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See the cake and have it too? Investigating the effect of watching a TV cooking show on unhealthy food choices

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ABSTRACT

This study tested whether exposure to food-related (vs. non-food related) TV content would increase unhealthy food choices in unsuccessful restrained eaters (i.e., chronic dieters with low perceived self-regulatory success; PSRS), decrease unhealthy food choices in successful restrained eaters (i.e., chronic dieters with high PSRS), and would not affect food choices in unrestrained eaters (i.e., non-dieters). As such, we attempted to (1) explain previous mixed findings on behavioral effects of exposure to food-related TV content, and (2) generalize previous findings on successful and unsuccessful restrained and unrestrained eaters' differential reactivity to isolated food cues (e.g., food words) to food cues embedded in TV content. In a one-factorial between-subjects experiment, participants viewed a cooking segment in which high-calorie cakes were prepared (n = 50) or a non-food segment (n = 62) of a TV show. The percentage of unhealthy (vs. healthy) food choices in a computerized choice task served as dependent variable. Eating restraint and PSRS were measured afterwards. In contrast to the hypothesis, no three-way interaction between TV content, eating restraint, and PSRS on the percentage of unhealthy food choices was found. However, it was found that overall, people with lower levels of PSRS made a higher percentage of unhealthy food choices compared to people with higher levels of PSRS. Contrasting findings from previous research using isolated food cues, this study showed no evidence of unsuccessful restrained eaters' heightened susceptibility to food cues in TV content, possibly explained by a lower salience of or attention to food cues.

1. Introduction

Watching TV programs related to food and cooking has become an increasingly popular form of entertainment [9, 16]. Nowadays, a wide variety of cooking programs is available, such as cooking competitions (e.g., *MasterChef, Top Chef*), travel cooking shows (e.g., *Gordon Ramsay: Uncharted*) and entertainment/talk shows containing cooking segments (e.g., *The Rachael Ray Show*). The preparation of food in these programs is often presented in an amusing and visually appealing way, and the dishes that are displayed are often high in calories, fat, sugar, and/or salt, but low in nutritional value (hereafter referred to as 'unhealthy'; [9, 35]).

It has been proposed that repeatedly seeing palatable, but unhealthy food cues on TV can be problematic as it may trigger food intake and thereby contributes to the development of overweight and obesity (e.g., [9]). Consistent with this, some previous experimental research found that watching food-related TV content (i.e., snack food commercials or a cooking show) increased food intake compared to watching non-food related TV content (i.e., non-food commercials or a nature show; [8, 28]). However, in other studies no such effect was found [7, 10, 36].

One likely explanation for these inconsistent findings is that the effects of food-related TV content on eating behavior (i.e., food choices and intake) may depend on individual differences in sensitivity to the influence of palatable food cues. More specifically, previous research has found that people who are chronically dieting (i.e., restrained eaters) but are relatively unsuccessful in their dieting attempts (i.e., have low perceived self-regulatory success; PSRS) show heightened reactivity to palatable food cues compared more successful dieters (i.e., restrained eaters with high PSRS) and non-dieters (i.e., unrestrained eaters; [22, 43, 54]). So far, however, research investigating reactivity to palatable

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food in successful and unsuccessful restrained and unrestrained eaters has mainly used isolated food cues (i.e., written words representing food, or bowls with food presented on a table in the laboratory). However, in our daily lives we frequently encounter food cues embedded within a certain context, such as on TV. Such food cues are part of more complex stimuli (i.e., usually a narrative, in which food cues are presented alongside other cues), and it remains to be tested whether exposure to food cues embedded in TV content produces effects similar to isolated food cues.

The aim of the current study was therefore to test whether exposure to food-related (vs. non-food related) TV content affected eating behavior depending on individual differences in eating restraint and PSRS. Eating behavior was operationalized by employing a computerized food choice task paradigm in which participants responded to 20 target trials, each consisting of pictures of one healthy and one unhealthy food item. As such, this study attempted to explain mixed findings of previous research on effects of food-related TV content on eating behavior, as well as to generalize previous findings on successful and unsuccessful restrained and unrestrained eaters' differential reactivity to (isolated) food cues to food cues embedded in media content.

