1/to a little extent ; 5/to a large extent)

Hunger- was evaluated by using one item (*How hungry are you right now? 1- not at all hungry; 7-very hungry*)

Self-monitoring of food consumption was assessed by using 2 questions trough which participants were asked to estimate how many grams of either chocolate or potato crisps have eaten during the entire experiment.

6.3.3. RESULTS

6.3.3.1. Analytic strategy and data handling

The amount of each food category eaten was calculated in grams, and scores were log transformed for all subsequent statistical analyses reported here, in order to reduce problems of

linearity and homogeneity of variance. Given that ER instructions did not significantly influenced the actual ER strategies used by participants, we calculated suppression and reappraisal checks based on the scores from ERQ, and subsequently include in the main analyses the suppression check as a between subject variable.

We further calculated food estimation (self-monitoring index) by subtracting the amount of food eaten (crisps and chocolate) from the amount estimated. Therefore, positive numbers represent overestimations and negative numbers reflect underestimations. Based on exploratory analyses, we included chocolate estimation scores in analyses reported in the following sections. Interaction effects were tested using Aiken and West (1991) recommendations and all independent variables were centered around zero before plotting their product

6.3.3.2. Manipulation checks: induced negative emotions and enacted ER strategies

The three groups were comparable in their levels of fear $F(2,71) = .69$, $p < .50$ and general negative affect $F(2,71) = .18$, $p < .83$ at baseline. Stress manipulation was successful at increasing general negative affect $F(1, 69) = 6.31$, $p < .001$, $\eta p^2 = .92$ and fear $F(1, 69) = 81.23$, $p < .001$, $\eta p^2 = .54$, across all three groups, with no significant between-subjects effects $F(2, 69) = .21$, $p = .80$ (Table 1).

Table 1. Negative mood and fear before and after the experiment and ER used in the three manipulation groups (*SD* in parentheses).

	Negative affect		**Fear**		**ER strategy used**	
	Baseline	**Posttest**	**Baseline**	**Posttest**	**Reappraisal**	**Suppression**
Reappraisors	12.61	14.07	7.69	8.61	3.46	3.80
	(3.60)	(3.47)	(2.22)	(2.40)	(.86)	(1.39)
Suppressors	12.53	13.73	7.37	8.26	3.17	3.54
	(3.21)	(3.01)	(1.73)	(2.53)	(1.07)	(1.35)
Control group	13.13	13.95	8.08	9.04	3.05	3.47
	(4.10)	(5.27)	(3.18)	(2.70)	(1.38)	(1.27)
Total sample	12.74	13.91	7.69	8.62	3.23	3.61
	(3.59)	(3.90)	(2.40)	(2.52)	(1.11)	(1.33)

Though there was a tendency of reappraisal group to use more reappraisal as an ER strategy, there were no between-group differences in ER strategies used, neither on suppression check, $F(1, 74) = .42$, $p = .65$ nor on the reappraisal check, $F(2,74) = .86$, $p = .42$. This suggests that the participants in the three groups didn't use the strategies as they were instructed.

Since participants didn't use ER as instructed but spontaneous use of suppression was

associated with chocolate, $r = .48$, $p < .01$ and chips consumption, $r = .80$, $p < .01$, we next divided groups based on their reliance on suppression as follows: +1 *SD* above the mean (> 4.94) –high use of suppression ($n = 12$); 4.94-2.98 medium use of suppression ($n = 51$); -1 *SD* below the mean (< 2.98) – low use of suppression ($n = 12$).

6.3.3.3. Amount of food intake: Impact of emotions and emotion regulation

The impact of emotions and regulation strategies on the amount of food intake was analyzed enclosing participants who ate from the respective food item

In a first step, two separate linear regressions analyses were conducted, with changes in negative affect and fear from T1 to T2 as independent variables and the amounts of chocolate, crisps and total food as dependent ones. The results show that neither changes in negative affect), all β's < .46, p's >.28, nor changes in fear, β's < .74 p's >.09 are predictive for food intake (for all categories). Also, the results show that neither fear (T2) nor NA (T2) predicted the amount of food intake, with all β's < .57, p's > .26 (for all categories).

