Physiology & Behavior 195 (2018) 76–81

Contents lists available at ScienceDirect

Physiology & Behavior

journal homepage: www.elsevier.com/locate/physbeh

Playing with food: The effects of food pre-exposure on consumption in young children

Arnd Florack[a,*], Simona Haasova[a], Sarah Hirschauer[a], Benjamin G. Serfas[b]

[a] Department of Psychology, University of Vienna, Austria
[b] Economic and Consumer Psychology, University of Duisburg-Essen, Germany

ARTICLE INFO

Keywords:
Self-regulation
Food consumption
Food exposure
Food pre-exposure
Children
BMI

ABSTRACT

Recent research has shown that pre-exposure to food can lead to reduced subsequent consumption in older children and adults when they focus on a task with a non-eating goal during exposure. One assumption is that the reduced consumption is a consequence of self-regulation that helps to concentrate on the task. Because self-regulatory mechanisms are still under development in young children, we studied the effects of food pre-exposure in young children under the age of six ($N = 81$). Children played a memory game with real sweets (food pre-exposure) or similar non-food stimuli (non-food pre-exposure) and we measured their subsequent food consumption. In contrast to the findings with older children in other studies, we found that pre-exposure led to an increase (not a decrease) in subsequent consumption. This effect was stronger among children with a higher BMI. Food exposure paradigms might not lead to the desired reduction in food intake in young children, whose BMI is positively associated with food reactivity. Thus, food exposure must continue to be considered a strong risk factor for obesity in young children.

1. Introduction

Given the far-reaching consequences of being overweight for children's psychological well-being and health [38], it is important to study how and when can children effectively self-regulate and strengthen their resistance to tempting food. The prevalence of overweight and obesity has increased dramatically in recent years [32], and can affect children even at a young age [6]. In a recent review of data for several European countries, the prevalence of overweight and obesity in four- to six-year-old boys, for example, was found to range between nine and 27% [9]. One factor that researchers regard as a potential driver of these alarming rates is the ubiquitous exposure to tempting foods such as sweets [14, 42, 43]. However, the effects of food exposure on consumption are more complex than one might expect.

At first glance, a consistent finding appears to be that exposure to food cues increases one's motivation to eat the corresponding food. For example, researchers found that preceding exposure to food or food-related cues led to the selection of larger portion sizes of the same food [12] and increased consumption [11, 15], even when individuals were satiated [5]. Recently, however, researchers have reported that exposure to food cues does not necessarily lead to an increase in subsequent consumption - the increase in consumption failed to appear, or a decrease in consumption occurred, in situations when consumers were cued with real food in a task in which eating was not the goal [19, 20], when they evaluated a large number of food pictures [26], or when they imagined eating the food repetitively (e.g., 30 times; [28, 29]).

While there are first indications that under specific circumstances exposure to food cues can lead to a reduction in food consumption among adults, research with children applying exposure paradigms that might lead to resistance to food temptations is rare. One notable exception is a study by Grubliauskiene and Dewitte [20], who asked children between seven and 12 years old to construct words from letter shaped candies in the food pre-exposure condition. Importantly, the objective was to use the candies to form words, not to consume them. Compared to a control condition, pre-exposure to one food (candies) did not lead to an increase in consumption of other sweets, similar but not identical to the exposed food, among girls, and even led to a decrease in consumption among boys. De Boer, de Ridder, de Vet, Grubliauskiene and Dewitte [7] used a similar task to build a self-control training with children aged between eight and 11 years old. After the training, they found that, compared to a control group, girls consumed less from attractive candies that were different from those used for the training.

The findings by Grubliauskiene and Dewitte [20] and de Boer et al. [7] are promising, but the studies differed in important respects from other studies on the effects of pre-exposure to food cues, and thus raise

* Corresponding author at: Department of Psychology, University of Vienna, Universitaetsstrasse 7, 1010 Vienna, Austria.
E-mail address: arnd.florack@univie.ac.at (A. Florack).

https://doi.org/10.1016/j.physbeh.2018.07.022
Received 24 January 2018; Received in revised form 19 July 2018; Accepted 25 July 2018
Available online 30 July 2018
0031-9384/

three important questions. First, other studies concentrating on sensory stimulation by food exposure typically use the same kind of food during both the exposure and consumption phases [34], and not a different kind of food, as in the above mentioned studies. Hence, the effect of pre-exposure to food with a non-eating goal in mind on consumption of the cued (exposed-to) food remains unknown.

Second, the studies by Grubliauskiene and Dewitte [20] and de Boer et al. [7] did not take into account the children's body mass index (BMI). Because BMI seems to be related to the strength of cueing effects of food on consumption, [13, 22, 39], regarding it as a potential moderator might provide better insight into the effects of food pre-exposure on children's consumption, which appear mixed at present.

Third, the aforementioned studies were conducted with children older than six. It is uncertain whether exposure to food would lead to cueing (increasing consumption) or blocking (decreasing consumption) effects in younger children, who have weaker self-regulatory competences [2].

