

## *Determinants of self-regulation in obesity: formation of implicit food preferences*

### BACKGROUND

The objective of this study was to investigate whether motor behavior can impact self-regulation of food intake in individuals with obesity. We utilized purposeful movement of the hand as a means to influence tendencies to approach and avoid foods compatible and incompatible with the weight loss goals.

### PARTICIPANTS AND PROCEDURE

One hundred individuals with obesity (BMI  $\geq$  30) participated in this study. The participants were randomized into 2 experimental groups. The first experimental group was induced to prefer dietary foods and to avoid fattening foods. The second experimental group was induced to prefer fattening food and to avoid dietary food.

### RESULTS

Experimental group 1 chose dietary products and avoided fattening items more often than group 2. We observed the increased importance of goals to lose weight and improve body shape as a result of manipulation consistent with its direction.

### CONCLUSIONS

Implicit manipulation of food preferences by approach/avoidance tasks can alter food preferences and attitudes.

### KEY WORDS

self-regulation; obesity; implicit preferences

ORGANIZATION – 1: Social Science Department, University of Warmia and Mazury, Olsztyn, Poland · 2: Social Sciences Department, University of Gdansk, Gdansk, Poland 3: Experimental Therapeutics and Pathophysiology Branch, National Institute of Mental Health, National Institutes of Health, Bethesda, MD, USA

AUTHORS' CONTRIBUTIONS – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection

CORRESPONDING AUTHOR – Małgorzata Obara-Gołębiowska, Social Science Department, University of Warmia and Mazury, 13 Prawocheńskiego Str., 10-447 Olsztyn, Poland, e-mail: malgorzata.obara@gmail.com

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## BACKGROUND

Perception of external stimuli initiates attitudes which shape our verbal, somatic and behavioral expressions. Attitudes may also be influenced by physical interactions with the environment. Cacioppo, Priester and Berntson (1993) demonstrated that motor behaviors, which are driven by non-declarative memory, also impact attitudes. In their 1993 experiment, arm extension movement toward an object induced desire of an object, whereas arm movement away from an object initiated rejection, hence demonstrating a link between arm flexion and extension with evaluative orientation. Importantly, it has been shown that flexion, or pulling toward oneself, is related to obtaining, consuming and approaching a desirable object, whereas extension indicates repulsion, rejection of undesirable objects or defense against harm. Thus, the motor act of flexing and extending has an effect on the evaluation of objects associated with that motor act and forms an associative network. The effects of motor movement were shown to influence formation of implicit preferences for fattening vs. dietary food by Fishbach and Shah (2006). Their study demonstrated that self-control can be influenced outside of conscious cognitive processing. Developing and using automated self-control may be useful for individuals struggling to control tendencies not compatible with their goals, as the automated processes do not exhaust cognitive resources and do not require effort.

In our study, we applied the Fishbach and Shah (2006) experimental design to study individuals with obesity (BMI  $\geq$  30) who were actively attempting to lose weight by participating in a structured program. Our objective was to find out whether it is possible to increase the motivation of individuals with obesity to lose weight and impact their food preferences by creating an associative network between the type of food and avoidance or approach tendencies. The associative network would be generated by engaging in motor behavior activating different evaluations of objects associated with them (pull with desire, approach and push with avoidance, repulsion) (Zanna, Kiesler, & Pilkonis, 1970). As a result, a non-declarative memory would be formed in relation to self and the type of object. We aimed to examine whether activating these associative networks would result in better self-control and nutritional choices in men and women attempting to lose weight. Unlike other studies that have used food approach/avoidance tasks (Becker, Jostmann, Wiers, & Holland, 2014; Fishbach & Shah, 2006; Schumacher, Kemps, & Tiggemann, 2016), in the present study both females and males participated, and gender effects were also investigated. In our study we also wanted to find out whether there are any gender differences in forming implicit preferences for fattening vs. dietary food.