To test the impact of emotion regulation use on eating, the percentage of participants who ate from the respective food item was subjected to ANOVA with one three-level factor (suppression check: low suppressors, medium suppressors, high suppressors) and experimental instruction (reappraisal, suppression, no instruction) as a covariate. In total, three separate ANOVAs were conducted**.** Results show that there was a significant effect of suppression check for crisps consumption, $F(2, 26) = .3.50$, $p < .05$, $\eta p^2 = .24$ and a marginally significant one for total food consumption, $F(2, 35) = .2.95$, $p = .06$, $\eta p^2 = .16$. Subsequent simple contrasts analysis revealed that high suppressors ate significantly more crisps ($p < .02$) and more total food ($p < .03$) as compared to low suppressors. The effect of covariate (ER manipulation) on consumption of all food categories as well as the effect of suppression check on chocolate consumption were non-significant, all F's < 1.56, p's > .12.

In further analyses, we examined the total amount of consumed food across all participants, irrespective of whether they ate or not. A significant main effect of ER instruction was found for all three different food scores: chocolate, $F(2, 77) = 3.40$, $p < .05$, $\eta p^2 = .09$; crisps $F(2, 77) = 3.35$, $p < .05$, $\eta p^2 = .08$ and total food $F(2, 77) = 2.50$, $p = .06$, $\eta p^2 = .07$.

Independent sample t-tests revealed that high suppressors ate significantly more total food t (16.09) = -2.06 ($M_{\text{high suppressors}} = .81$, $SD = .83$ versus $M_{\text{low suppressors}} = .25$, $SD = .44$) and more chocolate t (16.86) = -2.39, ($M_{\text{high suppressors}} = .58$, $SD = .62$ versus $M_{\text{low suppressors}} = .11$, $SD = .35$), all

p's < .05. Also, they ate slightly more crisps compared to people scoring low on suppression, t (14.58) = -1.86, $M_{\text{high suppressors}}$ =.65, *SD*=.75 versus $M_{\text{low suppressors}}$ =.21, *SD* =.33) *p*<.08 (see also Figure 1)

