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Review

Negative Affect and Maladaptive Eating Behavior as a Regulation Strategy in Normal-Weight Individuals: A Narrative Review

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Abstract: Emotions have a powerful influence on eating behavior, and eating behavior can have a powerful effect on emotions. The objective of the present narrative review was to evaluate the relationship between negative affect and maladaptive eating behavior as a regulation strategy in normal-weight individuals. A search of the literature within PubMed®, MEDLINE® and PsycINFO was conducted using a combination of the following terms: "affect", "negative affect", "affect regulation" and "maladaptive eating behavior". A total of 106 papers were identified for full text review and were included in the final set of literature. The manuscript presents an overview of the literature on negative affect and maladaptive eating behavior. It offers a brief overview of restrained, uncontrolled and emotional eating in normal-weight individuals and looks at maladaptive eating behavior used to regulate their affect. Based on the previous research findings, we argue that using more adaptive strategies for emotion regulation (cognitive reappraisal) might result in downregulating integral negative affect to food and in improving eating behavior.

Keywords: negative affect; affect regulation; maladaptive eating behavior; normal weight

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1. Introduction

Maladaptive eating behavior is a serious problem for health and psychological well-being. In eating psychology, two main maladaptive eating behaviors have been defined: restrained eating (persistent and conscious food intake restriction) [1] and disinhibited eating (an incapacity to restrain food intake once begun) [2] divided into emotional eating (overeating in answer to internal cues, e.g., emotions, affect, mood state) and external eating (overeating in response to external cues, e.g., seeing or smelling food) [3]. Maladaptive eating behavior is related to unhealthy attitudes and behaviors regarding food and could also be defined as eating unhealthy food (having less nutritional value and increased intake of high-sugar and high-fat foods) and not eating healthy food.

People are exposed to a multiplicity of external environmental cues in their daily lives, which have an impact on eating or not eating different foods. Human eating behavior is guided by response to food-related cues rather than by a physiological need [4]. Previous studies have suggested that both external and internal cues influence eating behavior [5–7]. Researchers are interested in internal states as, apparently, external environmental cues are unable to explain all of the observed maladaptive eating behavior. One of these internal cues is affect. This term is mainly used in referring to any state that represents how a situation affects a person [8]. Affect is used to describe the physiological, conscious or behavioral components of emotion. It can be described as the superordinate category for emotion episodes, moods, dispositional states and traits [9].

Experiencing negative affect has strong effects on unhealthy eating behavior (e.g., increased food intake in reaction to negative emotions, more palatable and less healthy meals) and poor food choices (e.g., more snacking behavior, a decrease in fruit and vegetable consumption) in both normal and overweight individuals [10–19]. Strategies that

individuals can use to regulate affect might be an effective method for changing existing maladaptive eating behaviors and improving them.

The objective of the present review is to investigate the link between negative affect and maladaptive eating behavior as a regulation strategy in normal-weight individuals (with the body mass index range from 18.5 to 24.99 kg/m^2). We first focus on distinctions in negative affect and in restrained eating, uncontrolled eating and emotional eating (maladaptive eating behavior). Next, we examine emotion regulation strategies and their connection with different maladaptive eating behaviors. We finish by arguing that using more adaptive strategies for emotion regulation (cognitive reappraisal) might result in downregulating integral negative affect to food and in improving eating behavior.

A search of the literature within the electronic databases PubMed®, MEDLINE® and PsycINFO was conducted. The search terms were "affect", "negative affect", "affect regulation" and "maladaptive eating behavior". In the present review, the titles and abstracts of the search results were assessed. For each paper, the type of the study (natural setting and laboratory experiments), the characteristics of the sample and the conclusion/results were defined. The key stages of literature search guidance are presented in Figure 1.

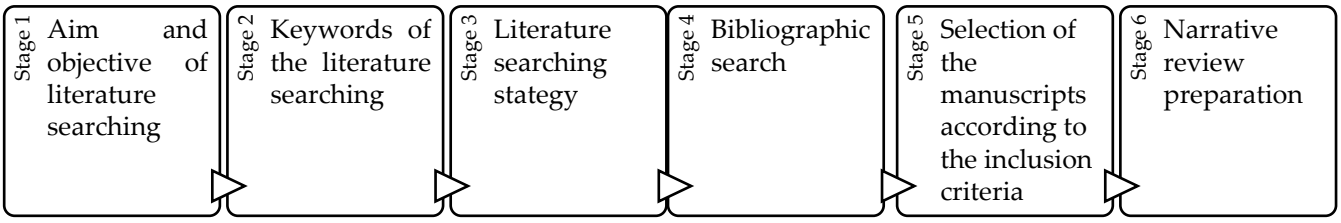

Figure 1. The key stages of literature search guidance for conducting a narrative literature review.

