Confronted with chocolate:

The role of self-control and temptation strength on food consumption

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Table of contents

Abstract

Temptations can evoke a conflict between immediate, smaller motives (i.e. enjoying a chocolate bar) and abstract, larger motives (i.e. losing weight). In order to resist temptations and behave in accordance with the long-term and larger motives, self-control is needed. Furthermore, the strength of a temptation influences whether people can resist temptations and make future-oriented decisions as well. The aim of the current research was to study the effect of both self-control and temptation strength on behavior and to examine the interaction effect between self-control and temptation strength on behavior. The sample consisted of 101 participants between 16 and 50 years of age (M = 22.38, SD = 4.26). The independent variables in this study were temptation strength, which was manipulated by offering the participants either weakly tempting or highly tempting food, and trait self-control, which was measured on a continuous scale. The dependent variable in this study was the amount of chocolate the participants consumed. Contradictory to the expectations, there was no significant predictive value of both self-control and temptation strength on food consumption. The predictive value of the interaction between self-control and temptation strength on food consumption turned out to be non-significant as well. Further research into the effect of this interaction on behavior is needed. The current study can be seen as the starting point of research into the interaction between self-control and temptation strength, as it is the first to combine these two.

Keywords: self-control, temptation strength, interaction effect, eating behavior, health

Many people will recognize the situation of walking into the supermarket and suddenly finding themselves strolling through the aisle with chocolate bars and candy, while they just decided to watch their weight. The exposure to the huge amount of chocolate and candy can be seen as a consequence of the Western environment that causes an overrepresentation of temptations in daily life (French, Story & Jeffrey, 2001). Temptations, such as chocolate and candy, can evoke a conflict between immediate, smaller motives and abstract, larger motives; one can enjoy the chocolate bar and be satisfied for a little while, or reject the tempting snack and thus behave in accordance with the long-term and larger motive of watching one's weight (Hoch & Loewenstein, 1991; Rachlin, 2000). When one keeps preferring the chocolate bar over the motive of losing weight, this will affect one's health; it can cause obesity, cardiovascular diseases, diabetes and psychosocial problems (Jansen et al., 2012).

In order to resist temptations and behave according to the more abstract motives, behavior needs to be controlled (Fujita, 2011). Self-control, the ability to exert control over the self by the self (Muraven & Baumeister, 2000), seems to be an important factor in controlling this behavior. The current study will investigate the importance of self-control in resisting temptations and controlling behavior. However, self-control is not the only factor influencing the decision one makes in the conflict between the immediate and abstract motive (Kroese, Evers & de Ridder, 2011). One could imagine that people respond differently when facing a big cheesecake than they do when facing a small profiterole. The second aim of this study will therefore be to investigate whether strong temptations will cause an earlier giving in to temptations, or vice versa. Furthermore, one could imagine self-control and temptation strength interacting with each other as well; the difference between the cheesecake and the profiterole might be smaller for people with a higher level of self-control, while this difference might be bigger for people with a lower level of self-control. However, this

interaction effect between self-control and temptation strength has never been investigated before. Therefore, the third aim of this study is to show whether the influence of temptation strength is different for people with a higher level of self-control compared to people with a lower level of self-control.

Self-control

As shown by the previous example, people are confronted with temptations every day. Something can be defined as a temptation when it is attractive and in conflict with one's goals at the same time (Geyskens, DeWitte, Pandelaere & Warlop, 2008). When facing a temptation, a dilemma arises which represents a conflict between two motives: one motive pressing for a smaller, concrete and proximal reward, and the other pressing for a larger, abstract and remote reward (Hoch & Loewenstein, 1991; Rachlin, 2000). When someone who quit smoking is offered a cigarette, a conflict will arise between the motive of enjoying a smoke and the motive of staying healthy. One can behave according to only one of the motives and thus has to make a choice; one cannot enjoy smoking and stay healthy at the same time. The conflict between the two motives is called a dual-motive conflict (Fujita, 2011).

In order to successfully resolve the dual-motive conflict and to stick to the larger and more abstract reward there is a necessity for self-control (Metcalfe & Mischel, 1999). Self-control is related to the resistance to temptations and can be described as controlling the urge to give in to temptations and thus behaving according to one's larger motives instead of behaving according to one's smaller motives (Mischel, 1974; Rachlin, 1995). According to this definition, the person who quit smoking is better at resisting the cigarette when he possesses a higher level of self-control, because he prefers the larger motive of staying healthy to the immediate motive of enjoying a smoke.