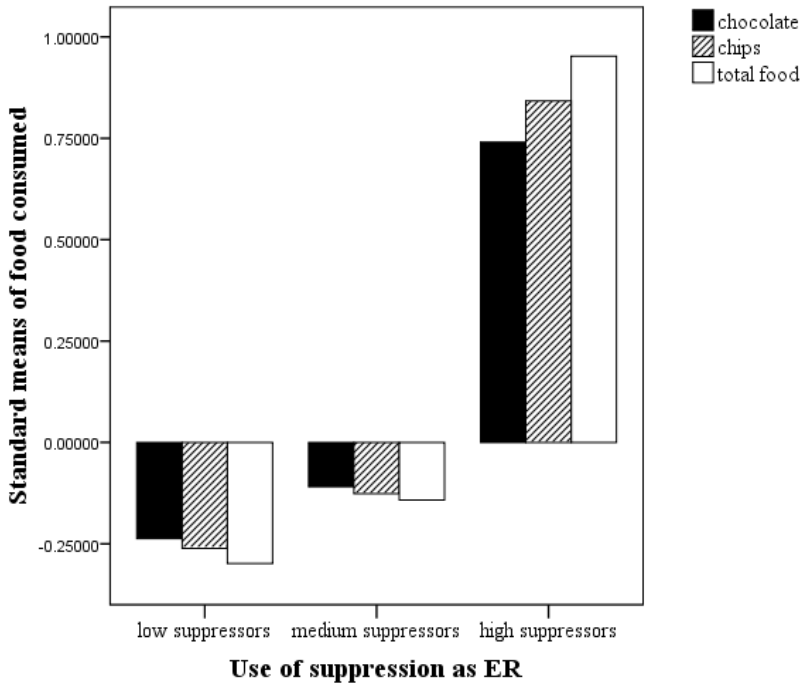


Figure 3. Amount of consumed food types by enacted suppression

6.3.3.4. The role of negative affect and suppression on self-reported hunger and self-monitoring of food consumption

In order to explore the effects of NA change (T2-T1) and the use of suppression on self-reported hunger and chocolate estimation respectively, we ran two separate hierarchical regression analyses with negative affect change, suppression and their interaction on both hunger and food estimation (Aiken & West, 1991). The results show that there was a significant interaction effect of change in negative affect x suppression on both hunger, $F(3, 71) = 3.79$, $p < .01$, $\beta = .28$, $p < .02$, and estimation of amount of chocolate estimation, $F(3, 64) = 3.83$, $p < .01$, $\beta = .27$, $p < .02$. Also, NA or suppression alone, could not account for the observed effects, either in the case of chocolate estimation or hunger levels, with all β's < .29, *p*'s > .06

The graphical displays show that the more people relied on suppression as a ER, the higher were levels in reported hunger (Figure 1). Also, higher use of suppression and higher levels of

changes in negative affect (T1-T2) were associated with poorer performances in estimating chocolate consumption, with a tendency towards overestimation of the amount eaten (Figure 2).

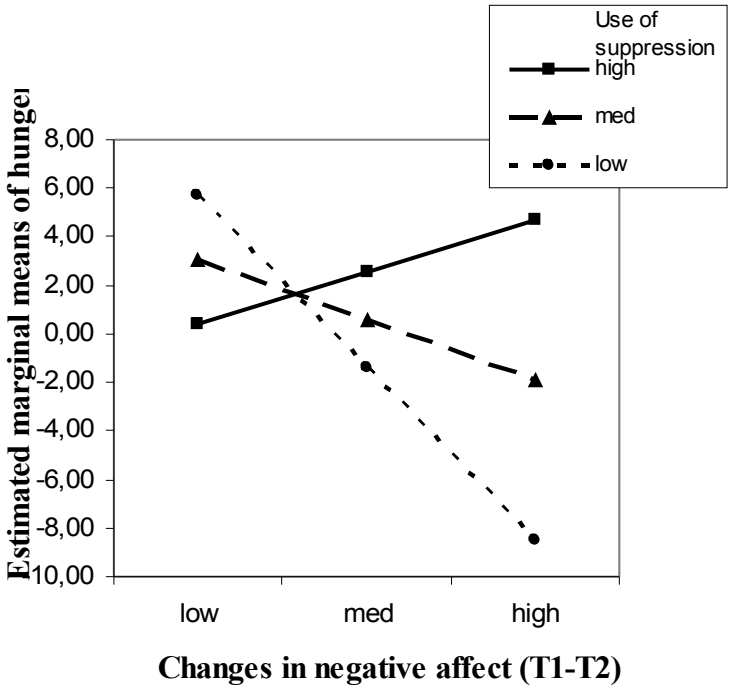


Figure 1. Interaction effects between changes in negative affect and self-reported hunger