The author (A.B-M) identified the published studies focusing on the relationship between negative affect and maladaptive eating behaviors over a 20-month period (until 30 September 2021). Only articles published in English were considered. Population-based studies, reviews, systematic reviews and meta-analyses were included in the literature selection process. Case reports, case series, commentary letters and articles published in languages other than English were excluded.

A narrative review was proposed in an attempt to summarize the literature and to answer the research question on the relationship between negative affect and maladaptive eating behavior as a regulation strategy in normal-weight individuals, focusing especially on restrained eating, uncontrolled eating and emotional eating. The purpose of this narrative review was also to present a theoretical rationale for the relevant role of negative affect on eating behaviors, integrating research in natural and laboratory settings.

2. Affect and Maladaptive Eating Behavior

The link between emotion and eating behavior has always been of interest to human behavior research. Over the last decades, it has been recognized that emotions have a strong impact on eating behavior and that eating behavior can have a powerful influence on emotions [20]. Emotions can induce changes in eating behavior [21], and eating is per se related to emotions [22]. Emotion is a complex reaction pattern being composed of subjective experience, expressive behavior (e.g., facial, bodily) and peripheral physiological responses (e.g., respiration, heart rate) [23]. Specific emotions such as anger, fear, joy and sadness affect eating responses in motivation to eat, food choice, affective reaction to food, eating speed, metabolism and digestion [24].

Furthermore, studies have found that positive and negative emotions can differ in their effects on eating. Negative emotions (such as anger, fear and sadness) may result in an increase in food intake and the consumption of unhealthy food (junk food) but in a decrease in food pleasantness in individuals who use eating as way to regulate their negative emotions [24]. Negative emotions, such as boredom, may be related to increased

appetite, but sadness may be related to decreased appetite [25]. In contrast, positive emotions, such as joy or happiness, can increase food pleasantness and the intake of healthy foods [24,26–28]. Positive emotions, in general, seem to be relevant triggers for eating indulgent food amongst healthy individuals with a normal weight [28]. A meta-analysis (including 33studies with a total of 2491 participants including healthy controls and patients with an eating disorder and with obesity) on how negative and positive emotions affect food intake across laboratory settings [29] showed that, overall, negative emotions resulted in increased eating (a small effect). Other outcomes from a meta-analysis based on laboratory-based studies (which included 20 studies with a total of 3670 participants including healthy controls and individuals with pathological eating behavior [30]) found a lack of an overall effect of negative emotions on eating behavior. In addition, positive emotions had a small effect on eating behavior, and overall positive emotions lead to increased food intake.

The empirical results on emotion-induced changes in eating are contradictory. On the one hand, high-intensity emotions are believed to suppress eating (these emotions influence on the autonomic nervous system activity that triggers physiological changes, e.g., slowed gastric emptying, the release of appetite-inhibiting hormones, that may induce satiety [31]. On the other hand, high-arousal emotions (such as anger) have been found to increase food consumption [26,27] or to not decrease eating in reply to highly intense emotions (results of most laboratory studies). In relation to moderately intense emotions, it is supposed that negative and positive emotions increase food consumption among people with a more controlled eating style [32]. To sum up, empirical results reflect the same inconsistencies as the discrepancy in views on how emotions impact eating [30]. Moreover, although extensive research has been carried out on negative emotions and eating, the very fundamental question of whether negative emotions influence eating, and in whom, remains unclear. It is worth pointing out that much research has been conducted on disordered eating among patients with eating disorders or obesity, and a much smaller number of studies have been devoted to maladaptive eating behavior among normal-weight individuals without a diagnosis of an eating disorder or obesity.

2.1. Negative Affect

Negative affect increases over time to the point where disordered eating occurs as a maladaptive emotion regulation strategy [33]. Some authors suggest that negative affect reduces after maladaptive eating behavior [34], whereas others point out that it does not decrease or continues to increase [35]. Taking into account the existing literature, it seems that negative affect and maladaptive eating behavior are interrelated and causally linked.

Negative affect is described as feelings of emotional distress [36]. An extensive literature has shown that negative affect leads to maladaptive eating behavior (e.g., over-consumption of high energy density foods or highly palatable foods), but it is not yet clear exactly how and why this happens. Prior work suggests that negative affect may lead to maladaptive eating because maladaptive eating reduces aversive affective states or because negative affect impairs top-down control. Thus, maladaptive eating behavior occurs, at least in part, in response to negative affective states [24,31,37].

