



Research report

Watching television while eating increases energy intake. Examining the mechanisms in female participants



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ABSTRACT

Watching television (TV) while eating tends to increase food intake, but why this occurs is not well understood. Here, we examined TV's effects on sensory specific satiety (SSS), interoception (i.e., hunger/fullness), mood and other variables, in females who all ate one snack meal with TV and another without TV. To manipulate the development of SSS, participants were assigned either to a group receiving a single type of snack food or one receiving four types. Everyone ate more with TV. More food items were eaten in the group offered multiple snack types. In the group eating a single snack type with TV, hedonic ratings indicated that SSS did not develop and this was associated with greater food intake. Irrespective of group, more food had to be consumed to generate the same shift in hunger/fullness when eating with TV, relative to no TV. TV exerted less effect on food intake both if it improved mood and if participants were unfamiliar with the TV show, and a greater effect if participants were frequent TV viewers. We suggest that TV can affect several processes that normally assist the voluntary regulation of food intake.

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Introduction

Lengthier TV viewing is associated with a greater body mass index (BMI), increased risk for cardiovascular disease and type II diabetes (e.g., Hill & Peters, 1998; but see, Ferguson, Munoz, & Medrano, 2012). Prospective studies indicate that greater TV viewing when young predicts excess weight gain and poorer physical health in later years (e.g., Wijndaele et al., 2010). TV viewing probably contributes to weight gain via reducing energy expenditure and increasing energy intake (Cleland, Schmidt, Dwyer, & Venn, 2008; Goris, Petersen, Stamatakis, & Veerman, 2009). In terms of energy intake, TV viewing may serve as a general marker for a poor diet, it may increase exposure to unhealthy food advertisements and displace sleep (e.g., Barr-Anderson et al., 2009; Otten et al., 2009; Wiecha, Peterson, & Ludwig, 2006). More directly, eating while watching TV can increase food intake (e.g., Bellisle, Dalix, & Slama, 2004; Bellissimo, Pencharz, Thomas, & Anderson, 2007; Blass et al., 2006; Hetherington, Anderson, Norton, & Newson, 2006; Martin et al., 2009; Ogden et al., 2013; Temple, Giacomelli, Kent, Roemmich, & Epstein, 2007). TV can also have a delayed impact on food intake, increasing it on a later TV-free meal (Higgs & Woodward, 2009; Mittal, Stevenson, Oaten, & Miller, 2010). While the evidence that eating with TV can increase food intake is generally supportive, the cause or causes of this effect are not well

understood. The aim of the experiment reported here was to explore several putative mechanisms for how concurrent eating with TV can act to increase food intake.

How might TV act to increase food intake?

Television is an effective form of distraction from on-going events in the internal and external environment. A good illustration of this is TV's ability to act as an analgesic for children receiving venipuncture (Bellieni et al., 2010). TV's capacity to distract may mean that people eating while watching TV do not pay attention to various signals that would normally indicate the end of a meal, so they end up eating more (Smith & Ditschun, 2009). The types of signal that might be affected by TV include attention to affective and interoceptive states. Affective signals are known to be involved in regulating food intake (i.e., sensory specific satiety; Rolls et al., 1981) via reducing the motivation to eat prior to the onset of physiological satiety signals. Changes in interoceptive states such as hunger and fullness, may also serve to signal when eating should stop. Both affective and interoceptive signals require attention to the internal milieu. If TV viewing reduces attention to the internal milieu, then these signals may not be noticed, leading the participant to overeat.

With regard to sensory specific satiety, Brunstrom and Mitchell (2006), examined whether eating a food while either playing or not playing a computer game influenced desire to eat ratings for that food. They found some evidence for smaller changes in desire to

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eat ratings following the computer game suggesting reduced sensory specific satiety. While computer games may have this effect, it does not automatically follow that TV viewing will. In particular, two studies have not found any unusual alteration in desire to eat ratings while eating with TV (Bellissimo et al., 2007; Ogden et al., 2013). Another study did find that TV affected food-liking judgments, but this depended upon the type of food (Blass et al., 2006). With macaroni cheese liking ratings obtained after the meal declined to a similar degree with or without TV, while for pizza, liking decline was less apparent with TV than in the no-TV control condition. It is then currently unclear whether eating with TV affects sensory specific satiety.

Brunstrom and Mitchell (2006) also examined whether hunger and fullness were affected in their video game experiment. They found that ratings of hunger changed less in participants who played the computer game while eating a set amount of food. However, results from studies using TV have generally failed to find significant alterations in hunger and fullness ratings (e.g., Bellisle et al., 2004; Bellissimo et al., 2007; Hetherington et al., 2006; Ogden et al., 2013; Temple et al., 2007). This failure has to be seen in the light of the typical finding of increased energy intake when eating with TV. Thus if participants consume more energy but report equivalent levels of hunger and fullness after a test meal (relative to a no-TV condition), this would *not* suggest equivalence in their use of these scales between conditions. Instead, it would imply that greater energy intake is required to produce an equivalent shift in hunger and fullness, when the participant eats with TV. Only one study has found greater changes in hunger following eating with TV than without, suggesting that sensitivity to internal state can still occur even with increased food intake (Blass et al., 2006). While it looks likely that changes in interoceptive state are diminished when eating with TV, there is as yet no direct evidence that this is the case.

