Stop overeating: The effect of training inhibition on eating behavior

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Abstract
More and more people in the world are getting fatter and are having trouble to lose weight. When people lack inhibitory control, they are more prone to indulge in high-caloric food. In this study, the effect of training inhibitory control on eating behavior was investigated. Expected was that inhibition training would increase inhibition ability and would lead to less food intake. To investigate the effect of training inhibitory control on eating behavior, participants were divided into three training conditions: The first group of participants had to inhibit a response for neutral stimuli and only responded to food-related stimuli, the second group consistently responded to neutral stimuli and inhibited a response for food-related stimuli. The third group never inhibited a response. Food intake was measured using a food diary and a taste test. The Restraint scale was used to measure restrained eating behavior, which could have influenced the results of the study. Results showed that the three groups of participants in the different training conditions did not differ significantly after the training on inhibitory control and food-intake. In conclusion, the inhibition training did not have an effect on inhibitory control neither on the food intake of the participants. A possible explanation for the lack of effect of the training could be that using non-specific food pictures and not consistently having to stop for a food item does not lead to better inhibitory control concerning food, because no association will then be learned between the stopping goal and different kinds of food.

Keywords
Inhibition, inhibitory control, stop-signal, training, eating behavior, food intake, restraint

Introduction
The number of people that are overweight in the Netherlands has increased over the last thirty years (1). In 2009/2011, 41% of the Dutch population was overweight and 10% was

obese. Both obesity and overweight are associated with health-risk factors such as diabetes, high blood pressure, high cholesterol levels, asthma, arthritis and fair or poor health status (2). The medical costs associated with obesity and overweight are very high. It has been estimated that 5,3% of the medical costs in the U.S. are attributable to obesity and 3,7% of the medical costs to overweight (3). According to the World Health Organization (4), behavioral and environmental factors are primarily responsible for the increase in obesity during the last thirty years. These behavioral and environmental factors are a sedentary lifestyle and excessive food intake. Most of the current interventions designed for treating obesity or preventing it are therefore aimed at reducing energy intake and increasing physical activity. However, despite the clear aim of obesity interventions, the benefits of treatment have been overstated and for most people the interventions are ineffective (5). Why are these interventions ineffective and is it difficult to decrease overweight and obesity? As noted above, an imbalanced dietary intake is a major factor in the development of overweight and obesity. This excessive eating can be seen as an addictive behavior (6). Central to addictive behaviors are the constructs of impulsivity and (poor) executive functioning (7). These constructs consist of different components, which include sensitivity to reward, preference for immediate gratification, risk taking, and disinhibition (8). Disinhibition is defined as: 'the inability to suppress, delay, or change a response that is no longer required or is inappropriate' (9). Disinhibition is thus an important factor in declaring addictive behavior and could therefore be an important factor that influences overeating in overweight people.

A theory, which explains behavior using the concepts of cognitive control and inhibition, is the Reflective-Impulsive Model (RIM; (10)). The RIM proposes that behavior is guided by two distinct cognitive systems: an associative system that operates through fast automatic processes and a propositional system, which acts through slower and controlled processes. The fast and automatic system is mainly active when cognitive abilities like response inhibition and working memory are low (10-12). When someone reacts automatically and affective to tasty food, the motivational drive to indulge in these types of food is triggered (10). The slower system is more 'reflective' and includes more controlled processes, which are associated with conscious deliberation, emotion regulation and expected outcomes in a propositional format. Using the slower system requires more cognitive abilities, like inhibitory control (11). Whenever a conflict arises between the motivational drive to indulge in high-caloric food and personal goals like dieting standards, the motivational drive needs to be overruled by inhibitory control. Using this inhibitory control can make the behavior in line with the more deliberate long-term goals (10). Consequently, when inhibitory control is low, the motivational drive will be stronger in guiding eating behavior, which leads to the inability to resist indulging in high-caloric, palatable food (13).