Numerous laboratory and field studies have shown that various forms of negative affect (including stress and other negative emotional states) lead to maladaptive eating behavior, which includes both the overconsumption of unhealthy food and the under-consumption of healthy food [18,24,37]. Laboratory studies have shown that incidental and experimentally induced negative affect leads to maladaptive eating behavior with regard to both hypothetical food choices and actual eating behavior [17,38]. Cross-sectional and longitudinal field studies using self-report meal questionnaires, as well as ecological momentary assessment, have also shown that higher levels of negative affect predict maladaptive eating behavior [31,39]. Even though there is a known, robust relationship between negative affect and maladaptive eating behavior, it is not yet clear

which of the two possible pathways between negative affect and maladaptive eating behavior is most important.

Negative affect can impact typical eating behavior in two ways. In the first pathway, negative affect causes an increase in tasty food craving (often unhealthy), and consumption of foods with a higher energy density (i.e., have a high calorie content, such as hamburgers or candy) [40,41]. Researchers have shown that, in at least some cases, individuals use tasty, highly rewarding high energy density food as a means of reducing negative affect [28,42]. In the second pathway, negative affect impairs top-down control over behavior, which studies have shown to be often required for choosing healthy, low energy density foods which also have vitamins, minerals and nutrients that play essential roles in a healthy diet [43,44]. While some people may find it rewarding to engage in healthy eating, the full benefits of maintaining a healthy diet come with more delay than the reward of eating tasty food [45]. Choosing to align eating (and other) behaviors with the pursuit of more delayed rewards is thought to require top-down control, and in the second pathway, negative affect disrupts the effective exercise of such control [43,46,47].

There are at least two pathways by which negative affect influences eating: by increasing the consumption of tasty, high energy density food as a means of reducing affect or by decreasing consumption of healthy, low energy-density food due to impaired top-down control [43]. In our model, these two pathways reflect the fact that negative affect might have an impact on eating either by increasing the weight given to taste or by decreasing the weight given to health in dietary decisions. As already mentioned, the taste value of a food is a marker of the immediate reward that can be used to palliate negative affect [42], whereas the health value of a food is the delayed reward that a person must represent using top-down control in order to make a healthy food choice [48]. Given that affect regulation leads to decreases in negative affect, such regulation should lead to improvements in eating behavior via both pathways, in other words, both via a decreased intake of tasty, high energy density foods and via an increased intake of healthy, low energy density foods.

It is worth adding that food choices in three eating situations, a neutral/typical meal (foods with medium nutrient density and medium energy), a healthy meal (foods with high nutrient density and low energy) and an unhealthy meal (foods with low nutrient density and high energy), provide information about a range of prototypical behaviors [49]. The actual process of making healthy choices is more difficult than making unhealthy ones in normal-weight individuals. Prior work suggests that negative affect may impair top-down control over behavior (which is needed to make healthy food choices) which may lead to underconsumption of healthy foods. Choosing tasty unhealthy foods does not require top-down control over behavior, whereas choosing untasty healthy foods does. In addition, the suppression of a thought (e.g., planning not to eat unhealthy snacks) may lead to this thought becoming more prevalent and will result in the increased consumption of unhealthy food [49].

Previous research studies have tested whether affect regulation can be used to decrease maladaptive eating [50,51]. However, in nearly all of these studies participants downregulated food-related affect (i.e., craving for food) rather than negative affect which is incidental to food (but which may be a cause of maladaptive eating behavior). Prior studies have shown that affect regulation strategies can effectively reduce craving for unhealthy foods, but all previous work has deployed these strategies to reduce craving itself rather than to downregulate the negative affect that may be a root cause of the craving [50,51]. It is worth pointing out that although many studies have examined negative affect and eating behavior, few studies have attempted to dissociate the contributions of two known pathways from negative affect to maladaptive eating behavior—the use of tasty food to cope with negative affect or the inability to choose healthy food due to impaired top-down control.

2.2. Integral and Incidental Affect

Distinguishing different affective experiences could help us to understand the decision-making at hand, as well as the confounding findings about the influence of affect on decision making. It is important to differentiate two types of affects, integral and incidental, because they have a substantial influence on decision making and final judgment [52]. Integral (or endogenous) affect is defined as an affect stemming from consideration of the decision or judgmental target itself (i.e., food craving); a "genuine" subjective reaction to a target [53]. In other words, integral affect concerns experienced feelings about a stimulus [54]: for example, how people feel about various choice options while purchasing a food product. In making a decision, people can use their affective reactions towards options as proxies for values and use them as information in the evaluation of the options [55]. Individuals' experiences of integral affect allow them to categorize experiences on a good–bad dimension and enable them to reach a decision [56]. To sum up, integral affect is linked with the decision, decision attributes or to the decision situation. It can come about through anticipatory thinking (thinking about possible outcomes) or through activation by an actual stimulus (e.g., when a task associated with a decision is presented in a pleasant or unpleasant way) [57].