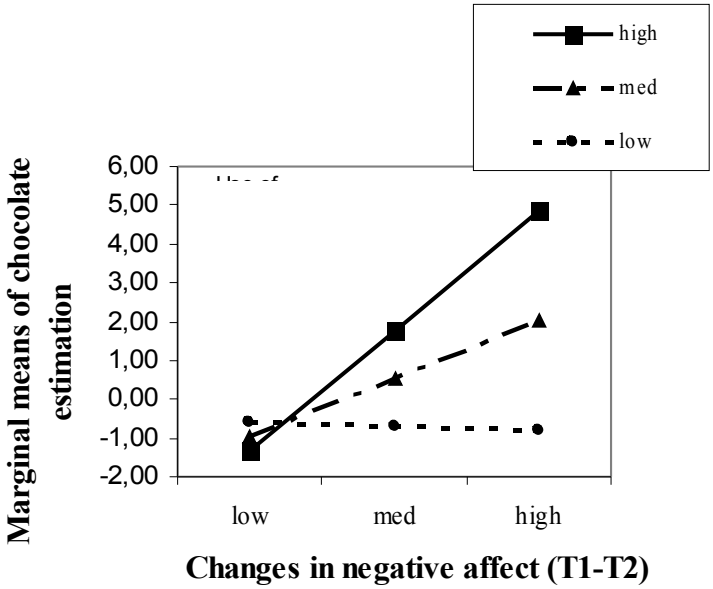


Figure 2. Interaction effect of negative affect x suppression on estimation of chocolate consumption (negative numbers represent underestimations)

6.3.4. DISCUSSION

6.3.4.1. Negative emotions after social stress, spontaneous and instructed ER, and food intake

The first hypothesis stated that participants instructed to reappraise their emotions would eat less after the social stress situation in comparison to those instructed to suppress their emotions. The results showed that experimental manipulation was not successful; meaning participants did not consistently use ER as instructed, but employed them rather spontaneously. This result is puzzling, given that in other studies of this kind (e.g Ehring, Tuschen-Caffier, Schnulle, Fisher, & Gross, 2010) the experimental manipulation of ER appeared successful. One might only speculate why, in this case, the ER instructions failed to show the same effects. Typically, experimental studies use short movies (about 5 minutes) while participants use ER as instructed. This is the first study of this kind, which uses a rather long stress induction procedure (the entire protocol for the Trier Social Stress test lasted for about 50 minutes), so we have virtually no data on whether ER instructions are successful for longer emotional encounters too. It might be that in these situations, participants have difficulties in regulating their emotions according to the experimental demanding rather that in their spontaneous, usual ways. Moreover, to our knowledge, there are no studies testing ER instructions in more ecological emotional settings (the participant is personally involved and deals with negative feedback from other persons), so probably the type of stressor, in addition to its duration might play a role in following instructions instead of spontaneously using ER as usual.

Though the experimental manipulation did not prove successful, when adding spontaneous use of ER (suppression) in the model, we found that it significantly influenced food intake, for chocolate, crisps and total food. Thus, once participants started to eat, *spontaneously but not manipulated ER influenced the amount of food intake*, with individuals suppressing their negative emotions during the interview eating significantly more food and more crisps in comparison to those who exhibited lower levels of suppression.

As in the previous experiment, fear and NA did not predicted eating versus non-eating and neither the amount of food intake, suggesting that overeating was rather a result of emotional dysregulation (high reliance on suppression) than of distress itself. Furthermore, similarly to the first experiment, the present results point to the idea that overeating via an ‘emotional route’ was highly unlikely, since only negative emotions did not account for the observed effects. Thus, it seems more likely that another potential mechanism, ‘the cognitive route’, as evidenced by other findings like impairments in the self-monitoring of food consumption and increased levels of hunger.

6.3.4.2. Influence of NA and suppression on self-monitoring of chocolate consumption and hunger

In a nutshell, increased in negative emotions from T1 to T2, and employment of suppression to manage distress proved to be a maladaptive combination: it led to higher amounts of consumed food and higher levels of hunger. and poorer self-monitoring of actual food intake

The present finding has important implications and raise exciting avenues for further research. Thus, we added to the growing body of evidence (Abraham & Michie, 2008), showing that self-monitoring is a key-component of successful self-regulation. It is known that mindful people (those who have the tendency to attend to the present moment) are more likely to eat in response to bodily cues rather than in response to environmental stressors. They also have a more accurate awareness of how much food they consume (Royal & Kurtz, 2010). Research could further tap on the relationships individual differences in being mindful, emotion regulation and eating.