In line with this theory, empirical evidence shows an important role for inhibitory control in overeating and overweight (13). Poor inhibitory control has been associated with obesity, excessive food intake, and other consumptive behaviors. Studies showed that overweight people score lower on tasks that measure inhibitory control and executive functioning (14). According to Guerrieri et al. (15), people with a weaker inhibitory control of impulsive responses are more vulnerable to the temptations of tasty, high-caloric food and eat more of this high-caloric food than people with stronger inhibitory control. Nederkoorn, Havermans, Roefs, Smulders and Jansen (16) also found that obese people have less effective inhibitory control compared to lean people.

The available evidence suggests a causal role for inhibitory control in overeating and overweight/obesity. This implicates that training cognitive abilities like inhibitory control could help regulate automatic impulses and increase control over food intake (13). Recent studies suggest that a way to accomplish improved self-control/inhibitory control is by presenting stop signals. Stop signals have been shown to be an effective tool to disrupt and inhibit motor impulses (17). Stop signals are therefore used to measure response inhibition. The stop-signal task and the go/no-go task are the most common measures of response inhibition (18). These tasks require inhibition of a dominant motor response. The stop-signal task is a reaction time task. Subjects who are responding to visually presented characters are occasionally presented with a stop signal that tells them not to respond on that trial. This stop signal is showed in a random selection of the trials after a variable delay (19). The stop signal task is based on a model, which postulates that reaction time processes and stopping processes compete with each other. Response inhibition then depends on which of the two processes wins this competition (20). The first index of inhibitory control for the stop-signal paradigm is the probability of responding on stop-signal trials, which is often seen as a function of stop signal delay (SSD). The second index of inhibitory control on this task is an estimate of the covert latency of the stop process, the stop-signal reaction time (SSRT) (19). In the go/no-go paradigm, subjects are presented with a series of stimuli and have to respond when a 'go' stimulus is presented. They have to inhibit their response when a no-go stimulus is presented. So they have to react when 'K' is presented, but inhibit their response when 'L' is presented for example. The index of inhibitory control in the go/no-go paradigm is the probability of performing a response on a no-go trial (19).

As described above, inhibitory control is an important factor in determining eating behavior and stop signals can be used to measure this inhibitory control. The question is now whether the stop-signal task or the go/no-go task can also be used to train this inhibitory control. Guerrieri et al. (15) demonstrated a decrease in food intake following an inhibitory control priming manipulation compared to a manipulation that primed impulsive behavior. This study, however, lacked a control condition, which makes it impossible to determine whether both of the manipulations (impulsivity vs inhibition) influenced the food intake compared to baseline (21). Houben & Jansen (21) examined the effect of food-related inhibition training on food intake compared to a control condition with a go/no-go task. The findings of this research indicated that training to inhibit food-related responses can be an effective strategy to help people gain more control over their eating behavior and decrease food intake (21). It is however questionable whether this go/no-go task leads to increased inhibition or is training another cognitive process. Maybe the stop-signal task could then better be used to train inhibition.

In the current research is therefore examined whether the stop-signal task could be used to train inhibition and whether increased inhibition leads to less food intake. A stop signal task with neutral pictures and a stop signal task with food-related pictures were used to investigate the effect of inhibition training on inhibitory control. The inhibition training consisted of a stop-signal task with neutral pictures and a stop-signal task with food-related pictures in which stop-signals appeared. The following research questions were formulated for this study: 'Can a stop-signal task be used to train inhibition?', 'Is the food-related stop signal task better for training food-related inhibition than the neutral stop-signal task?, and 'Does training inhibition using a stop-signal task lead to less food intake?'. It was expected that using a stop-signal task to train inhibition would strengthen food-related inhibition. The effect of inhibition training was expected to be greatest for the stop-signal training in which stop-signals appeared for the food-related stimuli, because this training would lead to a specific food-related inhibitory control. It was also expected that the inhibition training would lead to less food intake, which was measured using a taste test and a food diary.