On the other hand, incidental (or exogenous) affect includes all factors that induce affect but are unrelated to the judgmental target or the decision being made [53]. In other words, feelings independent of a stimulus, such as mood states, can be misattributed to it or can have an effect on decision processes [54]. Similarly to integral affect, incidental affect can also influence judgments and decisions [58] (Figure 2). To sum up, the distinction between integral and incidental affect based on its relevance to decisions may provide the key to explaining the complex influence of affect on psychological processes.

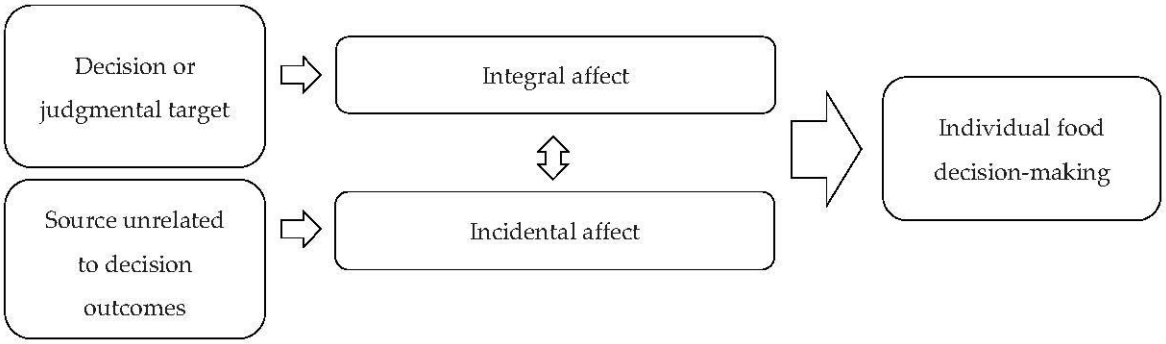

Figure 2. Integral and incidental affect and its influence on decision making.

Both mild incidental and integral affects are omnipresent in daily life [54] and interact with each other (Figure 2). Thus, a food consumption decision may be affected by two different types of affect: affect integral to the decision (food craving) and affect incidental to the choice (mood state). A previous review [52] has suggested that if integral and incidental affect is concurrently present, (1) integral affect dominates the overall response (a current incidental mood will have a significant effect on the overall judgment when integral affect is moderate or low in intensity), and (2) incidental affect has a significant influence on the integral response (when incidental affect is salient). In addition, the abovementioned review [52] has found that incidental affect congruent with the target may be beneficial to efficient decision making (it may amp up integral affect or the overall affective reaction), while incidental affect incongruent with the target may be detrimental (may attenuate the response).

Both integral and incidental affect play relevant roles in judgment and decision-making processes [54]. First, affect can act as information. Second, it can act as a spotlight concentrating people on different information depending on the extent of their affect and allowing them to compare the values of very different decision options or information. In this case, the two-step approach should be taken into consideration: (1) the extent

(e.g., weak vs. strong affect) or type of affective feelings (e.g., anger versus fear) focuses the decision maker on new information, and (2) the new information is utilized to guide the judgment or decision. Third, affect seems to be a motivator of information processing and behavior. Lastly, affect has been associated with the extent of systematic processing in decision making [54].

Subtypes of Incidental Affect

Incidental affect (affect that is unrelated to the decision) influences decision making (non-normative influence). There are two sources of incidental affect: dispositional (trait) affect and situational (state) affect [53]. Dispositional affect is related to a tendency to respond in a special affective way to a diversity of events across time and situations. On the other hand, situational affect is affected by incidental moods and emotions and depends on the valence of the emotion and on specific emotion effects. Even minimal sensory cues can contribute to this type of affect and influence consecutive decision making [53]

2.3. Maladaptive Eating Behavior

Eating behavior is an umbrella term that includes food choice and motives, dieting, feeding practices and eating-related pathologies such as eating disorders and obesity [59]. Eating behavior is complexly affected by psychological, physiological, nutritional, sociological and cultural factors. The modern eating patterns followed by the U.S. population are not adjusted to the Dietary Guidelines: about three-fourths of the population consume an eating pattern low in fruits, vegetables, dairy and oils, and most of the population does not follow nutritional advice and does not follow added sugars, saturated fats and sodium recommendations (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Eating- and weight-related issues are highly prevalent in both the United States and Europe.