To our knowledge, this is the first study documenting the effects of negative emotions and dysfunctional ER also on visceral states like hunger. Typically, other studies treated hunger as a precursor of self-regulation breakdown assuming that visceral states, as well as emotional ones deplete regulation resources devoted for attaining self-relevant goals. The present findings provide also an alternative route: negative emotional states, in conjunction with dysfunctional emotion regulation alter individual's awareness of internal states, such as hunger, and subsequently lead to food overconsumption. These results can also be interpreted in the light of the "Externality Theory" of eating, which posits that some individuals, especially obese ones, are more responsive to external cues, like the smell, texture and appearance of food than to the internal ones which signal hunger and satiety (Shachter & Rodin, 1974; Stroebe, 2008 for a review) Although it was not among the objectives of the present research, further studies could study the potential route stress- ER- eating, via alterations of hunger levels. Thus, it is possible that participants who employed suppression ate not so much as a direct response to stress but rather as a response to modified hunger levels.

6.3.4.3. Concluding remarks

These results, taken together systematically point towards a "cognitive route" via resource-depletion mechanism rather than an "emotional route" to overeating. First both reappraisers and suppressors reported comparable levels of negative emotions after the mood induction procedure, even though they used different ER.

In conclusion, the present research brings important contributions to the study of negative

emotions rose in social stressful situations, ER and eating. Recent research describes a pervasive trend to eat ‘‘mindlessly” (Wansink, 2004), but few studies have actually investigated who is most susceptible to mindless eating, and when it is most likely to occur. We provided evidence that social stress, when poorly managed is a key precursor of eating self-regulatory depletion. Also, it triggers the motivation to escape from the negative self-awareness state, with subsequent implications for behavioral monitoring and altered (perception of) visceral states.

CHAPTER 7. General conclusions and discussions

7.1. Summary

The aim of the present dissertation was to explore the relationship between hot factors, such as negative emotions, hot cognitions (worry) and automatic affective reactions on the self-regulation of eating on adolescents and young adults. There are two lines of arguments that ground the present research: one is the ecological argument and the other is the theoretical one. From an ecological perspective, the obesogenic environment (Egger & Swinburn, 1997) in which the ubiquity of palatable foods poses great challenges to individuals’ self-control abilities but more importantly, to individuals’ health (WHO, 2008). This is especially the case of adolescents, who are less efficient in self-regulation as compared to adults because of differences in the sensitivity to psychosocial factors and in sensation seeking and impulsivity (Steinberg, 2004)). The theoretical reasons are multifold. First, previous research addressed mainly on negative emotions, as hot precursors of behavior (Greeno & Wing, 1994; Heatherton & Baumeister, 1991; Macht, 2008), and focused less on other types of hot factors like affective reactions towards food (or appetitive responses). Also, most of the research addressed restrained or emotional eating styles, which are considered to be triggers of overeating. Other studies focused on individuals, mostly women, with eating-related problems like bingeing, bulimia or obesity (Ganley, 1988, 1989).

Based on the theoretical framework provided in Chapter 2 but taking into consideration also empirical shortcomings, we formulated several central questions: a) How can we reliably measure self-regulatory processes in adolescents? (Study 1); b) How do self-control and self-regulation processes influence the relationship between hot factors (automatic affective reactions and food-worry) and unhealthy snacking in adolescents? (Studies 2 and 3) c) How do negative emotions stemmed in different contexts influence unhealthy snacking and what is the role of ER? (Studies 4 and 5).

In Study 1, the results showed gender differences in adolescents’ employment of self-

regulation strategies, with girls being more active than boys in controlling food intake. We further explored this gender difference in self-regulation in the following studies and in relationship with hot factors such as automatic affective reactions and food worry.