1.1. Food cues and (un)successful restrained eating

Not all people are equally susceptible to the influence of food cues, and much research in this area has focused on restrained eating (for an overview, see [44]). Restrained eaters are people who are chronically concerned with their weight and diet, and when exposed to external food cues they may spontaneously generate hedonic cognitions about food (i.e., thoughts related to eating enjoyment; [42]). Unrestrained eaters are generally not concerned with their weight and for them, food cues are less likely to trigger such spontaneous cognitions. Instead, they are thought to focus more on informational aspects of food (e.g., nutritional value; [48]). However, research comparing restrained and unrestrained eaters' reactivity to food cues is not always consistent, as multiple studies have reported no differences between the two groups, for instance regarding craving [37], attention to food [59], and food intake [40, 55].

This may be because the group of restrained eaters likely consists of both successful and unsuccessful dieters who differ in their reactivity to food cues [49, 56]. Over the past years, researchers have started to use the PSRS scale by Fishbach et al. [22]; see also [38] to distinguish between more and less successful restrained eaters and their reactivity to palatable food cues (e.g., [3, 37, 43, 54]). The goal conflict model of eating proposes that even though both successful (i.e., with relatively high levels of PSRS) and unsuccessful (i.e., with relatively low levels of PSRS) restrained eaters are tempted when exposed to palatable food, successful restrained eaters automatically exert self-control when encountering such cues [49]. This is thought to occur because successful restrained eaters have likely developed strong facilitative links between palatable food cues and the activation of higher-order mental dieting goals, as a result of repeatedly and successfully using self-control in response to previous encounters with palatable food cues in the past [22]. Because of the absence of such strong facilitative links in unsuccessful restrained eaters, they may often fail to stick to their dieting goals when exposed to food cues, and engage in unhealthy eating behavior instead [49].

Consistent with these notions, empirical research has found that after exposure to palatable food cues (i.e., words representing food), but not after non-food cues (i.e., words or letter strings unrelated to food), dieting goals were more accessible in the mind of successful restrained eaters and less accessible in the mind of unsuccessful restrained eaters, as evidenced by differential reaction times to recognize diet-related words [22, 43]. There is also evidence for effects on eating behavior in line with these goals. After exposure to palatable food words (vs. non-words), unsuccessful restrained eaters showed more effort into obtaining high-calorie food, while successful restrained eaters showed more effort into obtaining low-calorie food [54]. Furthermore, another study found that after looking at bowls with unhealthy food (compared to bowls with non-food objects, such as bath salts), unsuccessful self-regulators (but not successful self-regulators) consumed more calories from unhealthy food [30].

1.2. Isolated food cues vs. food cues in TV content

The evidence on successful and unsuccessful restrained eaters' differential reactivity to food cues, as discussed above, is largely based on isolated food cues. That is, the food cues were words representing food [22, 43, 54], or real food in an isolated context [30]. However, in daily life, people often encounter food cues that are embedded within a context, for instance in TV content [9, 13]. In a cooking show, for example, food cues are part of a narrative in which the cook prepares the food and often interacts with other people (e.g., a celebrity invited to the show). Food cues embedded in such a context are likely more complex, and are therefore difficult to compare to words representing food or actual food. Food cues embedded in TV content could be more influential compared to isolated cues because the viewer might experience narrative transportation when watching TV content, which could lead to stronger effects [27, 39, 61]. It is also possible that food cues on TV are less influential, for example because of the presence of other cues that divert attention away from the food cues (e.g., the cook and celebrity talking about topics unrelated to the food; [62]). Or, it may be the case that food cues are influential regardless of the context in which they are presented.

Some initial evidence that differences between successful and unsuccessful restrained eaters also apply to food cues embedded in TV content was found by Alblas et al. [3]. Exposure to a cooking segment (vs. a non-food related segment) of a TV show briefly resulted in increased mental accessibility of a hedonic eating goal (i.e., the goal to eat palatable food) among unsuccessful restrained eaters, and in less accessibility of this goal among successful restrained eaters. Even though increased goal accessibility likely results in behavior in line with this goal [1, 6, 24], it remains to be investigated whether unsuccessful restrained eaters also engage in unhealthy eating behavior after watching food-related TV content.