In the literature, three major maladaptive eating behaviors have been described: restrained eating, uncontrolled eating and emotional eating. It is worth pointing out that these types of maladaptive eating behaviors can be found in healthy, normal-weight individuals. Restrained eating is related to the intention to restrict food intake for the purpose of preventing weight gain or promoting weight loss [60]. Restrained eating is not equivalent to dieting, mainly because it solely illustrates the intent (not the action) of food restriction [61]. Nevertheless, restrained eating has often been linked to a total restricting dietary energy intake [62], a lower total energy intake [63] (e.g., lower meal and snack frequencies, breakfast skipping), disinhibited overeating as an effect of a loss of cognitive control [1] (restrained eating is under cognitive control rather than physiological one) and higher body mass index [60]. For decades, restraint theory indicated that restrained eating elicits counter-regulatory responses, reduces the sensitivity of the individual to satiety signals and leads to dietary disinhibition (associated with, e.g., overeating, loss of control over energy intake [64,65]. In the 1970s, laboratory-based studies revealed that individuals trying to reduce their energy intake for achieving weight control consumed more palatable foods with regard to high-calorie preloads [65]. This brought about the development of 'Restraint Theory' [1,6], according to which restrained eating is under the cognitive control of eating (e.g., eating in response to rigid dietary rules) and replaces eating in response to physiological cues. Sensitivity to internal cues for satiety is reduced and results in disinhibition and intake of large amounts of food that is not associated with hunger [35] in situations where cognitive control is weakened. Even a minor violation of rigid diet rules (e.g., by consuming high-calorie, "forbidden" foods) can lead to ignoring dietary rules (cognitive abandonment of the rule) to disinhibit the suppressed eating desires [1] and to overeating. Numerous studies have demonstrated that restrained eaters also increase food intake in response to negative emotions, possibly because these emotions deplete the cognitive resources needed for abiding by the dietary rules [29,66]. To sum up, evidence for emotional overeating is surprisingly inconsistent [66]. Cardi et al. [29] found evidence for emotional overeating in negative mood across studies among restrained eaters

and individuals with binge eating symptomatology [29], while a more comprehensive and recent meta-analysis questioned it [30]. The present meta-analysis has demonstrated that solely restrained eaters were found to be vulnerable to negative-emotion-induced eating, and negative emotions did not influence eating behavior amongst self-reported emotional eaters.

Uncontrolled eating (sometimes called external eating) is characterized by the overeating of unhealthy food in reaction to external food cues [3]. Individual differences in uncontrolled eating could be explained by two psychological processes. The first one is reduced cognitive control (processes that permit individuals to behave in a goal-directed manner, including inhibition, interference control, cognitive flexibility and working memory) [67]. The second process is automatic action tendencies towards external food cues, which are assumed to be modulated by reward networks in the brain [68]. The previous findings [69,70] have suggested that overconsumption in response to external cues may represent a general concept of uncontrolled eating characterized by low perceived self-control and high-calorie food consumption.

Emotional eating, also referred to as 'comfort eating' [71] or 'stress-induced eating' [21], indicates overconsumption in response to negative emotions [72]. Emotional eating involves a conscious or unconscious excess food consumption (including sweetened, salty or fatty foods) for reasons other than physical symptoms such as hunger. Emotion-congruent eating versus emotion-regulating eating can explain the influence of emotions on the quantity and quality of food intake. Emotion-congruent eating means that positive emotions increase and negative emotions decrease the motivation and pleasure of eating. Emotion-regulating eating, also known as 'mood control eating,' explains that food intake serves to reduce unpleasant emotions (e.g., eating ice cream to relieve sadness) [73]. Several explanations regarding the psychological mechanism of emotional eating have been proposed. Psychosomatic theory underlines that overeating in response to negative emotions results from a lack of interoceptive awareness (e.g., an internal sensation of hunger), the incapacity to differentiate hunger sensations from arousal because of other aversive internal states or eating as a way to reduce negative emotions [32]. Psychological models regarding emotional eating [74,75] emphasize overconsumption in response to negative emotions as a maladaptive emotion regulation strategy. Masking theory demonstrates that overeating is an attempt to misattribute perceived stress to eating in order to divert an individual's attention from the original source of distress [74]. It is worth pointing out that while learning theories indicate that emotional overeating primarily fulfils an emotional regulatory function, cognitive theories indicate that emotional overeating results from disinhibition rather than from emotional regulation [66]. According to all these theories, before overeating occurs, individuals are unable to regulate negative affect that they experience, inducing them to use a maladptive strategy they do have access to, namely, overeating [66]. This suggests that the problem is not necessarily related to negative emotional experiences per se but rather with the absence of adaptive emotion regulation strategies available to regulate negative affect. Recent reviews have demonstrated inconsistent results as to which theory best explains emotional overeating [66].

Emotional eating may be the outcome of lower interoceptive awareness, difficulty with recognizing physiological cues of hunger or satiety and emotion regulation difficulties [76–78]. Emotional eating has also been found to be associated with overeating, excessive intake of sweet, high-fat and energy-dense foods [79], weight gain and difficulties losing weight [80], depression [81], overweight and obesity [81] and poor inhibitory control [69]. The findings propose that emotional eating might be an indicator of overconsumption generally and not specifically in the presence of negative or positive [29,69] emotions.