Bearing these three points in mind, the objective of the present study was to further examine the pre-exposure effects of food. Specifically, we studied pre-exposure effects in young children between three and six years of age and measured the consumption of both cued and non-cued food. We also examined the children's body mass index (BMI) as an important moderator of the effect of food pre-exposure on consumption.

The main contribution of the present study is to further differentiate the consumption-cueing and -blocking effects of pre-exposure to food and to find out whether pre-exposure to food prioritizing a non-eating goal can lead to reduced subsequent food intake even among young children. This would be an indication that a basic self-regulatory mechanism is already operating at this early age.

2. Theoretical background

A basic assumption in research on the regulation of food intake is that, leaving aside deprivation-induced appetite, food cues give rise to a motivational state to consume food [10, 24, 44]. Indeed, when humans taste, smell, or look at palatable food before actually eating it, the body elicits a great variety of physiological responses in preparation of consumption that are small in magnitude, but observable [27]. For example, the perception of food can elevate salivary flow [31, 33] and heart rate [1, 31]. Furthermore, studies with both humans and animals indicate that cues associated with food promote appetite for the cued food and are learned via conditioning [10, 34].

Considering that these basic mechanisms are activated when food is perceived, it seems rather surprising that exposure to food cues might strengthen resistance to food. However, humans do not only focus on eating when they are exposed to food, but often have other goals or tasks to pursue that modify their focus during food exposure. Indeed, a basic distinction between different exposure paradigms is that participants apply different foci to the food. For example, a typical study in which consumers ate more after food pre-exposure is a study by Fedoroff et al. [11] in which participants strongly focused on the food it self: Participants in the relevant conditions were exposed to the smell of pizza or chocolate chip cookies from an oven for 10 min while they wrote down their thoughts about that food. By contrast, studies finding that food pre-exposure can reduce subsequent food intake often require participants to pursue a task during the pre-exposure in which a focus on eating and the sensory aspects of the food is not adequate [8, 19, 20]. For example, in Grubliauskiene and Dewitte's [20] study, the children in the food-exposure condition had to physically construct words from the provided letter shaped candies. It is reasonable to assume that a strong focus on non-eating aspects of food reduces the desire to consume the food and spills over to a subsequent situation in which the food can be consumed and leads to a reduced consumption in this situation [19].

To perform a non-eating task when exposed to food requires self-control abilities to resolve the conflict between the desire to eat and the fulfillment of the non-eating task. However, the self-control abilities of young children under the age of seven are still under development [2] and they have much greater difficulty resolving conflicts in simple tasks than older children [35]. If such control abilities are not operating during pre-exposure to the food, pre-exposure to food will be less likely to lead to decreased subsequent consumption. Because knowledge about self-regulation effects in food consumption in young children is scarce, it is important to study the effects of pre-exposure to food prioritizing a non-eating task on subsequent consumption with participants under the age of seven.

To study the pre-exposure effects of food properly, it is further crucial to examine these effects on the cued food as well as on an alternative non-cued food. Examining only the effects of pre-exposure on non-cued food (e.g., [20]) comes with the disadvantage that possible effects on cued food are not observed, thus underestimating potential undesired effects.

It is further important to investigate the role of children's BMI and determine whether children with a higher BMI are less likely to show reduced consumption after food pre-exposure compared to children with a lower BMI. Jansen et al. [22], for instance, found that overweight children failed to regulate their food intake after they were exposed to an intense smell of food like normal weight children did. Ferriday and Brunstrom [13] reported that exposure to food in participants with a higher BMI led to greater salivation and a greater desire to consume both cued and non-cued food. Jansen et al. [23] further found that a higher BMI among children is related to children's food approach behaviors such as food responsiveness, possibly explained by genetic influences on weight and on susceptibility to eating in the presence of foods. Since reactivity to food cues has been discussed as a risk factor for obesity [39], and above-mentioned evidence suggests a link between BMI, representing an indirect measure of obesity (body fat levels), and regulation of food intake, we expected that the children's BMI would moderate the response to food pre-exposure.

3. The study

To test the hypothesis that pre-exposure to food in a non-eating task leads to reduced subsequent consumption of both the cued food and another non-cued food and whether this effect is weaker for children with a higher BMI, we conducted a study with kindergarten children, who took part in two experimental sessions in their kindergarten. We manipulated food pre-exposure with a memory game with sweets in one condition, and with similar, but non-food stimuli in the other condition. We measured the consumption of the food used in the memory game (cued food) and another kind of food (non-cued food) after the game. The order of the experimental sessions, representing the two conditions, was counter-balanced, as in similar studies (e.g., [22]). We also controlled for possible effects of gender.

4. Materials and method

4.1. Participants

We recruited 90 children between three and six years of age from two public kindergartens located in a medium size city in a Western European country. Following the principle of consent in studies involving children, we first thoroughly informed the children's parents about the study in a letter that also included a consent form. If parents agreed to let their child participate, we collected their signed consent forms. Children's participation was completely voluntary. Out of the 90 children who agreed to participate in the experiment, we subsequently excluded nine children from the data analysis due to incomplete participation, i.e. taking part in only one out of the two experimental sessions. The final sample consisted of 81 normally developing children (one with special needs), 38 boys and 43 girls, with an average age of