The current study therefore tested whether exposure to food-related TV content (i.e., a cooking segment of a TV show) vs. non-food related content affected food choices depending on levels of eating restraint and PSRS. These individual differences could possibly explain mixed findings of previous experimental research on behavioral effects of exposure to food-related TV content (e.g., [7, 10, 28]). Based on the discussed theoretical and empirical research, it was expected that unsuccessful restrained eaters – due to their low-self regulatory success – would be particularly susceptible to the influences of watching food-related (vs. non-food related) TV content, and as such exposure would for them result in more unhealthy food choices. In contrast, successful restrained eaters were expected to make less unhealthy food choices after watching food-related TV content due to facilitative links between tempting food situations and automatic activation of their dieting goals. As unrestrained eaters have been found relatively insensitive to external food cues [44, 48], their food choices were expected to be unaffected by exposure to food-related TV content. The following three-way interaction between TV content, eating restraint, and PSRS was therefore proposed:

H1. A three-way interaction between TV content, eating restraint, and PSRS is expected. Exposure to a cooking segment, compared to a non-food related segment of a TV show, results in more unhealthy food choices among unsuccessful restrained eaters (i.e., people high in eating restraint but low in PSRS) and in less unhealthy food choices among successful restrained eaters (i.e., people high in eating restraint and high in PSRS). Among unrestrained eaters (i.e., people low in eating restraint), unhealthy food choices are unaffected by exposure to the TV content, irrespective of levels of PSRS.

2. Materials and methods

2.1. Design and participants

In a single factor between-subjects experiment, participants were exposed to a cooking segment ($n = 50$) or a non-food segment ($n = 62$) of a TV show. A power calculation was performed in G*Power to estimate the required sample size [19]. To test the hypothesis with linear multiple regression estimating all possible main and interaction effects of condition (i.e., food-related vs. non-food related segment), eating restraint, and PSRS, using an expected medium effect size of $F^2 = 0.15$ (based on [43]), α of 0.05 and power of 0.80 this resulted in a required sample size of $n = 103$. Taking into account potential dropout, a total of 154 participants were recruited at the university and took part in the experiment. Several participants were excluded because they indicated that they did not eat the food presented in the TV show due to allergies ($n = 10$) or other restrictions (e.g., veganism, religious considerations; $n = 11$), or because they strongly disliked the food in the food segment ($n = 16$). Further, three participants were excluded because they responded very fast (i.e., below 300 milliseconds [ms]; [41]) or not within the maximum time they were given to respond (i.e., 3000 ms) on more than 10% of the trials in the choice task. Finally, two participants were excluded because of technical errors. All exclusion criteria were decided upon before data collection and based on previous work [3]. Additional analyses, testing the hypotheses without applying the exclusion criteria, showed no changes in the conclusion regarding significance of the three-way interaction (tested at $p < .05$). The final sample therefore consisted of 112 participants (90 females, 22 males; $M_{age} = 20.93$, $SD_{age} = 2.16$). In exchange for their participation, participants received course credit or €5. The study was approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of the University of Amsterdam and informed consent was obtained from all participants at the beginning of the experiment.

2.2. Procedure

Participants were tested individually in the university laboratory. They first read the cover story which pertained to attention for media content, then provided consent and answered questions assessing participant characteristics and hunger. Next, participants were randomly assigned to either the food-related or the non-food related TV content condition and watched the TV show segment. When finished, they completed the computerized food choice task and subsequently a questionnaire measuring eating restraint, PSRS, and how tasty they found each of the foods in the choice task. Finally, participants were asked what they thought the goal of the experiment was. Only few participants showed insight into the goal of the experiment ($n = 5$), indicating that our cover story had been successful. Additional checks showed that excluding these participants from the analyses did not change the conclusion regarding significance of the three-way interaction (tested at $p < .05$), which provides further evidence that participant awareness did not confound the study results. Upon completion of the study, participants were thanked for their participation, and they were offered a snack which they could freely choose from a bowl with mini candy bars and tangerines. After all data was collected, participants were debriefed about the goal of the study via e-mail.