A high level of self-control indeed proves to be positive in different domains; it can increase academic performances (Duckworth & Seligman, 2005), can result in better psychological adjustment (Tangney, Baumeister & Boone, 2004) and is accompanied by better interpersonal relationships (Eisenberg et al., 1997). A high level of self-control is associated with health behavior as well (Hofmann, Friese & Wiers, 2008). Tangney and colleagues (2004) indeed show that healthy eating behavior is related to a high level of self-control, due to the decrease of impulse control problems. The authors also show that self-control could heighten feelings of guilt when people are behaving opposite to their long-term goals and motives; people with a high level of self-control will feel more guilt when they succumb to unhealthy food temptations, which results in a decrease in this behavior (Tangney et al., 2004).

Thus, when faced with a dual-motive conflict people with a higher level of self-control are better at controlling the urge to give in to temptations and in behaving according to their larger and abstract motives. But what makes these people good at controlling their desires? What does self-control contain? Self-control, preferring the larger reward to the immediate reward, is seen by many as a process of effortful inhibition (Baumeister & Heatherton, 1996; Hofmann, Friese & Strack, 2009; Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000). According to these authors, people need to put in effort when using self-control in order to behave according to their larger motives. Self-control requires the recognition of temptations as undesirable and inhibiting them (Fujita, 2011). This inhibition process is conscious and it requires sufficient cognitive and motivational resources. Research into ego-depletion shows that these resources are limited and that self-control will weaken after effort (Muraven & Baumeister, 2000). When this occurs there are no resources left for other actions of self-control, which makes it more difficult for people to resist any further temptations.

Fujita (2011) agrees that effortful inhibition can be used for behaving according to the abstract motive when facing a temptation, but emphasizes that this is only one of the mechanisms people use within the dual-motive conflict. Effortless self-control, using self-control without depletion of this resource, proves to be another important process that can be used in order to behave according to the abstract motive (Fujita, 2011; De Ridder, Lensvelt-Mulders, Finkenauer, Stok & Baumeister, 2012). One way of effortless self-control is the regulation of one's decision-making environment by restricting the availability of temptations, which will consequently reduce the opportunity to indulge in these temptations (Mischel & Mischel, 1983). One can reduce the opportunity to snack by throwing away all chocolate bars and candy. Although throwing away all chocolate bars and candy takes energy, subsequently no more energy is taken for resisting the temptations, as they are no longer available. Therefore, the restriction of the availability of temptations can be seen as an effortless process. Another way of using effortless self-control is by automating one's behavior through the creation of habits (Adriaanse, Kroese, Gillebaart & De Ridder, 2014). Adriaanse and colleagues (2014) found that a high level of self-control might be accompanied by effective routines or habits, which are executed relatively automatically. When one wants to exercise more, one can create the habit of cycling to work instead of taking the bus. Results of a recent meta-analysis confirm that the use of habits is an effective form of self-control, by showing that the effects of self-control on both performing desired behavior and inhibiting undesired behavior are larger for habitual behavior than for behavior under effortful inhibition (De Ridder et al., 2012). The results show that the effects of controlled or effortful self-control on behavior are small, while the effects of automatic or habitual self-control are medium to large. The effect sizes of automatic or habitual self-control on behavior were in fact the largest effect sizes in the entire meta-analysis.

The meta-analysis of De Ridder and colleagues (2012) indirectly shows that effortful inhibition is not the only effective form of self-control; the dual-motive conflict can be solved by different kinds of self-control mechanisms. The definition of self-control as a concept limited to effortful inhibition therefore needs to be broadened to self-control as a dual-motive approach, in which different mechanisms can help to behave according to the larger motive. The dual-motive approach states that people need to choose the abstract and distant motive over the concrete and proximal motive (Fujita, 2011), but that different strategies can be used to accomplish this. People with a higher level of self-control can thus be seen as people who are better at using the different strategies such as restricting the availability of temptations, automating behavior by creating habits, or using effortful inhibition.

Temptation strength

A high level of self-control is important in resisting temptations and in behaving according to one's larger and abstract motives (Mischel, 1974; Rachlin, 1995). However, a high level of self-control is not automatically accompanied by successfully resisting a temptation. For example, a freshly baked cookie from the bakery might be too tempting to resist, regardless of one's level of self-control. Research by Kroese and colleagues (2011) confirms that characteristics of the temptation itself can have an impact on the resistance of the temptation. Temptation strength will therefore be another focal point in this study.