Study 2 points to gender differences in the strength of automatic affective attitudes towards healthy and unhealthy food items, but also in the role of modulating role of self-control. with girls being more in favour of healthy (fruit) items, which is in line with previous literature documenting food preferences. Not only boys were less in favour of healthy snacks (fruit), but at low levels of self-control, even when their affective reactions towards them were positive, they still ate more unhealthy snacks compared to girls.

Study 3 documented even more gender differences in relationship between hot-factors, showing that in adolescents of both genders, who worry about their eating habits, girls were more likely and more proficient in implementing both goal-oriented as well as temptation-oriented self-regulatory processes in trying to control their food intake.

Studies 4 and 5 were focused on disentangling the relationship between negative emotions, emotion regulation strategies and unhealthy snaking and showed that negative emotions elicited in non self-referent contexts (Study 4) or in self-referent ones (Study) lead to comparable higher chances to start eating chips and chocolate, and relatively higher amounts of food intake in individuals who used suppression in order to control their emotions. The effects of suppression were visible also on the self-monitoring of food intake and self-reported hunger (Study 5).

7.3. Implications of the present findings

The role of hot factors on the self-regulation of eating in adolescents

First, in the case of adolescents, Studies 2 and 3 show that the role of hot factors such as affective reactions and worry about food on snacking behavior is not straightforward and it largely depends on gender. From a dual-process model perspective of self-regulation (Meltcafe & Mischel, 1999; Hofmann et al., 2005; 2007) it seems that at least in boys, the automatic affective responses stemmed from the 'impulsive' system shortcut the volitional control emerged from the 'reflective' system (Study 2). . From a dual-process model perspective of self-regulation (Meltcafe & Mischel, 1999; Hofmann et al., 2005; 2007) it seems that at least in boys, the automatic affective responses stemmed from the 'impulsive' system shortcut the volitional control emerged from the 'reflective' system (Study 2). We interpreted these findings in the light of previous research, showing that boys generally have higher intakes of unhealthy snacks (Currie et al., 2008) and are less motivated to

control their appetitive reactions towards certain foods (Wardel et al., 2004).

The present results highlight the importance of contextualizing the paths of influence from hot factors to food intake, depending on both gender and self-regulatory resources. These findings have several implications for both research as well as interventions. First, interventions aimed to promote healthy eating in adolescents should take into consideration gender issues. Especially in primary prevention and health education, efforts have been made only recently to tailor interventions to individual's characteristics (De Bourdeaudhuij & Brug, 2000). In adolescents, tailored interventions previously focused on bolstering motivation to adhere to healthy dietary patterns depending on the motivational level, or readiness to change (e.g. Berg-Smith et al., 1999).

The role of hot factors on the self-regulation of eating in young adults

Our findings converge to the idea that higher resource allocation towards managing immediate negative emotions might be the responsible mechanism behind the increased eating in the groups who used suppression as an emotion regulation strategy. This is in line with other studies of this kind, which showed that suppression is more cognitively 'costly' that reappraisal (i.e. Gross & John, 2003; Sheppes & Gross, 2011; Sheppes & Meiran, 2011) and it leads to poorer emotional and cognitive performances (Gross & John, 2003; Gross & Levenson, 1997; Richards & Gross, 2000; 2006; Szasz et al., 2011) as well as riskier choices in decision-making tasks (Heilman et al., 2010).

The consistent direction of the results reported in Study 4 and 5 has several implications. First, in rapport to the previous literature that failed to detect a clear pattern of behavior in normal eaters under stressful situations (see Macht, 2008, for a recent review), we found a consistent increase in eating behaviors in those using a maladaptive way to deal with their negative emotions. Therefore, in light of the present findings, which are similar with the results of another study that assessed emotion regulation strategies and food intake (Evers et al., 2010) we suggest that these large differences in observed eating patterns might be due, at least in part, to *individual differences in effectively dealing with emotional states.* This has important implications for research and practice, since it has been shown already that individuals' ability to successfully regulate emotions are trainable (Koole, van Dillen, & Scheppes, 2011). Also, emotion regulation training is already a component of the dialectical behavioral treatment protocols for binge eating disorder (Telch et al. 2001), which showed significant alleviation in bingeing symptoms in those receiving the protocol in comparison to a wait-list group.