## PARTICIPANTS AND PROCEDURE

One hundred individuals (58 females, 42 males, age  $M = 50.09$ ,  $SD = 9.49$ ) with obesity (BMI  $\geq$  30) participated in the study. All were currently enrolled in weight-loss retreat programs in the Warmian-Masurian region. The study was approved by the ethical committee of the Clinical Hospital in Olsztyn, Poland. Consenting participants were randomly assigned to one of the two conditions: experimental group 1 (29 females, 21 males) – activating approach of dietary foods and avoidance of fattening foods; experimental group 2 (29 females, 21 males) – activating approach of fattening foods and avoidance of dietary foods. The subjects were blind to the study purpose. After the conclusion of the experiment all subjects were thanked for their participation and fully debriefed. Moreover, as a reward for taking part in the experiment, the participants were offered an additional program based on the theories of self-control and goal implementation (Mischel & Shoda, 1995; Gollwitzer, 1999; Verhoeven, Adriaanse, de Vet, Fennis, & de Ridder, 2014; Hagger, 2015) to support pro-health nutritional habits.

The approach and avoidance task was performed using a Toshiba satellite pro L 50-A-12Q laptop computer equipped with an Extreme 3D Pro joystick to record responses. The stimuli consisted of 120 names of foods categorized into dietary and fattening categories on the basis of their calorie content (Daiber, 2002) and judgment of a physician specializing in weight loss and two registered dietitians. The judges were in high agreement as to the categorization of the selected foods,  $W\text{-Kendall} = .90$ ,  $\chi^2 = 320.25$ ,  $p < .001$ .

At the beginning of the study, the individuals were informed that they would be participating in a study investigating physical activity and task performance.

The two experimental groups performed a food categories approach and avoidance task. For the first experimental group, the manipulation aimed at activating approaching dietary foods and avoiding fattening foods. They were instructed to pull the joystick toward themselves whenever the name of the food item appearing on the computer screen belonged to the category of dietary foods promoting weight loss, and push away from themselves when the product belonged to the category of fattening, high calorie foods. The second experimental group was manipulated to activate approaching fattening foods and to avoid dietary, low calorie foods by pulling toward themselves whenever the high calorie, fattening food name was shown, and to push away in response to the names of the dietary, low calorie foods. Practice trials preceded each task in the two experimental groups.

After completing the approach/avoidance task, both experimental groups rated the importance of

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the following goals: 1. *Improvement of body shape* and 2. *Loss of excess weight*. The goals were evaluated on a 7-point Likert scale.

After all subjects completed their forms, everyone was informed that there was a food reward for their participation, and that they could choose one item from a list of 6: chocolate, apple, carrots, cake, grapefruit or chips. The participants indicated their reward choice by writing down what they wished to receive on a piece of paper. Subsequently, the subjects were informed that they would only receive low calorie rewards, namely apple, carrots or grapefruit, and were fully debriefed.

Małgorzata  
Obara-  
Gołębiowska,  
Hanna Brycz,  
Joanna  
Szczepanik

## RESULTS

To assess the effect of the experimental manipulation, an analysis of variance (design: 2 groups  $\times$  2 genders) on food choice (transformed into the  $z$ -score) was conducted. Neither an effect of gender nor an interaction was found. We observed a non-significant but very promising result (in the larger population)  $F(1, 98) = 2.71, p = .061, \eta^2 = .04$  with group 1 (approaching dietary foods) choosing a healthy reward snack ( $M = 0.23$ ) more often than group 2 (avoiding dietary foods) ( $M = -0.23$ ).

Next, we examined the effect of manipulation on the goals related to participating in a weight loss program with an analysis of variance (design: 2 groups  $\times$  2 genders) for two declarative measures. There was no effect of gender and no interaction between variables.

In regards to goal 1, *Improvement of body shape*, there was a main effect of group  $F(1, 98) = 4.75, p = .009, \eta^2 = .06$ , with group 1 (approaching dietary food) evaluating this goal as more important ( $M = 6.03$ ) than group 2 (avoiding dietary food) ( $M = 5.76$ ).

In regards to goal 2: *Loss of excess weight* there was a non-significant but very promising result (in the larger population)  $F(1, 98) = 2.56, p = .065, \eta^2 = .03$ . Again, group 1 rated this goal as more important ( $M = 6.26$ ) than group 2 ( $M = 5.97$ ) (Figure 1).

## DISCUSSION

The objective of this study was to investigate the impact of non-declarative memory on self-regulation of individuals with obesity as related to food choices while attempting to lose weight. We used a task exploiting flexion and extension movements in order to activate approach or avoidance of fattening vs. dietary foods and examined whether such activation influenced food preferences and goal assessment and led to behavior consistent with activated preferences. We aimed to demonstrate that non-declarative memory implicitly influenced self-regulation and that implicit cognitive processes impact behavior directly relevant to food choices. Following the manipulation, experimental group 1, which had activated dietary food preferences and avoided fattening foods, indeed chose dietary products and avoided fattening items more often than group 2, which underwent activation of seeking fattening products and avoiding dietary food items. We also observed the increased importance of goals to lose weight and improve body shape as a result of manipulation consistent with its direction. This was true for both men and women in our study.