2.3. TV content

The stimulus materials consisted of two segments of a talk show called *The Rachael Ray Show*. Participants in the food-related content condition viewed a cooking segment in which two high-calorie cakes were baked, whereas participants in the non-food related content condition viewed a segment in which funny science experiments were conducted. A pretest among 22 participants (18 females, 4 males; $M_{age} = 26.82$, $SD_{age} = 2.09$), who did not participate in the main experiment, confirmed that the cakes in the selected segment scored relatively high on food appeal and desire to eat ($M_{food\ appeal} = 68.32$, $SD_{food\ appeal} = 23.85$; $M_{desire\ to\ eat} = 52.05$, $SD_{desire\ to\ eat} = 28.55$; on a scale from 0 [*not appealing at all / no desire to eat at all*] to 100 [*extremely appealing / extreme desire to eat*]) but low on perceived healthiness ($M = 1.47$, $SD = 0.67$; on a scale from 1 [*not healthy at all*] to 7 [*extremely healthy*]). Furthermore, *The Rachael Ray Show* was generally unfamiliar in our target audience ($M = 1.09$, $SD = 0.43$; on a scale from 1 [*unfamiliar*] to 7 [*very familiar*]), and the food and the non-food related segment were rated as equally entertaining, $t(21) = 0.36$, $p = .972$. The segments were therefore deemed suitable to use in the experiment, as it would be unlikely that prior knowledge about the content of the show, or differences in perceived entertainment level between the conditions, could influence responses.

2.4. Measures

2.4.1. Eating restraint

Eating restraint was assessed with the Concern for Dieting subscale of the Restraint Scale ([45]; Dutch translation by [32]). With six items, this subscale measures chronic dieting motivation for weight control. Example items are "How often are you dieting?" (1 = *never*, 5 = *always*) and "How conscious are you of what you are eating?" (1 = *not at all*, 4 = *extremely*). The mean summed score was 13.66 ($SD = 3.14$, α = 0.65, range 7–23; scores did not differ between the two experimental conditions, $p > .10$). An overview of descriptive statistics of this as well as other measures can be found in Table 1.

2.4.2. PSRS

To measure perceived dieting success, PSRS was assessed with three items [22]: "How successful are you in losing weight?" (1 = *not successful*, 7 = *very successful*), "How successful are you in watching your weight?" (1 = *not successful*, 7 = *very successful*), and "How difficult do you find it to stay in shape?" (1 = *not difficult*, 7 = *very difficult*, reversed coding). The mean score was 4.17 ($SD = 1.26$, α = 0.61, range 1–7; scores did not differ between the two experimental conditions, $p > .10$).

2.4.3. Unhealthy food choices

Unhealthy food choices were assessed in a computerized choice task (based on [51]) which was programmed in Inquisit 4 [31]. Food choice tasks are considered a suitable method to assess individual decisions about eating behavior [23, 47], and food choices made based on pictures

Table 1
Descriptive Statistics of All Included Variables.

	Frequencies	*M (SD)*	*Range (possible range)*
Sex	80.4% female 19.6% male		
Handedness	83.0% right-handed 15.2% left-handed 1.8% ambidextrous		
Age		20.93 (2.16)	18–29
BMI		21.95 (3.36)	16.65–36.98
Hunger		36.66 (28.36)	0–100 (0–100)
Tastiness of foods in the choice task		6.47 (0.71)	4.78–8.63 (1–9)
Eating restraint (6 items, summed score)		13.66 (3.14)	7–23 (6–25)
PSRS (3 items, mean score)		4.17 (1.26)	1–7 (1–7)
% Unhealthy food choices in the choice task		51.97 (24.83)	0–100 (0–100)

of food in a computerized task are found to correlate with actual food intake [12]. Every trial in the task started with a blank screen for 500 ms, followed by a fixation cue (*), which was presented in the middle of the screen for 1000 ms. Next, two pictures of objects appeared. Participants were instructed to choose the object they would like to have the most at that moment, by pressing either the left shift key (with their left hand) or the right shift key (with their right hand). The choices in the task represented actual food choices for participants, as they were told they would receive one of their chosen objects by the end of the session (see also [52]). Participants were instructed to not think too long but decide based on their first impression. They were also informed that if they did not make a choice within 3000 ms (cf. previous research using food-related choice tasks; (42017) [51]), the computer would decide for them. As soon as the participant had chosen, or 3000 ms passed, the next trial started.