It is assumed that a freshly baked cookie will tempt people more than a plain one from the supermarket. Thus, people intuitively expect the probability of succumbing to temptations to be higher when temptations are stronger. This view is supported by Metcalfe and Mischel (1999), who state that strong temptations will undermine self-control more than weak temptations. As mentioned before, Metcalfe and Mischel (1999) consider self-control as a process of effortful inhibition; people need to put in effort in order to behave according to the larger motive. Metcalfe and Mischel (1999) state that strong temptations will cause more

activation of the affective system and that these temptations will thus require more effort in resisting. Strong temptations are therefore harder to control and the probability of succumbing to them will be higher. When faced with the freshly baked cookie one's affective system will be activated more and one needs to put in more effort in resisting than when faced with the plain cookie. According to Metcalfe and Mischel (1999) the cognitive and motivational resources needed for effortful inhibition will be depleted faster when faced with the freshly baked cookie than when faced with the plain cookie, which will cause an earlier giving in to the freshly baked one.

However, one can also imagine the opposite: facing a large bag of crisps will make one more scared of all the calories and fat it contains than when facing a small bag of crisps. Subsequently, self-control is expected to be higher for the strong temptation (i.e. the large bag of crisps). Do Vale, Pieters and Zeelenberg (2008) conducted an experiment in order to investigate the power of strong temptations within the self-control process, by examining the effect of package size of a temptation on self-control. The results show that small packages (i.e. weak temptations) increase the amount of consumption, whereas large packages (i.e. strong temptations) are associated with a higher level of self-control and a decrease in the amount of consumption. Both counteractive control theory (Trope & Fishbach, 2000) and the critical level model (Gilbert, Lieberman, Morewedge & Wilson, 2004) provide an explanation for these results.

Counteractive control theory states that temptations remind people of their long-term and larger motives and automatically trigger goal-oriented behavior (Trope & Fishbach, 2000). This will help in resisting temptations and in behaving according to one's long-term motive when facing a dual-motive conflict. According to Trope and Fishbach (2000), temptations are judged by their intrinsic costs. When one is confronted with a strong temptation, this temptation is associated with higher costs (i.e. many calories or a high amount

of sugar) and is seen as a threat to one's long-term motive (i.e. eating healthy). As a result, one is reminded of one's long-term motive and will consequently be better at resisting the temptation. These counteractive control effects are found to be effective only for strong temptations; the stronger the temptation, the more one will be reminded of one's long-term motive and the better one will be at resisting the temptation (Kroese, Evers & de Ridder, 2009). According to counteractive control theory, the large bag of crisps is associated with more calories and a higher amount of fat and will therefore be seen as a threat to the long-term motive of watching one's weight, which is accompanied by a higher level of self-control.

In further support of counteractive control theory, the critical level model states that strong temptations result in a higher level of self-control as well. This model states that certain defense mechanisms used for resisting a temptation (i.e. self-control) only become active when this temptation reaches a certain level of intensity (Gilbert et al., 2004). When temptations are not strong enough to reach this level, they will not be detected as a danger and will not be eradicated actively. The small bag of crisps will not reach the level of intensity that will activate self-control, whereas the large bag of crisps will reach this level and will consequently be accompanied by a higher level of self-control and less consumption.

Counteractive control theory and the critical level model state that temptations, especially strong temptations, can activate the long-term motive within the dual-motive conflict and will consequently improve people's ability to resist these temptations (i.e. self-control). The two models provide an explanation for the results of the earlier research into package size of Do Vale and colleagues (2008). The results of this study show that small packages do not manage to activate the self-control system and can thus increase the amount of consumption. These results can be explained by the fact that small packages will not cause a self-control conflict and that self-control will therefore not be activated. Large packages can cause a decrease in consumption, because they are a clear example of a self-control conflict.

Self-control will therefore be activated in order to resist this temptation and to act in accordance with the long-term motive of eating healthy. Thus, according to counteractive control theory and the critical level model weak temptations form a bigger threat to behaving in accordance with the long-term motive than strong temptations; people manage strong temptations more carefully than weak temptations.