Material and Methods

Participants

In this study 79 female participants were recruited, aged between 18 and 60 years old. Of these participants, 71 completed the study. Only female participants were included to prevent influence of gender differences. The participants had a mean BMI in the pre-test of 23.46 (SD = 3.06). Participants were excluded from the study if they didn't understand the Dutch language, because the study materials were all in Dutch.

Materials and measures

The participants came twice to the Maastricht University for a lab session. In between of these sessions, they performed a stop-signal training.

Stop-signal task – dependent variable

The participants performed two versions of the stop-signal task. One was a general stop-signal task with non-specific stimuli and the other was a food-specific stop-signal task where food-related pictures were presented. The participants completed these stop-signal tasks during two lab sessions (before the training and after). In the general stop task, only X's en O's were presented as stimuli. The participant was asked to press 4(←) When the X stimulus appeared and 6(→) for the O stimulus. The participants were asked to react as quickly as possible (in the go trial), but in 25% of the trials a stop-signal appeared. During stop signals an auditory stop signal was presented and participants had to inhibit the learned response. The participants were instructed not to respond when this stop-signal appeared. The delay between the go signal (X or O) and the stop signal gradually increased through the trials depending on the participant's performance. The initial delay was set at 250 ms. If participants succeeded in inhibiting their go response, the delay between the go and stop signals was increased by 50 ms, This increase in delay made it more difficult to inhibit the go response in the next trial. If a participant failed to inhibit a go response (by pressing a response key even though a stop signal was present), the delay was decreased by 50 ms, thereby making it easier to inhibit the go response in the next trial. In this study, participants completed two practice blocks without stop signals and one with stop signals. Afterward, they completed two test blocks of 64 trials successively. The food-specific stop-signal task was similar to the general stop signal task, but the X and O stimuli were replaced with pictures of sweet and savoury food. The participants were asked to press 4(←) when a savoury item was presented and 6 (→) when a sweet item was presented.

The two variables measured in this task were the go signal reaction time (RT) and stop delay, both in ms. The dependent variable stop-signal reaction time (SSRT) was calculated by subtracting the stop delay from RT. Higher SSRT's indicate decreased inhibitory control or increased impulsivity.

Stop-signal task – training

For training, four different versions of the stop-signal task were developed: a general stop training, a general control/go training, a food stop training and a food control/go training. In the general stop training, non-specific stimuli were presented and in 25% of the trials a stop signal appeared. The general control/go training was the same as the general stop training except that no stop signals were presented. This version thus only contained go trials. The food stop training was also similar to the general stop training (because stop signals are presented in 25% of the trials), but the non-specific stimuli were replaced by food-related pictures. The food control/go training was similar to the general control/go training (no stop signals are presented), but food-related pictures replaced the non-specific stimuli. The participants were asked to react as quickly as possible by pressing E (for 'O' and for pictures of savoury food) or U (for 'X' and pictures of sweet food) in the go trials. When a stop signal was presented, the participants were asked to inhibit their response. Participants were randomly assigned to three conditions: In the first condition (general stop training condition/Neutral Stop - Food Go), each session consisted of a general stop training followed by a food control/go training. In the second condition (food-stop training condition/Neutral Go - Food Stop) each session contained a general control/go training followed by a food stop training. In the third condition (control condition) a general control/go training and a food control/go training were performed. The difficulty of the tasks within all conditions increased with every trial.

Food diary

The participants kept a record of their dietary intake (food and drinks) using the 'Eetmeter' on the website www.voedingscentrum.nl. The 'Eetmeter' contains a database with food items, which can be used by the participant to enter their food intake. Caloric information is provided as well as information about sugar and fat intake.