The choice task started with three practice trials with pictures of household objects, after which participants responded to 52 trials (randomly presented in two blocks of 26 trials with a 30-second break in between). The target trials consisted of 20 different healthy vs. unhealthy food pairs: chocolate bar vs. raspberries (depicted in Fig. 1), bonbons vs. cherries, pizza vs. red bell pepper, fries vs. mixed red fruit, chocolate muffins vs. mixed yellow fruit, ice cream vs. blackberries, Kinder Bueno chocolate vs. nectarine, biscuits vs. kiwifruit, smarties vs. cucumber, brownies vs. salad, crisps vs. yellow bell pepper, KitKat chocolate vs. orange, cake vs. melon, paprika flavored crisps vs. tangerine, Mars chocolate vs. pear, blueberry muffin vs. apple, profiteroles vs. red currant, wine gums vs. tomatoes, donut vs. orange bell peppers, mixed sweets vs. carrots. The other 32 trials were filler trials which served to mask the purpose of the task. These included trials with two office-related objects, two foods of the same category (e.g., both healthy food) and office-related vs. (healthy or unhealthy) food objects. All pictures were obtained from a standardized image database [14]. Based on the ratings as provided in the database, the pictures for the target trials were selected on perceived healthiness (low vs. high) and expected calories (low vs. high) to ensure there was a clear distinction between the healthy and unhealthy food in each of the target trials.

After removing very fast trials (i.e., choices made within less than 300 ms) and trials on which no choice was made within 3000 ms, the percentage of unhealthy choices from the target trials was calculated and served as the dependent variable. The mean percentage of choices for unhealthy food was 51.97 (SD = 24.83, range 0–100). The average latency of making the target choices was 1040.29 ms (SD = 342.52, range 426.28 – 1908.90).

2.4.4. Participant characteristics, hunger, and tastiness of food

Participants' age, sex, handedness (left/right), and body height and weight were assessed. Body mass index (BMI) was calculated afterwards as weight in kilograms divided by height in meters squared. In addition, before watching the TV segment participants were asked to report their hunger level on a scale from 0 (*not hungry at all*) to 100 (*extremely hungry*). At the end of the experiment, participants rated the tastiness of each of the foods in the choice task on a scale from 1 (*not tasty at all*) to 9 (*very tasty*).[2]

2.5. Analyses

Initial checks showed that the data met the assumptions for parametric statistics. Correlational analyses were then performed to test the influence of the participant characteristics and hunger on the percentage of unhealthy choices made, in order to decide whether control variables needed to be included in the main analyses. To test H1, PROCESS was used as a macro in SPSS [29]. A moderated moderation model (number 3) was chosen with TV content as the independent variable, eating restraint and PSRS as continuous moderators and the percentage of unhealthy choices as the dependent variable. All predictors were mean centered in the analyses [2].

3. Results

3.1. Influence of participant characteristics and hunger

To check for potential confounding variables, the relationship between the participant characteristics and hunger and the percentage of unhealthy food choices was examined. The percentage of unhealthy food choices was not related to age, sex, handedness, BMI, or hunger (all $ps > 0.10$). No covariates were therefore included in the main analyses.

3.2. Unhealthy food choices

H1 stated that watching a cooking segment of a TV show, compared to a non-food related segment, would result in more unhealthy food choices among people relatively high in eating restraint but low in PSRS (i.e., unsuccessful restrained eaters), in less unhealthy food choices among people relatively high in both eating restraint and PSRS (i.e.,