It can be concluded that the strength of a temptation has an impact on the self-control process (e.g. Kroese et al., 2009). However, the direction of this influence remains undetermined; there is a contradiction between the two perspectives regarding the role of temptation strength. The first perspective, by Metcalfe and Mischel (1999), states that strong temptations make people less capable of resisting temptations, whereas the perspective including counteractive control theory (Trope & Fishbach, 2000) and the critical level model (Gilbert et al., 2004) states that strong temptations make people more capable of resisting temptations.

Current study

Combining all the information regarding self-control, it can be concluded that people with a higher level of self-control are better at advancing the abstract motives over the concrete motives when they face a conflict between these two (Fujita, 2011; Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000). Furthermore, Tangney and colleagues (2004) show that a higher level of self-control is related to healthy eating behavior. Due to these results, the first hypothesis of this research is stated as follows: people with a higher level of self-control will be better at resisting temptations than people with a lower level of self-control.

The role of temptation strength on behavior is somewhat less clear; the classic approach of Metcalfe and Mischel (1999) states the opposite of counteractive control theory (Trope & Fishbach, 2000) and the critical level model (Gilbert et al., 2004). The classic

approach states that strong temptations are harder to control and will require more effort in resisting (Metcalfe & Mischel, 1999). However, recent insight shows that it is the other way around; strong temptations will improve one's ability to resist the temptations (Gilbert et al., 2004; Trope & Fishbach, 2000). Therefore, the hypothesis on the effect of temptation strength on behavior will be based on counter active control theory and the critical level model and is stated as follows: people will be better at resisting strong temptations than at resisting weak temptations.

A considerable amount of research has been conducted into the influence of self-control on resisting temptations and on the different perspectives regarding the influence of temptation strength. However, the interaction effect between self-control and temptation strength on behavior has never been investigated before. People with a higher level of self-control recognize the threat of a temptation faster (Gillebaart, Schneider & De Ridder, 2015). For these people there seems to be no substantial difference between their behavior in strong tempting and weak tempting situations. On the contrary, people with a lower level of self-control recognize a conflict between their two motives slower (Gillebaart et al., 2015). Due to the expectation that strong temptations are accompanied by a higher level of self-control, it is self-evidently expected that people with a lower level of self-control will be better at resisting strong temptations than they will be at resisting weak temptations. These people will not be triggered to resist weak temptations, because they do not notice them. However, they will recognize strong temptations easily and will thus be better at resisting these temptations. Therefore, the third hypothesis of this research is stated as follows: the difference between giving in to strong temptations and weak temptations will be smaller for people with a higher level of self-control than for people with a lower level of self-control. When more knowledge of the interactive effect of self-control and temptation strength on behavior is available, this can be used in designing interventions regarding the promotion of a healthy lifestyle; when

the results show that the effect of temptation strength differs between people's level of self-control, this should be taken into account when designing interventions. Within this study eating behavior will be used as the target behavior, as it illustrates a typical self-control dilemma and is highly influenced by self-control (Hofmann, Rauch & Gawronski, 2007).

Method

Participants

The recruitment of participants took place at the Uithof in Utrecht. Participants were recruited through the distribution of flyers. Participants received a small fee for participation (€2 or 0,5 course credits). In total, 101 participants completed the study, consisting of 76 female and 25 male participants. No participants were excluded due to task performance, preferences or outliers. The participants were between 16 and 50 year of age (M = 22.38, SD = 4.26). Participants' mean Body Mass Index [BMI; weight/(height^2)] was 22.29 (SD = 3.43) and their self-reported hunger was on average 5.48 (SD = 2.48) on a scale of 10.

Design

The experiment included two independent variables and one dependent variable. The first independent variable was temptation strength. This variable was manipulated between participants during the experiment by offering the participants weakly tempting or highly tempting food. The second independent variable was trait self-control, which was measured on a continuous scale. The dependent variable in this study was the amount of chocolate the participants consumed, measured in grams.

Procedure

The experiment was conducted in the social psychology laboratory of Utrecht University. Participants were told a cover story, which stated that they would participate in a marketing study that investigated the influence of personality on the effect of food marketing. Participants were brought to a cubicle where the experiment took place on a computer.

Participants were semi-randomly assigned to either an unpacked or a packed variant of chocolate, which was available in the cubicle and was weighed before the experiment.