3. Affect Regulation and Maladaptive Eating Behavior

Affect regulation is fundamentally considered as a mechanism by which individuals initiate, maintain, modulate or change the occurrence, intensity or duration of their own

emotions, moods and feelings [82] so as to pursue an affective equilibrium or homeostasis (maximize pleasant experiences and minimize unpleasant ones) [83]. According to [9], affect regulation is superordinate to coping, emotion regulation, mood regulation and traditional ego-defensive processes. One of several major forms of affect regulation is emotion regulation.

3.1. Emotion Regulation Strategies

The previous section showed that negative affect is a source of many difficulties connected with eating. Therefore, downregulating negative affect could lead to improvements across a wide variety of maladaptive eating behaviors. For this, adaptive emotion regulation is advisable for successfully reducing negative affective states, strengthening or controlling positive affective states and restoring emotional balance [84].

Emotion regulation has been described as a subtype of both behavioral self-regulation and coping [85]. Emotion regulation as a construct has been described in a number of different ways. One of the best-known models [9,86] defines emotion regulation as the efforts individuals engage to impact the experience and expression of their emotions. Emotion regulation strategies are comprised of two components: antecedent- and response-focused strategies [87]. Antecedent-focused strategies are adopted before the complete activation of emotion response tendencies has taken place and have changed behavioral and peripheral physiological responding, whereas response-focused strategies appear once an emotion is already underway, thus, after the response tendencies have been generated [86]. There are two prototypical strategies that are commonly used in daily life: cognitive reappraisal and expressive suppression [86]. The first one is an antecedent-focused strategy that requires reframing or changing the way of thinking about an emotion-prompting situation in order to change the emotional effect of a situation once it has occurred. Expressive suppression, on the other hand, is a response-focused strategy that entails actively inhibiting the internal experience and external expression of emotion after emotional activation has occurred [86]. These two strategies differ in the required amount of self-regulatory resources and have different consequences. Generally, cognitive reappraisal appears to change the primary appraisals of emotional stimuli without the need for persistent self-regulatory effort over time [88]. It is associated with less experience and less expression of negative emotion, less physiological activation and more positive experience of emotion, which means that this strategy can be regarded an adaptive emotion regulation strategy. In contrast, expressive suppression entails active efforts to inhibit dominant responses, resulting in comparatively greater "resource depletion" than reappraisal [28]. It is associated with increases in physiological responding and decreases in behavioral expression, but it ends in failure to reduce the experience of emotion, which is why this strategy can be regarded as a maladaptive one [89].

It has been noted that some individuals use eating as a strategy to regulate their emotions. The means in which emotions are regulated influence eating behavior [28]. Some individuals become involved in eating as a way to downregulate negative emotions, which is likely because of using more maladaptive emotion regulation skills. Impaired emotion regulation is related to difficulties in regulating eating behavior. Deficits in emotion regulation skills result in dysregulated (overeating sweet or high-caloric foods) or overregulated eating behavior, which may result in underweight, malnutrition or excess body weight (Figure 3). The regulation strategies used to cope with negative emotions are responsible for increased eating (emotional eating). It is worth pointing out that the use of more adaptive emotion regulation strategies (e.g., cognitive reappraisal) might result in reducing maladaptive eating behavior. Cognitive reappraisal has been widely theorized to be protective against psychopathology [90], eating pathology and eating-related symptoms (medium to large effect size) [91]. Thus, it is plausible that cognitive reappraisal strategies, in particular those concentrating on the benefits of not eating, could potentially enhance the capacity to reduce unhealthy food intake [92]. We argue that using cognitive reappraisal might be useful in downregulating integral negative affect associated

with food by improving eating behavior (making more very healthy choices and fewer unhealthy ones, i.e., placing a higher weight on health when making dietary decisions).