[2] The variables below were additionally measured for several reasons (as specified below). The influence of the potential moderating variables and variables related to underlying processes was exploratorily assessed to gain further insight into the study findings. However, none of these variables led to different conclusions regarding the hypothesized three-way interaction nor did they provide insights on processes, so they are not further discussed. Data from all additional measures is available from the first author upon request. *Background variables (assessed for participant recruitment for another study)*: mother tongue, country of origin, use of glasses / contact lenses. *Variables related to the stimulus materials (assessed to confirm findings of the pretest in the study sample):* entertainment value of the TV show [18], familiarity with the TV show. *Potential moderating variables (assessed to explore the influence of potential moderators other than eating restraint and PSRS):* impulsivity [60], current dieting status, trait self-control [50], success in dieting and losing weight, The Dutch Eating Behavior Questionnaire (DEBQ; [57]), depletion before watching the TV segment [34]. *Variables related to underlying processes (assessed to gain insight into processes explaining potential behavioral effects):* hunger after exposure to the TV segment, the use of self-control and concentration during performing the choice task [33], and – only in the food-related content condition – how appealing the food present in the cooking segment was, and whether participants felt the desire to eat this food. *Filler questions (assessed to mask the purpose of measuring hunger levels before and after exposure to the TV segment):* levels of stress, tiredness, energy, happiness, and fullness.

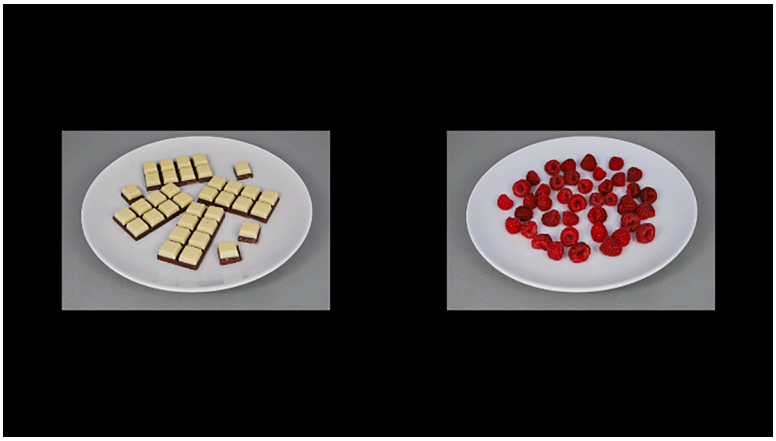

Fig. 1. Visual presentation of one of the target trials in the food choice task. The food pictures were obtained from Charbonnier et al. [14].

successful restrained eaters), and that it would not affect unhealthy food choices among people relatively low in eating restraint (i.e., unrestrained eaters).

The expected three-way interaction between TV content, eating restraint, and PSRS was not significant, $B = -0.00$, $SE = 1.30$, $t = -0.00$, $p = .999$, *95% CI* [−2.58, 2.58]. H1 was therefore not supported. However, it was found that independent of TV content and eating restraint, people with lower levels of PSRS made a higher percentage of unhealthy food choices compared to people with higher levels of PSRS, $B = -4.03$, $SE = 1.89$, $t = -2.13$, $p = .036$, *95% CI* [−7.79, −0.28]. The other main and two-way interaction effects were not significant. Details of all results can be found in Table 2.

3.3. Exploratory analyses

Three exploratory analyses were additionally performed. First, some previous research suggested that food exposure only affects reactivity to the cued food or the food category it belongs to, but not other types of food [20, 21]. To explore this possibility, the hypothesis was tested again, but with only the sweet food choices of the choice task (as the cooking segment depicted sweet cakes). Second, as previous research showed that watching a cooking segment only shortly affected goal accessibility [3], it is possible that effects on food choices were only short-lived as well. The hypothesis was therefore tested with only the choices of the first block in the choice task (approximately 10 choices, but this differed slightly per participant because the order of all trials was random across the two blocks). Third, the perceived tastiness of food is likely an important predictor of food choices [5, 52]. It could therefore be argued that differences between successful and unsuccessful restrained eaters are particularly found on trials in which the unhealthy food is perceived as tastier than the healthy food, because these trials require self-control (i.e., to choose the healthy, but less palatable food over the unhealthy, palatable food). To test this possibility, the hypothesis was tested with only the choices for which a participant rated the unhealthy food at least two points higher on tastiness than the healthy food (cf. [51]). However, none of these analyses led to different conclusions regarding significance of the three-way interaction (tested at $p < .05$).

Table 2
Effects of TV content, Eating Restraint, and PSRS on the Percentage of Unhealthy Food Choices.