The first part of the experiment included signing the informed consent and completing questionnaires regarding general information. Thereafter, some filler questions about marketing and food packaging were asked. Subsequently, the cover story was repeated and participants were told they had to judge the chocolate on different aspects. It was emphasized that the participants were allowed to taste as much chocolate as they wanted throughout the duration of the experiment. The participants were asked to judge the chocolate on appearance, taste, texture and on how tempting they considered the product to be. After this taste test, participants had to complete the Quick Big Five Personality Test, containing 25 questions about the participant (Vermulst & Gerris, 2005). This questionnaire was used as a filler task. After this filler task the participant's level of self-control was measured by the Dutch version of the Trait Self-control Scale (Tangney et al., 2004). When the experiment was finished, the participants were debriefed about the objectives of the experiment.

The average duration of the experiment was 10 minutes per participant. When participants had completed all the tasks, they got the remuneration for their efforts. The amount of chocolate was weighed, without mentioning this to any of the participants to prevent them of thinking the amount of consumed chocolate had any significance for the experiment.

Materials

General information.

Participants were asked to fill in their age, gender, length and current weight. Length and current weight were asked in order to determine the BMI for each participant. Participants were asked if they were allergic to any food and if they were on a diet. When they answered this last question positively, they were asked what their reason for dieting was. Participants

were asked how hungry they were at that specific moment. They could scale their appetite on a 10-point Likert scale, whereby 1 represented ‘not hungry at all’ and 10 represented ‘extremely hungry’.

Self-control questionnaire.

To measure the independent variable level of self-control the Dutch version of the Brief Trait Self-control Scale, with Cronbachs α = .80, was used (Tangney et al., 2004). This questionnaire contained a short introduction and 13 questions on a 5-point Likert scale, whereby 1 represented ‘not at all applicable to me’ and 5 represented ‘very applicable to me’. Examples of questions in this questionnaire were; ‘I refuse things that are bad for me’ and ’I am good at resisting temptations’.

Temptation strength.

Temptation strength was manipulated by offering an unpacked or a packed variant of the same chocolate. A pilot study showed that an unpacked product is rated as more tempting than a packed product. Each participant got either the unpacked chocolate (i.e. chocolate in a bowl), which was considered as more tempting and a stronger temptation, or the packed chocolate variant (i.e. chocolate in a bag), which was considered as less tempting and a weaker temptation.

Amount of consumed food.

The participants were allowed to eat as much chocolate as they wanted. In both conditions an amount of 75 grams of chocolate was presented to the participant. The amount of chocolate was weighed with a digital scale before the participants arrived and after they left the laboratory. The difference between those two measurements was used to determine the amount of consumed chocolate.

Food marketing effects.

Participants were asked to judge the chocolate by answering different questions related to the product. It was emphasized that the participants were allowed to consume as much chocolate as necessary in order to judge the product as well as possible. The questions 'How attractive does the product seem to you?' and 'How do you rate the taste of the product?' had to be answered on a 7-points Likert scale, whereby 1 represented 'very unattractive/very distasteful' and 7 represented 'very attractive/very tasteful'. Furthermore, the participants were asked to write down their description of the product, considering taste, texture, sensation in mouth and crunchiness. The last question the participants had to answer was; 'What is your final judgment about the product?'.

Big-Five personality questionnaire.

In order to make the cover story more credible, the participants were asked some questions about their personality. They were told that these questions were asked in order to clarify how they would react in certain situations. The Quick Big-Five Personality Test (Vermulst & Gerris, 2005) was used, which asked participants 25 questions about how they viewed themselves. Participants had to answer these questions through a 5-points Likert scale, whereby 1 represented 'totally disagree' and 5 represented 'totally agree'. Examples of Big-Five Personality questions were; 'I see myself as someone who is considerate and kind to almost everyone' and 'I see myself as someone who is reserved'. The Big-Five Personality questions were only used as a filler task and were not included in the analysis.

Results

Before analyzing the data, the dependent variable total amount of consumed chocolate had to be corrected for skewness. After a logarithmic transformation correction the variable was found to be normally distributed and this transformed variable was used for all analyses.

The thirteen variables of the Trait Self-control scale were combined into a mean score on self-control (M = 2.93, SD = 0.59). Participants reported an average score of the

attractiveness of the chocolate on a 10-point scale (M = 5.45 SD = 1.22). The participants consumed 19.60 grams of chocolate on average (SD = 18.92). The average transformed amount of consumed chocolate was 1.07 (SD = 0.46). The participants reported an average level of hunger on a 10-point scale (M = 5.48, SD = 2.48). The participants' level of hunger was significantly positively related to the dependent variable total amount of consumed chocolate, r (100) = .44, p < .001. Therefore, this variable will be taken into account as a covariate when analyzing the data. Hunger was not significantly related to the independent variable self-control, r (100) = .09, p = .373. The total amount of consumed chocolate was not significantly related to age (r (100) = .11, p = .302), BMI (r (100) = .11, p = .295) and diet (r (100) = .04, p = .665).

