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Research report

Effects of awareness that food intake is being measured by a universal eating monitor on the consumption of a pasta lunch and a cookie snack in healthy female volunteers ☆

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ABSTRACT

To date, there have been no studies that have explicitly examined the effect of awareness on the consumption of food from a Universal Eating Monitor (UEM – hidden balance interfaced to a computer which covertly records eating behaviour). We tested whether awareness of a UEM affected consumption of a pasta lunch and a cookie snack. 39 female participants were randomly assigned to either an aware or unaware condition. After being informed of the presence of the UEM (aware) or not being told about its presence (unaware), participants consumed ad-libitum a pasta lunch from the UEM followed by a cookie snack. Awareness of the UEM did not significantly affect the amount of pasta or cookies eaten. However, awareness significantly reduced the rate of cookie consumption. These results suggest that awareness of being monitored by the UEM has no effect on the consumption of a pasta meal, but does influence the consumption of a cookie snack in the absence of hunger. Hence, energy dense snack foods consumed after a meal may be more susceptible to awareness of monitoring than staple food items.

Introduction

Measuring food intake within laboratory settings can be a challenge and it has been suggested that consumption in a laboratory may not be representative of normal eating behaviour (Meiselman, 1992). One concern about laboratory based assessment of eating is that if participants are aware that their intake is being monitored, this might affect how much food is consumed.

There is evidence that when participants are directly observed by a researcher who is present in the same room, they consume less food than when an experimenter is not present (Roth, Herman, Polivy, & Pliner, 2001). This inhibitory effect of observation on eating also extends to situations when the experimenter is not in the same room, but participants believe the experimenter will know how much food they have consumed (Polivy, Herman, Hackett, & Kuleshnyk, 1986). More recently, Robinson, Kersbergen, Brunstrom, and Field (2014) conducted two experiments to examine how awareness of food intake monitoring affects eating behaviour. In the first study, they found that when participants believed their food intake would be monitored, the majority of participants indicated that they would eat less food as a consequence. In the second study, when participants were explicitly informed that their food intake would be monitored, they consumed less in a taste test than when they were not given information about monitoring of intake. Given the evidence that participants may change their eating behaviour in response to knowing that their intake is being monitored, it is important to extend our understanding of how awareness of consumption monitoring affects eating in the laboratory.

Appetite researchers usually use cover stories and paradigms designed to reduce awareness that food intake is being monitored to mitigate potential effects on intake. For instance, the disguised taste-test paradigm requires participants to provide sensory ratings of foods. However, the sensory ratings are a cover story, and the true aim is to examine the amount of food consumed (Higgs, 2002). Nevertheless there is evidence that participants in laboratory studies may believe that their intake is being measured, even when they are told that it is not being monitored (Robinson et al., 2014).

Most research on awareness of monitoring has been conducted on intake of highly palatable energy dense snack foods (e.g. cookies: Polivy et al., 1986; Robinson et al., 2014; Roth et al., 2001).

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Comparatively less work has investigated whether awareness affects the intake of staple foods, lunches and subsequent snacks. Westerterp-Plantenga et al. (1990) and Westerterp-Plantenga, Wouters, and ten Hoor (1991) reported that participants who were made aware that their consumption of a pasta lunch would be monitored did not eat differently from participants who were unaware of the monitoring procedure. However, a fixed portion of pasta was provided to participants, which might have limited the ability to detect differences between groups. Nevertheless, the results of Westerterp-Plantenga et al. (1990) are particularly interesting because they used a universal eating monitor (UEM), a device developed to measure food intake in a covert manner (Kissileff, Klingsberg, & Van Itallie, 1980). The UEM comprises a concealed balance which is interfaced to a computer that records weight every few seconds. By serving food to participants on a plate placed on a mat covering the balance, it is possible to record within-meal eating behaviour. It is important to ascertain whether awareness of a UEM affects eating behaviour because inadvertent movement of the balance by participants can lead to loss of data. From our own work and that of others (Hubel, Laessle, Lehrke, & Jass, 2006; Thomas, Dourish, Tomlinson, Hassan-Smith, & Higgs, 2014), it has been shown that testing unaware participants who may for example, accidentally lean on the scales, can lead to losses of up to 26% of study data. If awareness of the UEM does not affect intake, then making participants aware of its presence could potentially prevent such data loss while avoiding problems with demand effects.