					95% CI	
	B	*SE*	*t*	*p*	*LL*	*UL*
Percentage of choices for unhealthy food						
TV content	−8.33	4.77	−1.75	.084	−17.78	1.13
Eating restraint	0.30	0.77	0.39	.700	−1.22	1.82
PSRS	−4.03	1.89	−2.13	.036	−7.79	−0.28
TV content x eating restraint	−1.27	1.56	−0.81	.419	−4.37	1.83
TV content x PSRS	−4.42	3.81	−1.16	.247	−11.97	3.12
Eating restraint x PSRS	−0.53	0.62	−0.86	.392	−1.76	0.69
TV content x eating restraint x PSRS	−0.00	1.30	−0.00	.999	−2.58	2.58

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

4. Discussion

The present study attempted to explain previous mixed findings on behavioral effects of exposure to food-related TV content (e.g., [7, 10, 28]), and to generalize previous findings on unsuccessful restrained eaters' heightened susceptibility to isolated food cues [30, 54] to food cues embedded in TV content. However, in contrast to the hypothesis, no three-way interaction between TV content, eating restraint, and PSRS was found. More specifically, the results showed no evidence that watching food-related (vs. non-food related) TV content resulted in more unhealthy food choices for unsuccessful restrained eaters compared to successful restrained eaters (or unrestrained eaters).

An unexpected relationship between PSRS and the percentage of unhealthy food choices was found in the current study: participants who perceived themselves lower in self-regulatory success made more unhealthy food choices compared to participants who perceived themselves to be higher in self-regulatory success. This finding is consistent with previous research reporting associations between low self-regulation and increased unhealthy dietary choices [25, 46]. Findings from the current study further suggest that self-regulatory success is not only important for restrained eaters, but also for unrestrained eaters who are generally unconcerned with dieting and their weight. Why this relationship was found in the current study is not immediately evident, as the PSRS scale specifically measures success in dieting and losing weight, something that is deemed relevant for restrained, but not unrestrained eaters. However, some other research also found that PSRS predicts eating-related goals and behavior in both restrained and unrestrained eaters [3, 54]. Thus, even for people who are not concerned with their diet, self-regulation may play an important role in food choices. It should be noted that PSRS was not manipulated in the current research, and therefore no causal conclusions can be drawn from the association between a lower PSRS and a higher number of unhealthy food choices. Investigating the causality of this relationship may be a topic for future research.

The current study did not find evidence that mixed findings of previous research on the effects of food-related TV content on eating behavior (e.g., [8, 10, 28]) could be explained by individual differences in eating restraint and PSRS. Even though previous experimental

research showed that watching a cooking segment (vs. a non-food segment) of a TV show briefly resulted in increased mental accessibility of a hedonic eating goal among unsuccessful restrained eaters, and in less accessibility of this goal among successful restrained eaters [3], in the present study no evidence was found for behavior in line with this goal accessibility. Other variables may therefore be more likely to explain inconsistent effects of food-related TV content on eating behavior. Previous research has provided some avenues for further investigation into moderators of food exposure effects on TV, such as gender [4], transportability [61], and cognitive load [63]. In general, research on effects of food cues on TV – and in other media content – on eating behavior remains scarce, particularly in adults, and this topic requires additional investigation to better understand to what extent, why, and for whom exposure to food-related media content may affect eating behavior [11].

Furthermore, findings from the current study are in contrast with prior empirical investigations on differences between successful and unsuccessful restrained and unrestrained eaters' behavioral responses to (isolated) food cue exposure [30, 54]. While previous studies showed that exposure to palatable food cues (i.e., words and real food) resulted in increased effort to obtain unhealthy food and in actual unhealthy food intake in people who are unsuccessful (but not successful) in weight regulation [30, 54], the current study shows that these findings cannot be simply applied to food cues embedded in media content. A potential explanation for these differential findings is that isolated cues are likely more salient and/or more attentively viewed. For instance, in the study by Van Koningsbruggen et al. [54], written words representing a range of unhealthy foods were presented repeatedly on the screen (i.e., 15 times per food). In the study by Houben et al. [30], participants were instructed to intensively look at (real) food for 10 min, smell it, imagine how it would taste and even taste a small piece. In the current study using TV content, the food cues were likely less salient because they were embedded in content that contained other cues as well (e.g., the talk show host and the chef having a conversation), and participants were not instructed to pay specific attention to the food cues.