Restraint scale and eating behavior questionnaire

Each participant completed the Restraint Eating Scale (22). This questionnaire consists of eleven items. Nine items are valued using a Likert Scale. A total score of the questionnaire is obtained by adding the scores of the separate items. A high score means more restrained eating and a lower score means less restrained eating. The maximum score is 35 points and the minimum score is 0 points. The higher the participant scores on the questionnaire, the more restrained that person is. Restrained eaters are chronically trying to restrict their food intake, but mostly unsuccessful in these attempts and more prone to overeating than unrestrained eaters (13). In the questionnaire questions are added concerning demographic characteristics: age, gender, height and weight.

The participants also filled in a questionnaire about their eating pattern of last week. This questionnaire consists of 7 items which have to be answered using a scale with the following categories: Less than once a week, 1-2 times a week, 3-4 times a week, 5-6 times a week, every day.

Taste test

The participants were instructed to do a taste test. For this test, they received two bowls of chips and were told that these are two different kinds of chips. The participants were instructed to taste the chips and fill in a questionnaire about it. They were told to take their time and could eat as much as they liked. The researcher left the participants and returned when they were ready. The questionnaire contained questions about the chips and questions about the extent of hunger and craving. The extent of hunger and craving could explain the eating behavior of the participants in the taste test. This was measured using a 10 cm VAS scale. The amount of eaten chips was measured using scales (grams).

BMI (Body Mass Index)

During the first lab session, the height and weight of the participants was measured. Based on this information a BMI (Body mass index) was calculated using the following formula: Kg/m2. BMI is an index for the height-weight ratio and provides an estimate of the health risk of a bodyweight (BMI-meter, n.d.). A BMI <18,5 indicates underweight, a BMI between 18,5 and 24,9 indicates a healthy weight, a BMI between 25 and 29,9 indicates overweight, a BMI between 30 and 34,9 indicates obesity (severe overweight) and a BMI >35 indicates extreme obesity (23). During the second lab session the participants were weighed again and a BMI was calculated again.

Procedure

The participants were invited to come twice to the Maastricht University for a lab session. The first session lasted about 45 minutes and the second session about 20-30 minutes. The second session had to take place 7 or 8 days after the first. The participants had to minister their dietary intake before the first and after the second lab session during seven days. For this purpose, the participants kept a record of their daily energy intake, using de 'Eetmeter' of the site Voedingscentrum.nl. The participants received their login details the day they had to start administering their dietary intake or the day before they had to start. After the first week of keeping the food diary, the participants had the first lab session. During this session they first signed the informed consent and then performed the general and food-specific stop signal task (dependent variable). Next, they filled in the Restraint Scale and the Eating behavior questionnaire. After this, they completed the taste test. Next they were weighed and their height was measured to calculate their BMI and at last they completed the stop signal task (training), for which they were registered before they came to the session. The participants were assigned to one of the three conditions for this training, which are: general stop-training condition, food stop-training condition and a control condition. The participants completed five trainings in total so they completed one during the first lab session and the remaining four at home. The participants were provided with the information that was necessary to complete the online training at home, such as the login details that were sent to their e-mail addresses. After 7 or 8 days the participants came again to the Maastricht University for the second lab session. During this session they completed the general and food-specific stop – signal task (dependent variable) again. After that, they filled in the Eating behavior questionnaire and completed the taste test. At last the participants were weighed again in order to calculate their BMI. After this session, the participants kept a food diary again for seven days using the 'Eetmeter'. After completing all the activities in the research, the participants received a reward, which was either six participant points or a gift voucher of fifty euros.

Statistical analysis

Whether de training led to improved inhibitory control and reduced food intake was tested using ANOVA with condition (general stop training condition, food-stop training condition and control condition) as between-subjects factor, restraint as a covariate and repeated measures (pre-test versus post-test) on the dependent variables, BMI, food intake (diary and taste test), eating behavior, SSRT on the neutral and food-related stop signal task and hunger and craving.

Results

Eight participants did not complete their participation in the study and were therefore removed from the sample. The ultimate sample therefore consisted of 71 participants divided over the three training conditions: Neutral Stop - Food Go (n= 22), Neutral Go - Food Stop (n= 27) and Control condition (n= 22).