Also, the fact that we found significant impairments in the ability to self-monitor behavior and an increased hunger level in those using suppression (Study 5) has important implications and raise exciting avenues for further research. Thus, we added to the growing body of evidence (Abraham & Michie, 2008), showing that self-monitoring is a key-component of successful self-regulation. It is known that mindful people (those who have the tendency to attend to the present moment) are more likely to eat in response to bodily cues rather than in response to environmental stressors, and are more aware of how much food they consume (Royal & Kurtz, 2010). Research could further tap on the relationships individual differences in being mindful, emotion regulation and eating and work on interventions aimed to booster this particular skill.

7.3. Contributions of the present thesis

In the following paragraph we summarize the main theoretical, empirical and methodological contributions of the present thesis.

Theoretical and empirical contributions:

Chapter 1-systematically investigated the relationship between hot factors and self-regulatory literature. We brought together different types of hot factors(negative emotions, automatic affective reactions, hot cognitions) and analyzed them in relation with food intake and self-regulatory mechanisms that mediate or moderate these relationships.

Study 1- one of the first studies aimed to systematically investigate the use of self-regulatory strategies for eating in adolescents, combining bottom-up (adolescents own views regarding self-regulation) and top-down (categorization of self-regulatory strategies as advanced by Conteractive Control Theory; Fishbach & Converse, 2011) approaches.

Study 2- the first study that investigates the potential 'functional' role of worry towards food. Also, this was one of the first studies to address the relationship between the use of specific self-regulatory strategies (aimed at temptation versus goal) in relation to unhealthy snack intake in adolescents.

Study 3- the first study that investigated automatic affective reactions towards different foods and sunsequent food consumption in adolescents, by looking also at the moderating role of dispositional self-control.

Study 4 – showed, for the first time that not only the use of suppression leads to higher food intake when adults deal with negative emotions, but it is first of all associated with higher chances of starting eating in the first place. Also, it was the first study to test the comparative effectiveness

of suppression and reappraisal after the occurrence of the negative emotional event, and showed that reappraisal might prove less efficient when employed in a latter emotional iterative phase

Study 5- replicated successfully the same results, by extending them on social stress situations. Moreover, this was the first study that showed that the use of suppression to deal with NA leads not only to increased food consumption but also to poorer monitoring of food intake and elevated hunger.

Methodological contributions

In Study 1- we presented the procedure of developing and validating a questionnaire tapping on self-regulatory strategies for eating in adolescents. The instrument was shown to have good psychometric properties in the Romanian sample and is therefore a valid instrument to be used in further research.

Study 2- showed the procedure for developing and implementing an experimental task meant to assess automatic affective reactions towards foods. This was done by adapting an existing implicit measure, namely Go/nonGo Association Task.

Study 3- put to a first empirical test the scale developed and validated in Study 1.We have shown that the scale is discriminative between those with high versus low unhealthy snack consumption and fits well the assumed theoretical model of the study.

Study 4 employed a different experimental paradigm than the studies before, allowing us to study two major things: 1)who starts to eat in the first place, by using a free-eating setting and 2) what is the efficiency of suppression when used late rather than early in the emotional-iterative process. These two major changes in the experimental task allowed for a more ecologic,valid study of the effect of suppression versus reappraisal on food intake.

Study 5- is the first study of this kind that uses the Trier Social Stress Test (TTS), in relationship with eating and self-monitoring of food intake. The experimental task was modified so as to integrate a) opportunities to eat; 2) explicit negative feedback regarding performance. We showed that TTS is a reliable way of inducing interpersonal stress and has negative consequences on the self-regulation of eating, when it is coupled with the suppression of emotional expression.

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