This potential explanation of cue salience and/or attention to the food cues accounting for differential effects of food cues in an isolated context compared to food cues a media context receives support from prior research [15, 53, 58, 62]. Coelho et al. [15] experimentally manipulated salience to food cues by instructing participants to either pay attention to food cues present in the testing room (i.e., by writing down their thoughts about the food; attended food cue condition) or to focus their attention on something else (i.e., by writing down a neutral story; incidental food cue condition). Exposure to the attended food cue condition (vs. a non-food cue condition) increased food intake of unsuccessful restrained eaters, but this effect was not found for the incidental food cue condition, suggesting that for unsuccessful restrained eaters only highly salient or attentively viewed food cues may result in food intake. Further evidence for the relation between salience of food cues, attentive viewing and eating behavior can be found in eye-tracking studies. For example, Zhang and Seo [62] reported that attention to food cues in pictures decreased when other cues presented alongside the food (i.e., in the background) were more salient. In turn, the duration of visual attention to food cues has shown to predict subsequent eating behavior [53, 58]. In future research, the influence of cue salience and/or attention should be further explored, for example by directly comparing isolated food cues vs. food cues embedded in TV content, or by instructing half of the participants to pay explicit attention to food cues in the TV content. In general, additional research should be conducted on how people respond to more naturally occurring food cues (such as in TV content), as based on the current research it appears that effects of food cues may differ based on the way these cues are presented.

A limitation of the current study is that effects of food cues were only studied with one type of TV content (i.e., a cooking show). However, food cues on TV appear in many ways [9, 17], such as in commercials, or more subtly in TV content that is not food-related per se (e.g., a sitcom or movie depicting a dinner scene). These different types of TV content may also differ with regard to the salience of food cues or the amount of attention allocated to these cues. For instance, exposure to food cues in TV commercials is usually shorter compared to a cooking show, and the cues may be viewed less attentively because of viewers' awareness of the persuasive intent of commercials. Differences in successful and unsuccessful restrained and unrestrained eaters' reactivity to food cues in other types of TV content could therefore be a topic of future investigation (see (42016), for a recent study on visual attention to subtly presented food cues in a talk show). Such research would also be valuable for replication purposes, as it would provide additional insights on the generalizability of previous findings with isolated cues to food cues in media content. If future studies find no evidence for successful and unsuccessful restrained eaters' differential reactivity to food cues in (other) media content either, a next step could be to employ equivalence testing or Bayesian statistics to examine potential evidence for a null effect.

Another limitation of this study is that even though the food cues were presented in a naturalistic way (i.e., embedded in actual TV content), participants watched the TV show in a laboratory context. This should be regarded as limitation concerning the ecological validity of this study. A recent study found that the behavioral effects of a manipulation of food portion size were larger in a naturalistic compared to a laboratory setting [26]. It is possible that effects of other external influences, such as exposure to food-related TV content, might be similarly enhanced in a naturalistic setting. It would therefore be interesting to replicate the current study in a naturalistic setting, for instance in people's homes.

5. Conclusions

To our knowledge, this study was the first to test effects of exposure to palatable food cues on eating behavior of successful and unsuccessful restrained and unrestrained eaters using actual media content. In contrast to the hypothesis, watching a cooking segment (vs. a non-food segment) of a TV show did not result in more unhealthy food choices in unsuccessful restrained eaters. Future research should continue to study effects of food-related TV content on eating behavior in order to understand this relationship and explain mixed findings of previous research. In the current research, however, no evidence was found that unsuccessful restrained eaters are more susceptible to food-related TV content compared to their successful counterparts. This suggests that effects of exposure to isolated food cues cannot simply be generalized to those of exposure to food cues in a more natural context (i.e., embedded in media content). A starting point for a better understanding of these findings could be to investigate the role of cue salience or the amount of attention allocated to food cues.

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Declarations of Competing Interest

None

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