Table 1. Mean scores on Restraint, BMI, Food intake (Chips), Eating behaviour, SSRT and SSRT-food (Standard deviation between parentheses)

	Neutral Stop - Food Go	Neutral Go - Food Stop	Control condition
Restraint	12.55 (3.23)	15.22 (5.15)	14.82 (4.11)
SSRT before	304.33 (28.66)	308.35 (51.59)	300.01 (45.79)
SSRT after	268.32 (25.23)	268.93 (37.40)	271.54 (30.87)
SSRT food before	328.41 (41.53)	345.9 (70.85)	326.1 (59.63)
SSRT food after	303.75 (46.91)	304.31 (38.21)	297.15 (30.6)
Chips before	10.45 (7.2)	13.11 (11.61)	17 (13.47)
Chips after	12.19 (7.78)	14.96 (13.32)	14.05 (10.06)
Food diary before	1681.35 (293.49)	1600.96 (312.28)	1608.62 (226.84)
Food diary after	1663.05 (351.08)	1597.27 (345.34)	1554.86 (379.87)
BMI before	23.09 (3.01)	23.54 (2.95)	23.74 (3.33)
BMI after	23.01 (2.78)	23.6 (2.95)	23.67 (3.15)
Eating behaviour before	15.45 (2.48)	16.04 (2.24)	16.59 (2.48)
Eating behaviour after	15.82 (2.4)	15.89 (2.28)	16.09 (2.45)

SSRT and SSRT-food

Table 1 contains the mean scores and standard deviations for SSRT (neutral stimuli) and SSRT-food (food-related stimuli). For general SSRT, main effects were found for time, F (1, 67) = 23.2, p < 0.01, but no main effects were found for condition (F (2, 67) = 0.04, p = 0.96) or restraint (F (1, 67) = 0.05, p = 0.82). The results showed an effect of time indicating that all participants had a lower SSRT on the post-test than on the pre-test. An interaction effect was shown for time*restraint, F (1, 67) = 5.33, p = 0.02. This result indicates an effect of restraint on the SSRT for neutral stimuli over time. The less restrained eaters had a stronger decrease in SSRT than the more restrained eaters. No significant effect was found for time*condition (F (1, 67) = 0.91, p = 0.41). For SSRT-food, no significant effects were found for the main and interaction terms, all F < 2.65.

Food intake - Taste test (chips) and food diary

Mean scores and standard deviations for the amount of eaten chips (grams) are also shown in Table 1. Food intake differed significantly over time, F (1, 67) = 17.76, p < 0.01, which indicates an effect of time on the amount of eaten chips before and after the training. The results indicate that the participants overall ate more chips in the post-test compared to the pre-test. No significant effects were found for restraint, F (1, 67) = .59, p = .44, and neither for condition, F (2, 67) = 1.39, p = .26. A significant time*restraint interaction effect was found, F (1, 67) = 19.79, p < 0.001. This indicates an effect of restraint on the amount of eaten chips over time. A median split on restraint shows that the less restrained eaters ate fewer chips over time and the more restrained eaters ate more chips over time. No significant differences were revealed for the interaction time*condition, F (2, 67) = 2.84, p = .07.

Table 1 provides a summary for the mean scores (calories) and standard deviations of the food intake before and after the training measured with the food diary. Food intake did not differ significantly over time, F (1, 63) = 0.175, p = 0.68. There was also no significant effect of condition, F (2, 63) = 1.4, p = 0.25. No significant differences were found for the interaction terms time*restraint and time*condition, all F < 0.45. Restraint did, however, have a significant influence on food intake, F (1, 63) = 4.78, p < 0.03. Correlation analysis showed that the more restrained eaters had higher means on caloric intake before the training than the less restrained eaters.