An overview of means and standard deviations of age, BMI, hunger, mean self-control, total amount of consumed chocolate and the corrected total amount of consumed chocolate is displayed in Table 1.

Table 1. Means (M) and standard deviations (SD) of the key variables for the total sample

	Total sample	
	M	SD
Age	22.38	4.26
BMI	22.29	3.43
Hunger	5.48	2.48
Mean self-control	2.93	0.59
Total amount of consumed chocolate	19.56	18.92
Transformed total amount of consumed chocolate	1.07	0.46

Randomization and manipulation check

Participants were equally divided between the two conditions; 50 participants were presented the strong temptation and 51 participants were presented the weak temptation. In order to test whether the randomization was successful, separate ANOVA's with age (F (1, 93) = .08, p = .776), gender (F (1, 99) = .55, p = .459), BMI (F (1, 99) = .01, p = .928), diet (F (1, 99) = 1.30, p = .257) and hunger (F (1, 99) = 3.91, p = .051) as dependent variables showed no significant differences between the two conditions (strong vs. weak temptation). This indicates that the randomization of participants between the two conditions was successful. In order to test whether the manipulation worked, an ANOVA was conducted with temptation strength as the independent variable and attractiveness as the dependent variable. The ANOVA found a non-significant effect for the variable attractiveness, F (1, 99) = 0,87, p = .353. This indicates that the manipulation within this experiment has not been successful; the temptation was not rated differently by participants in the two conditions.

Main analysis

A regression analysis was conducted in order to examine the predictive value of mean self-control on total food consumption, with the total amount of consumed chocolate as the dependent variable and mean self-control as the predictor. Hunger was entered as a covariate. The analysis showed that the predictive value of mean self-control on the total amount of consumed chocolate was non-significant, F (1, 98) = .17, p = .679, indicating that people with a higher level of self-control are not significantly better at resisting temptations than people with a lower level of self-control.

In order to examine the influence of temptation strength on the total amount of consumed chocolate a regression analysis was conducted as well, as hunger could then be entered as a covariate. Within this regression analysis the total amount of consumed chocolate was used as the dependent variable and the strength of the temptation was seen as the

predictor. The predictive value of temptation strength on the total amount of consumed chocolate was not found significant, F (1, 98) = 2.73, p = .102, showing that the two conditions were not significantly different from each other in terms of consumption.

In order to formally test the interaction effect of self-control and temptation strength on the total amount of consumed chocolate, a bootstrapping approach developed by Preacher and Hayes (2004) was used. As with the other two analyses, hunger was entered as a covariate. The predictive value of the interaction between the two independent variables self-control and temptation strength condition on the dependent variable consumed chocolate was estimated at .036 [95% CI: -.28, .35]. This bootstrapping analysis was based on 5000 samples (z = 5000) with a confidence interval of 95 percent. The confidence interval found in the current study included zero, indicating that the interaction effect between self-control and temptation strength on the total amount of consumed chocolate was non-significant.

Discussion

The aim of the current research was to study the effect of self-control and temptation strength on behavior. The study examined the main effects of both self-control and temptation strength on behavior; it examined whether self-control is important in resisting temptations and whether strong temptations will cause an earlier giving in than weak temptations. The interaction effect between self-control and temptation strength has been examined in this study as well. This effect has never been investigated before, even though it is of great importance; when the effect of temptation strength differs between people's level of self-control, this difference should be taken into account when designing interventions.

The first hypothesis has not been confirmed; people with a higher level of self-control did not eat significantly less than people with a lower level of self-control and are thus not significantly better at resisting temptations. This non-significant result is contradictory to the

results of Hofmann and colleagues (2008) and Tangney and colleagues (2004), which show a correlation between a high level of self-control and healthy eating behavior.