In this study we tested whether explicit awareness of the UEM would affect intake of a pasta lunch (staple food item), and a subsequent cookie snack (palatable, energy dense food item). The use of the UEM allows us to examine whether awareness of monitoring affects the total amount of food consumed, the microstructure of a meal and within meal appetite ratings. Participants had ad-libitum access to a pasta meal, followed twenty minutes later by ad-libitum access to a chocolate chip cookie snack. Participants in the aware condition were made explicitly aware of the presence of the UEM, while those in the unaware condition were not. It was hypothesised that awareness of the UEM would decrease the amount of cookies consumed, but have no effect on the amount of pasta that was eaten.

Materials and methods

Participants

A total of 72 female student volunteers were recruited from the School of Psychology at the University of Birmingham. During testing, 3 participants in the unaware condition became aware of the UEM, while 30 participants (25 unaware and 5 aware) accidentally leaned on the UEM balance during their test session, triggering an error with the software which prevented accurate measurement of subsequent eating behaviour. Therefore, 39 participants successfully completed testing and their data were used for analysis. The 39 participants had a mean age of 19.7 years (SEM 0.2) and a mean body mass index (BMI) of 21.8 (SEM 0.4). Reimbursement for participation in the study took the form of course credits or a £10 payment. Informed consent was obtained from participants and ethical approval was provided by the University of Birmingham Research Ethics Committee. The study was conducted in accordance with Good Clinical Practice and the ethical standards laid down in the 1964 Declaration of Helsinki. Participants were not recruited if they: had food allergies; smoked cigarettes; took medication that affected appetite; were diabetic or had participated in a previous study using a UEM. All of these were assessed via questionnaire in the laboratory.

Design

A between-subjects design was used with a single factor of awareness with two levels: aware and unaware. Participants were randomly allocated to one of these conditions and order of testing within sessions was counterbalanced so that half of the participants completed a batch of questionnaires followed by a computer task, while the other half had the order reversed. Based on an awareness study by Roth et al. (2001) and a UEM study by Yeomans (1996), effect sizes were calculated (Cohen's $d = 0.97$ and 1.00, respectively), and power analyses were conducted, showing that at least 18 participants were required per group to detect an effect (80% power; $p < 0.05$).

Universal eating monitor (UEM)

Test meals were served on a Sussex Ingestion Pattern Monitor (SIPM), a validated UEM (Yeomans, 2000). This consisted of a balance (Sartorius Model CP4201, Sartorius Ltd., Epsom, UK; 0.1 g accuracy) placed underneath, but protruding through, the surface of a table. A placemat on the table was used to hide the balance from the participants' view. The balance was connected to a laptop computer and relayed balance weights every 2 seconds.

Pasta lunch

Based on our previous work (Thomas et al., 2014), dishes filled with 220 g (253 kcal) of pasta were set on the placemat. Each time the participant ate 50 g of pasta, the SIPM software (version 2.0.13) interrupted the participant with instructions to complete computerised VAS ratings (hunger, fullness and pleasantness of the pasta). After consuming 150 g, participants were interrupted and provided with a fresh dish of 220 g of pasta. Participants were asked to eat until they felt 'comfortably full'. The lunch consisted of pasta shells in a tomato and herb sauce (Sainsbury's UK), served at 55–60 °C.

Cookie snack

Bowls containing 80 g (390 kcal) of cookie pieces were set on the placemat. Each time the participant ate 10 g of cookie pieces, the SIPM software interrupted the participant with instructions to complete VAS ratings as described above for pasta. After consuming 60 g, participants were interrupted and provided with a fresh bowl containing 80 g of cookie pieces. Participants were asked to eat until they felt 'comfortably full'. The cookies were Maryland Chocolate Chip Cookies, with each cookie being broken into 6–7 pieces. This approach was designed to reduce the likelihood that participants could track the number of cookies they ate (Higgs & Woodward, 2009).

Stop signal reaction time task (SSRT)

Behavioural impulsivity has been reported to affect the consumption of food (Guerrieri et al., 2007), hence, the SSRT was included to ensure that there were no differences between groups on this measure. The SSRT (as described in Verbruggen, Logan, & Stevens, 2008) involves presenting participants with either a square or a circle shape on a screen that they are required to identify. On no-signal trials, a shape is presented and participants respond by identifying the shape. On stop-signal trials, an auditory stop signal alerts participants to withhold making a response to the presentation of the shape. The task consists of 32 practice trials followed by 192 experimental trials and takes 20 minutes. Calculation of the stop signal reaction time provides a measure of inhibition of response (behavioural impulsivity).