BMI, eating behavior and hunger and craving

The mean scores and standard deviations for the three conditions on BMI before and after the training are shown in Table 1. No significant effects were found for time, condition or restraint, and neither for the interactions time*condition and time*restraint (All F < 1.64). A summary of the mean scores and standard deviations for the variable eating behavior can be found in Table 1. For this variable, no significant effects were found for time, condition, or restraint, nor for the interactions terms (time*condition and time*restraint, all F < 3.9.

For the analysis of hunger and craving one participant was excluded due to lack of data on this variable (n = 70). A summary of the mean scores and standard deviations for hunger and craving are shown in Table 2. For the variable hunger no significant effects were found for the main effects neither for the interaction terms, all F < 1.78. For the variable craving, there were also no significant effects found for the main and the interaction terms, all F < 0.94.

Table 2. Mean scores on Hunger and Craving (Standard deviation between parentheses).

	Neutral Stop - Food Go	Neutral Go - Food Stop	Control condition
Hunger before	3.61 (2.14)	3.61 (2.8)	4.24 (2.89)
Hunger after	5.26 (2.2)	4.17 (2.66)	4.29 (2.19)
Craving before	4.45 (2.35)	4.57 (2.67)	5.45 (3.04)
Craving after	5.55 (2.3)	3.95 (2.16)	5.17 (3)

Discussion/Conclusion

The aim of this study was to investigate whether training inhibition (for neutral and food-related stimuli) would lead to more control over eating behavior and consequently to less food intake. The first hypothesis of the research was that the inhibition training would strengthen inhibitory control of the participants concerning food-related inhibition. Hypothesized was also that training inhibitory control would lead to less food intake and that the food-related training would have the greatest effect on this dietary intake.

As expected, the participants scored lower on SSRT (neutral) in the post-test than in the pre-test, which indicates an increased inhibitory control for neutral stimuli. For the SSRT for food- related pictures no effect of time was found. The participants thus only got less impulsive for the neutral stimuli and not for the food-related stimuli. There was however no significant difference between the groups, which indicates no difference over time between the training conditions and the control condition. It could therefore be a possibility that all participants just got better in performing the general stop-signal task due to practice. The extent to which participants were restrained eaters had, however, a significant effect on SSRT (neutral stimuli). The less restrained eaters had a lower SSRT mean score than the more restrained eaters. This means that the more restrained eaters remained more impulsive than the less restrained eaters.

Against the expectation, the participants overall ate more chips after the training than before. It remains unclear what could explain the overall higher food intake. No effect of the training was found on food intake in the taste test, but the extent to which participants were restrained eaters did affect the food intake. The less restrained eaters ate fewer chips after the training and the more restrained eaters ate more chips after the training than before. This is in line with the higher impulsivity of this group (more restrained) shown on the SSRT for neutral stimuli in the post-test. The fact that the more restrained eaters ate more chips after the training could be ascribed to the concept of ego-depletion. This concept is described in the Ego-Strength Model of Self-Regulation, which proposes that people have a limited capacity of self-control (24). This means that when people have used great amounts of self-control during one task, there is not much self-control left for other tasks. This will have a negative influence on the performance on the tasks left. The more restrained eaters were maybe more depleted than the less restrained eaters because they were sticking to a diet and therefore had less ego-strength left to control their eating behavior in the taste test after they had to inhibit their responses in the training (25).

The results showed no significant differences in food intake before and after the training measured with the food diary. The different training variants did thus not have an influence on the food intake of the participants before and after the training, against the expectation. Restraint, however, did have an effect on the food intake before the training. Correlation analysis showed that the more restrained eaters had a higher caloric intake before the training than the less restrained eaters. The training conditions also did not significantly have an effect on hunger, craving, BMI, and the eating behavior (questionnaire). These results are against the expectation. Expected was that BMI, hunger and craving would decrease for the participants in the neutral and food-related training and the eating behavior of these groups would get healthier.

