Mind over food

IMPACT ADDENDUM

Research findings

The aim of the current dissertation was to examine the influence of mindset on psychological and physiological variables involved in eating behavior. Taken together, the research in this dissertation shows that mindset affects brain activity when people view food pictures, but only when the manipulation of the mindset is strong and task-based. For example, when people who are overweight were asked to pay attention to the tastiness of the presented high caloric food pictures (hedonic mindset) neural responses were stronger than when people payed attention to the colours of the food pictures (neutral mindset). Importantly, whereas neural activity differed between these mindsets, no significant difference in neural activity was observed between highly palatable versus highly unpalatable food items. The distinction between palatable and unpalatable food items could only be made when analyzing the brain data using a multivariate analysis approach assessing the multivoxel patterns of neural activity. That is, multivoxel patterns related to palatable foods differed significantly from those related to unpalatable foods, a finding which was most pronounced for the hedonic mindset. Mindset also influenced actual eating behavior and food craving. People consumed more food and desired food more when in an induced *loss of control* as compared to a *control* mindset. We did not observe any effects of mindset on metabolic and hormonal responding and the accompanying craving, hunger and satiety states. In addition, this dissertation showed that a food cue exposure intervention did not lead to any of the expected effects on brain activity as reaction to viewing visual food stimuli while in a hedonic mindset.

Relevance

Obesity is a worldwide problem; the number of adults with obesity (BMI ≥ 30 kg/m2) has nearly tripled since 1975. As the population with obesity is at high risk of health complications, and is often unsuccessful at dieting and maintaining weight-loss, examining mechanisms that contribute to the maintenance of obesity and/or an unhealthy lifestyle is highly important. Obesity is ultimately caused by a prolonged energy imbalance: the number of calories consumed exceeding the number of calories expended. An often-cited cause for this energy imbalance is our current obesogenic environment. However, we all live in the same environment, but not everyone is obese. It has been proposed that people who are overweight or obese may be more sensitive to this obesogenic environment. In addition, we believe that examining a

person's current mindset (hedonic versus health/neutral) is of major importance to understand the psychological and physiological mechanisms in eating behaviour.

In this dissertation, we show that mindset is important to consider when examining psychological and physiological mechanisms in eating behaviour. Our findings lead to novel insights and more elaborative scientific understanding in the current inconsistent field of neural and cognitive mechanisms in food cue processing. Our findings show that brain processes in food perception are dynamic and dependent on someone's current mindset. Interestingly, whereas mindset did influence neural responding to visual food processing, no difference in neural activity between highly palatable versus highly unpalatable food items were found. These findings reflect a significant shift in the field, as it is commonly assumed that the level of neural activity in the mesocorticolimbic system of the brain reflects the reward value of food. Our findings suggest that this level of neural activity more likely reflects saliency. Our findings also indicate that it is difficult to grasp and change a mindset to change eating behaviour, that a mindset should be very strong and eating context-dependent.

The findings of this dissertation are valuable for society as they underline the importance of mindset for eating behaviour, that it matters which mindset you have when you engage with food. We show that a mindset influenced brain responses when seeing food items and actual eating. This knowledge could be used in daily life by helping people to have a healthy mindset when this is needed. For example, by nudging people at the right moment to make a healthier choice in a relevant context. This could be achieved by sending mindset messages to people's smartphone on relevant moments, such as when shopping for food items in a grocery store. Knowledge on the impact of mindset on the psychology and physiology of eating behaviour is essential for the improvement of interventions for reducing overweight and increasing health.

Target group

The target groups of our research are people who are coping with eating and weight problems, like people who overeat and are (at risk to become) overweight or obese. However, our research is also of relevance for people with other eating-related problems, like people suffering from bulimia nervosa or anorexia nervosa. Obviously,

for people being underweight (i.e. due to anorexia) a different mindset manipulation target is needed than for people who are overweight or obese to improve healthy eating. In addition, the mindset manipulations used in this dissertation could also be adapted to other age groups, like adolescents and children. Furthermore, the research findings of this dissertation are of relevance to all people interested in mindset, eating behaviour, and neuroscience related to food perception, more fundamental neuroscience, and/or biological mechanisms involved in food processing. These can be people from the general population interested in (one of) these topics or people working in food science, such as dieticians, clinicians, and of course people working in academic research related to this field. If we understand more about the role of mindset and the mechanisms involved in eating behaviour, eventually treatment could be optimized by targeting problem factors better. This dissertation is also of interest for neuroscientists in general, as our research underlines the importance of a well-controlled fMRI paradigm. This to be sure of the exact ongoing mental process of participants while they perform the task in the scanner, to overcome the problem of reverse inference.

Activity

The findings of this dissertation are of great value for science. Results of the research of this dissertation have been presented at several scientific interfaculty, national and international symposia and conferences. Researchers, students and/or clinical therapists attended these conferences, and shared their thoughts and feedback on this topic. Scientific articles derived from the research from this dissertation are published or about to be published in international peer-reviewed journals.

Our research findings can give future directions for intervention development by using mindset messages to improve healthy behaviour. Our research shows that to most effectively change eating behaviour, mindset should be addressed in the right manner and in the right eating-context. One of the possibilities to do this is to design a mindset-changing mobile smartphone application, and to examine eating behaviour outcomes. This idea has already been implemented in a current running study to test the influence of mindset messages (hedonic versus health) on snacking behaviour in daily life. This is performed by using an Ecological Momentary Intervention (EMI) app for two weeks in female healthy-weight students. A next step would be to develop and use this kind of mobile application in a clinical population.

Another activity performed to share our research findings was via teaching at Maastricht University. Teaching included lectures on topics of this dissertation and the design of teaching materials for related courses (psychology of eating, eating behaviours) for bachelor and master students in psychological science, health and social sciences and university college Venlo. Several students have joined projects from this dissertation and gained experience in executing research by assisting research, doing internships and/or writing bachelor or master theses on topics related to this dissertation.

It is also important to inform the more general public. The eating disorders and obesity eating group has organized a public event in which the research of this dissertation (and other research from our research group) was presented to the general public. Here, we provided an interactive lecture about the topics of this dissertation. We will continue to share our research on multiple (online) channels for researchers, students, clinicians and general public.