The ability to achieve one's goals is greatly dependent on the ability to efficiently regulate one's own behavior (Baumeister, Heatherton, & Tice, 1994; Naughton, McCarthy, & McCarthy, 2015; Hubert, Guimard, Florin, & Tracy, 2015; Hagger, 2014). Additionally, according to Muraven and Baumeister (2000) the proper functioning of self-control requires cognitive strength and resources which are gradually depleted by earlier attempts at self-control. Thus, the effectiveness of conscious self-control decreases as the resources are being depleted (Englert, Zwemmer, Bertrams, & Oudejans, 2015; Barber & Smit, 2014). However, there are also self-control strategies which can be implemented at the automated level of processing (Fishbach & Shah, 2006). Automated processing is less complex, efficient and less prone to error.

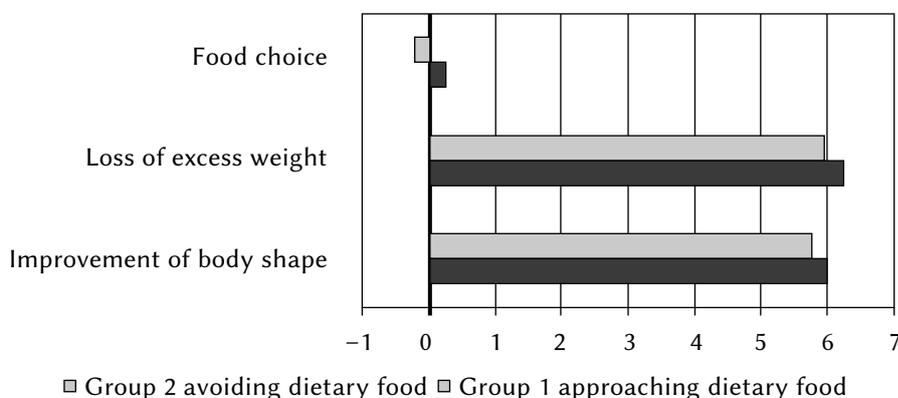


Figure 1. Subjective importance of dietary goals and food choice as a function of avoid vs. approach manipulation.

Changing natural tendencies which one desires to overcome in order to achieve one's goals through conscious self-regulation and control is associated with high cognitive cost and often ends in failure (Bargh, 1994; Baumeister, 2014). The results of our experiment, as well as those reported previously (Fishbach & Shah, 2006), have shown that behavior, such as motor movement of an arm, may produce different attitudes and behavior toward certain objects. The effects of our experiment in compliance with studies of Fishbach and Shah (2006) demonstrated that self-control can be influenced outside of conscious cognitive processing. Also, according to Becker et al. (2014), Schumacher et al. (2015) and Stice, Lawrence, Kemps, and Veling (2016), the effects of motor movement influence formation of implicit preferences for fattening vs. dietary food. The above studies, similarly to our findings, demonstrated that bias modification training has potential to reduce cognitive biases for attractive targets and affect health behaviors.

The results of our experiment have also shown that there are no gender differences in forming implicit preferences for fattening vs. dietary food.

This has a direct impact on implicit abilities to control one's food choices, which is crucial for successful weight loss and weight management. The practical recommendation for individuals with obesity trying to lose weight is to develop and implement behavioral strategies to strengthen self-regulation through efficient use of cognitive resources (Ramage, Farmer, Apps, & McCargar, 2014; Altman & Wilfley, 2015). Future studies should address specific ways in which motor behavior could help in establishing automatic tendencies supporting weight loss and improvements in eating habits.

## LIMITATIONS

The limitation of our study is the kind of measuring declaration for motivation to maintain a diet (dependent measures). We used only two items, separately, to assess the need for *Improvement of body shape* and *Loss of excess weight*. We did not make an effort to create a questionnaire that measures motivation for dieting behavior. We also did not try to validate one of the existing questionnaires, e.g. the Three-Factor Eating Questionnaire (TFEQ) (Löffler et al., 2015). The results of our studies shall be treated with special prudence.

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