Distraction may not be the only way that TV could affect the amount of food eaten. In a study with children, Francis and Birch (2006) found that TV only acted to increase food intake in those who reported watching more TV at home and in those who more regularly ate with the TV on. One way in which regular exposure to TV could affect ingestive behaviour in both children and adults is through associative learning. TV could become associated with food, such that watching TV then comes to cue food intake (Wansink, 2004). This type of associative effect could result from many causes, including frequent exposure to food related cues on TV shows, TV advertising of palatable foods, and prior eating bouts accompanied by TV. As many people watch TV while they eat, and many more watch TV for leisure, this past history may represent an additional explanatory factor in driving TV's impact on food intake in adults, although this remains to be tested.

A further possibility is that TV affects food intake via its impact upon mood. Several studies indicate that mood can affect food intake (e.g., Bongers, Jansen, Havermans, Roefs, & Nederkoorn, 2013; Groesz et al., 2012; Yeomans & Coughlan, 2009). Recent findings suggest that increased eating can occur when individuals are in a positive mood (Bongers et al., 2013; Evers, Adriaanse, de Ridder, & de Witt Huberts, 2013). In the Evers et al.'s (2013) study, which compared snack consumption after a positive mood induction relative to a neutral mood induction, the positive mood induction was found to significantly increase food intake. The influence of mood on food consumption may also depend on individual differences in eating habits, notably in dietary restraint. Turner, Luszczynska, Warner, and Schwarzer (2010) examined the effect of restrained eating and positive mood induction on food consumption. Unrestrained eaters ate more following the positive mood induction, in contrast to restrained eaters, a finding similar to the one reported by Yeomans and Coughlan (2009). These findings imply that if a positive mood were induced by TV viewing, moderated perhaps

by restraint, this could represent a further factor in increasing food intake. This too remains to be tested.

The current study

While there is good evidence that eating with TV can increase food intake, how this comes about is less well understood. To address this we examined four possibilities: (1) Is sensory specific satiety disrupted by TV viewing? (2) Is sensitivity to interoceptive states reduced by TV viewing? (3) Are TV viewing habits related to the impact of TV on eating in the laboratory? (4) Can changes in mood be predictive of greater food intake and are these moderated by restraint? To address these questions we adopted the following mixed design that had *one within-factor*, eating with TV on one session and without TV on another, and *one between-factor*, manipulating the variety of food provided. For the within factor, we selected a TV comedy show that would be familiar and engaging for the participants used in our study. For the between factor, participants were randomly assigned to either receive a snack meal consisting of one type of palatable food or a snack meal consisting of four types. This manipulation was included as a single food type is more likely to induce sensory specific satiety than multiple foods (e.g., Rolls et al., 1981). Thus if TV exerts its effects primarily by disrupting sensory specific satiety then the effect of TV should only be evident in the single food group. Before and after each snack meal, participants rated the affective properties of all of the foods, as well as rating hunger, fullness and mood. No ratings were obtained during the snack meals, as we did not want to draw participants' attention to their internal state. After the TV viewing session, participants rated the show, so that we could determine if content-related variables impacted on eating behaviour (e.g., not enjoying the show or having seen it before might alter its distraction potential). At the end of the study, participants were asked how frequently they watched TV and how often they ate with the TV on, to assess viewing habits. Participants also completed the three factor-eating questionnaire (Stunkard & Messick, 1985), to measure dietary restraint. Finally, and in line with much of the previous research on this topic (e.g., Bellisle et al., 2004; Brunstrom & Mitchell, 2006; Ogden et al., 2013), we used only female participants so as to preclude using gender as a further independent variable.

We predicted that if TV disrupts sensory specific satiety then this should be most evident in the Single food group. Thus, when compared to the Variety food group, we expected that the Single food group would eat more food on their TV session compared to their no TV session, and that their affective ratings would change less on their TV session as compared to their no TV session. As a manipulation check, we also expected that the Variety food group would consume more food than the Single food group, and that their affective ratings would change less across each meal (i.e., less sensory specific satiety).

For interoceptive sensitivity, we predicted that there would be no difference in hunger/fullness ratings between the TV and no-TV sessions. However, as we expected food intake to differ between the TV and no-TV sessions, we predicted that the amount of food needed to produce the same unit-change in hunger/fullness ratings would reveal that more food was needed to produce the same unit-change in these ratings when eating with TV.

If prior TV viewing habits are important in driving the effects of TV in the lab, we expected to observe a positive association between frequency of TV viewing and excess food intake in the TV viewing and eating session. Similarly, if eating with the TV also builds associations between eating and TV, more frequent eating with the TV should be associated with greater excess food intake in the TV viewing and eating session.

We expected mood to be elevated after watching the TV comedy show selected for this study. We predicted that the more TV

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