This contradiction can be explained by different components. First, it was unclear whether all participants in this study had the goal of losing weight. According to Tangney and colleagues (2004) a high level of self-control is accompanied by healthy eating behavior due to higher feelings of guilt when one is behaving opposite to one's long-term goals and motives. Kroese and colleagues (2009) state that participants who are exposed to temptations consider their goals as more important than participants who are not exposed to temptations. Therefore, it was assumed that the exposure to a temptation in this study would be sufficient to produce feelings of guilt and to activate self-control. However, this might not have been the case in the current study; participants who did not have the goal of losing weight might not have felt guilt when consuming the chocolate. Consequently, the correlation between their level of self-control and their consumption might have been less strong than for people who did have the goal of losing weight (Tangney et al., 2004).

Second, the contradiction can be explained by the amount of hunger. According to Raynor and Epstein (2003) hunger has an influence on food consumption, which has been proven in the current study as well; hunger had a significant influence on the total amount of consumed chocolate. The amount of hunger could have undermined the effect of self-control on the amount of consumed food; when people are hungry they will eat regardless of their level of self-control. According to Read and Van Leeuwen (1998) hunger is one of the most familiar hot states. When people are in hot states they are focused on the present and they do not make future-oriented decisions. A prime example of this phenomenon is that of grocery shopping while hungry, which will result in buying things one does not want to eat when behaving according to one's long-term motives (Read & Van Leeuwen, 1998). Thus, the people in this study who were hungry only thought of their short-term motive of enjoying the

chocolate and they did not make future-oriented decisions, whereas self-control is described as behaving according to one's long-term and future-oriented motives instead of behaving according to one's short-term motives (Mischel, 1974; Rachlin, 1995). Thus, the amount of hunger in this study made it hard to measure the effect of self-control on the total amount of consumed chocolate.

The second hypothesis stated that people would be better at resisting strong temptations than at resisting weak temptations. Metcalfe and Mischel (1999) state that strong temptations require more effort in resisting and are therefore harder to control. In contrast to this theory, counteractive control theory (Trope & Fishbach, 2000) and the critical level model (Gilbert et al., 2004) state that strong temptations can activate the long-term motive within the dual-motive conflict and will consequently improve people's ability to resist temptations (i.e. self-control). The current study did not find evidence that leads to the same conclusions as any of these three theories; participants who were faced with the unpacked chocolate (i.e. the strong temptation condition) did not eat a significantly different amount of chocolate than participants who were faced with the packed chocolate (i.e. the weak temptation condition). Thus, the results showed no significant effect of temptation strength on the total amount of consumed chocolate.

The contradicting findings in the current study and previous studies can be explained by different components. First, the manipulation of temptation strength in this study has not proven to be successful. A temptation is defined as something that is attractive and in conflict with one's goals at the same time (Geyskens et al., 2008). The variable attractiveness was not rated differently by participants in the two conditions, which indicates that the manipulation of attractiveness has not worked within this experiment; the unpacked and packed product were not significantly different in terms of attractiveness. Besides, the second characteristic of a temptation, being in conflict with one's goals, was not manipulated and measured;

participants were not asked whether they had the goal of losing weight and this could therefore not be taken into account when analyzing the data. Thus, the manipulation of temptation strength has not proven to be successful and could therefore have influenced the effect of temptation strength on consumption.

A second explanation for the contradicting findings between the current study and the three theories is the amount of hunger. As with the first hypothesis, hunger could have undermined the effect of temptation strength on the amount of consumed food; when people are hungry they will eat regardless of the strength of the temptation. Read and Van Leeuwen (1998) state that people are more likely to buy the most tempting product when in hot states, such as hunger. Referring to the example of grocery shopping, hungry people will buy the freshly baked cookie sooner than the plain cookie from the supermarket. On the other hand, hungry people might also be indifferent to the strength of a temptation; due to their hunger they might be as satisfied with the plain cookie as with the freshly baked one. Which of these two situations applies for the current study is unknown, but they both show that the amount of hunger will influence the effect of temptation strength on behavior (i.e. the total amount of consumed chocolate).

Last, it was expected that the difference between giving in to strong temptations and weak temptations would be smaller for people with a higher level of self-control than for people with a lower level of self-control. This hypothesis has not been confirmed within the current study; the interaction effect between self-control and temptation strength on the total amount of consumed chocolate was non-significant. In this study, the difference between giving in to strong temptations and weak temptations has not proven to be smaller for people with a higher level of self-control than for people with a lower level of self-control. This non-significant effect can be reflective of the actual situation; the interaction between self-control and temptation strength might not exist. In this case people with a higher level of self-control

and people with a lower level of self-control react similar on the difference between the big cheesecake and the small profiterole. However, the explanations mentioned for the non-significant results of the two main effects (i.e. self-control on behavior and temptation strength on behavior) could have influenced the interaction between self-control and temptation strength on behavior as well.