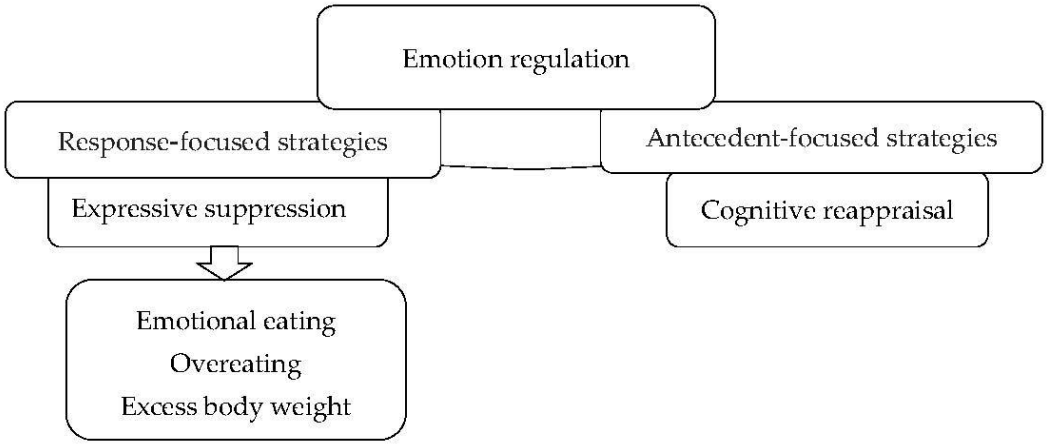

Figure 3. Emotional eating as a consequence of maladaptive emotion regulation strategy.

Emotion dysregulation has been described as a potential transdiagnostic risk factor [93] and a robust correlate of disordered eating behaviors (including a spectrum of maladaptive eating behaviors and cognitions linked to negative psychological and physiological health outcomes). Emotion regulation difficulties are related to increased binge eating [94], dietary restraint [95] and eating pathology in general [91]. Emotion regulation has mostly been recognized as a correlate of emotional eating [28,96]. Recently, Braden and colleagues [96] examined the psychological (emotion regulation and disordered eating behaviors) correlates of emotional eating across negative and positive emotional eating dimensions, determining that negative emotional eating was linked to increased emotion regulation difficulties and disordered eating behaviors. These data are consistent with research founding a positive association between negative emotional eating and emotion regulation difficulties [78].

Most studies have shown that suppression is linked to higher levels of distress and cognitive reappraisal appears to enhance subsequent behavioral self-regulation outcomes [86,88]. In addition, suppression is related to poorer behavioral self-regulation. There are few laboratory-based studies testing the impact of emotional suppression and cognitive reappraisal on eating behavior following negative mood induction. Vohs and Heatherton [97] found that when participants were requested to suppress their emotional reactions (they watched a stimulus video clip planned to induce negative affect), they reported higher levels of food intake, particularly ice cream, demonstrating that suppression is related to decreased subsequent behavioral restraint. Evers and colleagues [28] employed similar emotion-induction procedures but evaluated the impacts of habitual or trait emotion regulation styles (high or low suppression, and high or low cognitive reappraisal) of food consumption [28]. Suppression moderated the relation between sad mood and food intake, such that high suppression participants consumed considerably more than participants who do not frequently make use of suppression. In addition, the previous study demonstrated that suppression was equally efficacious as acceptance in limiting reported chocolate consumption over a week [98]; however, those in the suppression condition consumed significantly more chocolate during the follow-up laboratory session.

Previous research [28] has demonstrated that maladaptive emotion regulation strategies resulted in increased comfort food intake (sweet or salty foods) compared with adaptive strategies and with spontaneous emotion expression. The findings also revealed that (1) individuals regularly using suppression ate more when being emotional than individuals rarely using this strategy and (2) participants who suppress their negative emotions consumed more comfort foods than those who reappraise their emotions. To sum up,

these mixed results confirm the thesis that the way people regulate their negative emotions modulates the amount of food intake.

Taut, Renner and Baban [99] investigated the effects of negative emotions (fear, negative affect) and emotion regulation strategies (suppression, cognitive reappraisal) on food consumption in a neutral control condition where participants chose whether and how much they desired to consume and also whether they wanted to consume at all (ad libitum food intake). The authors examined whether participants use eating as a secondary coping strategy when emotion regulation is ineffective. The majority of participants in the reappraisal group were less likely to consume both chocolate and crisps in comparison to the control and suppression groups. However, among individuals who ate, there was no difference in the amount consumed across conditions. Thus, the main discrepancy between the three emotion regulation strategies appears to be whether or not eating is utilized as a secondary regulation strategy at all rather than differences in the amount of food required for secondary regulation as indicated in previous research [28]. The main difference between suppression and reappraisal is whether or not eating is needed as a secondary coping strategy, rather than differences in the amount of food intake per person as proposed in the study by Evers et al. [28]. The findings indicate that when individuals are faced with a negative event, eating is employed as a secondary coping strategy when the adopted emotion regulation strategy is ineffective. Inversely, an adaptive emotion regulation strategy, such as reappraisal, reduces the probability of food consumption, even when emotion regulation is utilized during rather than before the unfolding of the negative event. Thus, the means people cope with negative emotions might be more appropriate for elucidating emotional eating than the distress itself [28].