In conclusion, neither the general inhibition training nor the food-specific training had an influence on inhibitory control, food intake and weight. Hence, none of the hypotheses could be confirmed. The lack of effect of the training on impulsivity and food intake could be due to the non-specificity of its stimuli. In recent studies an effect was found on food intake when specific inhibition training was used (13, 21). In these studies, participants had to inhibit a response for specific food-related stimuli (e.g. chocolate) and respond towards different stimuli. Results showed that this type of training had a significant effect on preference and intake of the high-caloric food (14). Thus, using a specific type of food-related stimuli could create an association between this particular food item and the goal of stopping behavior (19). This could facilitate the response inhibition towards this food product, which is maybe not occurring when stopping behavior is being associated with different kinds of foods, which was tested in this research. Another possible explanation for the lack of effect of the training in this study could be that participants did not consistently inhibited a response for food-related stimuli. The participants only had to inhibit a response in a number of trials and therefore it could be a possibility that the participants did not form an association between food items and a stopping response due to the inconsistency of the pairing of food items with the stopping goal.

A limitation of this research is that the amount of time between the pre- and post-test was only one week. It is quite difficult to find any differences in BMI or eating behavior due to the training in such a short period. The research also did not include a long-term follow up. It is therefore unclear whether the training could have a long-term effect or has to be repeated several times to have an effect on the long term. Examining possible long term effects and the effectiveness of a repeated inhibition training should be addressed in future research to further investigate the potential of the training for its clinical relevance concerning weight loss. It could also be possible that the study sample does not give a proper representation of the target group of the inhibition training. The training is meant to help people who are overweight to lose weight. It has been shown that people who are obese have less inhibitory control towards neutral stimuli than lean people (14). In this study, most of the participants were not overweight, but had a healthy weight. It could be that their capacity to inhibit responses is already very high compared to the overweight population for which the training is meant. A possibility could thus be that a threshold exists for the effect of the training. Maybe inhibition training only has an effect when the inhibitory control is beneath a certain threshold. It is therefore recommended that future research should contain a screening for motivation of the participants to lose weight or even only include participants who are overweight.

What not yet has been hypothesized, is using the stop signal task not only to train inhibitory control towards high-caloric food, but also using it to promote healthy food. Promotion of healthy food is widely used in programs which aim at promoting healthy diets through community based interventions. For example, different interventions that aim at promoting healthy food that are aimed at children are found to be effective (26). Because promoting of healthy food could be effective, this could also be integrated in the training. A go/no-go training could be developed in which participants have to inhibit their response for pictures of high-caloric food and respond to healthy food. The participant will then maybe create an association between the high-caloric food and a stopping response and associate healthy food with a go response. There is, however, not yet any evidence for the effectiveness of this type of training. Future research could provide more clarity about the possibility to combine inhibitory training and promotion of healthy food and the effectiveness of these different types of concepts.

In sum, this research did not confirm earlier findings that inhibition training could be effective to help people decrease their food intake. The lack of effect could be due to the non-specificity of the stimuli in the training. Results from earlier research indicated that a specific training, which uses a specific food-related item, could have an effect on inhibitory control concerning that specific food item (13, 21). To support this, future research should focus on investigating the effect of specific inhibition training. This specific inhibition training could make use of only one specific food item or combine food items with consistently inhibiting a response. It could also be a possibility to combine a specific food item with consistent stopping. The idea of combining training of inhibitory control and promoting healthy food at the same time could also further be investigated to explore the possibilities of such a concept. When inhibition training turns out to be effective, the training could be used in the clinical practice to help dieters with decreasing their food intake concerning the type(s) of food that are a problem for them. The training could then be aimed at the food item(s) that are particularly hard to resist for a certain person.

Role of the student

Anouk Hendriks was an undergraduate bachelor student of Health Sciences and executed the research in collaboration with M. Kunze, a Master student. The students implemented the research together under supervision of Katrijn Houben, who proposed the topic, designed the study and study materials. Processing of the results, formulation of conclusions and writing were done by the student.

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