The current study has a number of strengths. First, the interaction effect of self-control and temptation strength has never been investigated before. When more knowledge of this effect is available, this could be used for designing interventions regarding the promotion of a healthy lifestyle; when the effect of temptation strength differs between people's level of self-control, this should be taken into account when designing these interventions. Thus, the current study is innovative and contributes to science and the design of interventions, regardless of the lack of significant results. Second, temptation manipulations used in this study were real and consumable temptations. Most studies into food temptations use pictures of temptations, which are harder to translate into everyday situations (e.g. Gillebaart et al., 2015; Kroese et al., 2009). Besides, Geyskens and colleagues (2008) state that the use of real products is associated with stronger effects on behavior. Thus, the use of real and consumable temptations can be seen as a strength of this study, as it has real life implications and is associated with stronger effects.

Some limitations have to be mentioned as well. First, this study mostly involved participants from a sample of young and well-educated students. This may endanger the external validity of the current results. The meta-analysis of De Ridder and colleagues (2012) emphasizes that the effect of self-control is larger among a sample of younger participants. The relation between self-control and food intake might therefore be stronger in the current sample than it will be in a more age diverse sample. On the other hand, the effect of self-control among well-educated students shows the opposite pattern; the effect of self-control is

smaller among a sample of well-educated students compared to a community sample (De Ridder et al., 2012). Future research has to investigate the effects of self-control and temptation strength on behavior within a sample not limited to young and well-educated students.

A second limitation concerns the manipulation of temptation strength in the two conditions. According to Geyskens and colleagues (2008) a temptation has to be attractive and in conflict with one's goals at the same time. However, within the current study the two conditions were not different in terms of attractiveness. Therefore, future research has to create two conditions which are significantly different in terms of attractiveness. This could be done by adjusting the temptations to the preferences of participants; half of the participants should be tempted by their highest rated temptations, while the other half of the participants should face their lowest rated temptations. Besides the non-significant difference in terms of attractiveness, no attention has been given to the second characteristic of a temptation, the conflict with one's goals. Because chocolate (i.e. many calories and a high amount of sugar) has been the temptation in this study, participants needed to have the goal of eating healthy and losing weight. However, the current study was unable to distinguish between participants who did have the goal of losing weight and participants who did not. Future research should only include people who want to lose weight in order to make sure the temptation is in conflict with the long-term motives of participants. Wardle, Haase and Steptoe (2006) state that women are particularly suitable for this kind of research, because the dieting goals are particularly relevant to them. However, excluding men from the sample could possibly contrast with the external validity of the study. Whether or not it contrasts with the external validity depends on the goal of the research and the research question(s). Besides, the meta-analysis of De Ridder and colleagues (2012) shows that the effect of self-control on behavior is equally strong for women and men; an unequally divided sample in terms of gender will

thus not be a problem. Whether this can be stated for the effect of temptation strength as well has not been proven yet. If future research finds the same effect for temptation strength, the effects of self-control and temptation strength on behavior could be studied with an all-female sample containing only women who have the goal of losing weight.

A third limitation concerns the amount of hunger participants experienced. Hunger can undermine the effect of self-control, temptation strength and the interaction effect between these variables on the amount of consumed food. However, it is hard to control for the effect of hunger without avoiding the occurrence of a ceiling effect. Instructing participants to not eat before the experiment results in hungry participants that are likely to eat a maximum amount of the food offered. However, instructing participants to eat before the experiment results in satiated participants that are likely to eat a minimum amount of the food offered (Read & Van Leeuwen, 1998). Therefore, in order to accomplish a more constant amount of hunger and a smaller difference in the amount of hunger participants will experience, future research should only conduct the experiment precisely in between meals, as participants will then be neither satiated or hungry and the effect of hunger will be minimized (Read & Van Leeuwen, 1998). However, it remains difficult to eliminate the effect of hunger on behavior, as the effect of hunger is different for every individual.

Altogether, the current study adds to research on self-control and temptation strength, as it is the first to study the interaction effect of these two variables. The current study can therefore be seen as the starting point of research into the interaction between self-control and temptation strength on behavior. When including the recommendations, future research might find an interaction effect which can be used for designing interventions regarding the promotion of a healthy lifestyle.

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