Cognitive reappraisal, such as thinking of long-term health consequences of eating unhealthy food when regarding images of such foods, enhances inhibitory region activation (less inhibitory control is connected with greater weight gain), decrease reward region (hyper-responsivity of the reward region contributes to overeating) and attention region activation, as well as to prevent weight gain [100]. A recent study [101] has shown that cognitive strategies reduce unhealthy and enhance healthy food consumption (craving). Thus, changes in craving may affect the consumption of both healthy and unhealthy foods. These findings evidence that training-based interventions (specifically, regulation of craving training) affect eating behavior (increasing healthy food choices in the face of enticing unhealthy options) and can reduce unhealthy eating (reducing total caloric consumption, particularly of high-caloric or unhealthy foods) [101] and might be beneficial in helping people enhance their recruitment of inhibitory regions when faced with high-fat or high-sugar foods [100].

3.2. Applying Affect Regulation to Incidental Affect in the Context of Eating

Understanding how incidental affect influences food intake is an important topic. The previous studies showed that incidental affect influences in-store shopping [102] and in-home food choice [103]. In addition, the findings showed that incidental affect (sadness and happiness) impacts food consumption within a general population [104]. A previous study [104] showed that incidental affect influences consumption levels at the individual level. Consumption levels of a hedonic product are lower for individuals in a state of happiness than for those in a state of sadness. In other words, while sad individuals presented a substantial refuse in their consumption, happy individuals appeared to be unswayed by nutritional information. Thus, it seems that happy people are already avoiding food intake, and the presence of nutritional information does not force their food intake any lower. Conversely, sad people took of liberty of trying and overcoming their negative state by eating more (in the information-absent condition) [104]. This study also showed that happy people consumed more raisins in comparison with sad people. In the lack of mood-changing cues, affective evaluation predominates, therefore, people comport according to their mood state (i.e., happy people have positive evaluations and

tend to consume more, while sad people have negative evaluations and tend to consume less) [104].

4. Directions for Future Research

The present review has shown that negative affect is a source of many difficulties connected with eating. Therefore, downregulating negative affect could lead to improvements across a wide variety of maladaptive eating behaviors. For this, adaptive emotion regulation is advisable for successfully reducing negative affective states and strengthening or controlling positive affective states [85].

A rich literature has shown that people can and do use a host of different affect regulation strategies to regulate affective responses including stress responses and negative emotions and moods [85]. Maladaptive emotion regulation strategies (such as suppression of emotions) are positively associated with emotional eating [76]. While suppression appears to be maladaptive in terms of increased comfort food intake in comparison to reappraisal [28], reappraisal seems to be related to reduced food intake. Correlational studies found that negative affect did not predict eating behavior among non-clinical samples [28,99], however many limitations exist in the previous and current studies, therefore further research in this area is needed. In addition, the exact process of emotions affecting eating behavior is still uncharted.

Cognitive reappraisal applied to incidental affect might be more effective than some of prior efforts. Additional studies are needed in order to further investigate the effect that specific emotion regulation strategies have on maladaptive eating behavior in normal-weight individuals. These results could provide worthwhile insights into the emotional mechanisms underlying maladaptive eating behavior.

Narrative review is the limitation of the present work. Future work should focus on a systematic review, currently widely considered as studies with the highest level of evidence, and follow a set of strict established guidelines, such as PRISMA or Joanna Briggs Institute guidelines.

In addition, in an ongoing global pandemic of coronavirus disease, individuals can present unfavorable changes in eating behavior [105], therefore, it would be needed to investigate changes in eating behavior and emotion regulation in normal weight individuals during the COVID-19 pandemic.

5. Conclusions

The scientific literature (field and experimental studies) provides clear evidence that negative emotions and maladaptive emotion regulation strategies influence maladaptive eating behavior. It is assumed that moderate arousal or moderately intense emotions affect eating [30].

It is plausible that increased food consumption may be an attempt to downregulate negative emotion. The previous research has demonstrated that the way in which individuals cope with negative emotions (rather than experience negative emotions) may determine the influence of emotion on eating behavior [28]. The more "costly" an emotion regulation strategy is in terms of consuming self-regulatory resources, the more individuals are likely to increase food intake as a secondary regulation strategy [99]. Continuous involvement in self-regulatory acts (such as abstaining from eating or regulating one's emotion states) could lead to resource depletion and a reduction in skill to self-regulate at a later point [106].

Some individuals use eating in order to face their negative emotions and regulate them. That leads to increased or decreased eating and is linked to an increased use of maladaptive emotion regulation strategies. Therefore, it is important to teach normal-weight individuals to use more adaptive emotion regulation strategies to properly manage their emotions and affect. Maintenance of advantageous emotion regulation is necessary in those people in order to have adaptive eating behavior without over-control or loss of control over eating. The use of more adaptive strategies for emotion regulation (cognitive reappraisal) might

reduce maladaptive eating behavior. Therefore, effective interventions can help to sustain eating behavior change.

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