



The effect of television watching and portion size on intake during a meal



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ABSTRACT

Watching television while eating and eating from larger portion sizes of food are factors that have been found to independently increase food intake. When combined, these factors may further enhance consumption. This investigation, using a $4 \times 2 \times 2$ mixed factorial design, with a between-subjects factor of order of conditions and within-subjects factors of television watching (NO TV and TV) and portion size (SMALL and LARGE), tested the independent effects and interaction of these factors in seventeen women and three men (21.6 ± 2.3 kg/m², 22.3 ± 3.7 years, 80% white and 95% non-Hispanic). In each condition, participants had 30 min to eat a meal containing macaroni and cheese and salad with dressing. For NO TV, participants sat for 30 min while eating, while for TV, participants viewed a 30-min show containing no food cues while eating. In SMALL the meal provided 1083 kcal, while in LARGE the meal provided 200% of SMALL. Mixed factorial analysis of variance revealed a significant main effect of portion size on grams and energy consumed of the total meal. Participants consumed more grams (577.9 ± 150.5 g vs. 453.1 ± 96.6 g; $p < 0.001$) and energy (903.9 ± 270.4 kcal vs. 734.6 ± 187.1 kcal; $p < 0.001$) in LARGE as compared to SMALL. No significant effect of television watching or interaction of television watching and portion size was found. Results of this study suggest that to assist with reducing intake, smaller portion sizes should be implemented in all types of eating situations.

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1. Introduction

Obesity, a complex health condition, currently affects one-third of adults in the United States (Centers for Disease Contr, 2014a). The prevalence of obesity has increased over the past 40 years, and it has been proposed that changes in leisure time activities and the food environment have decreased energy expenditure and increased energy intake, contributing to the change in obesity prevalence (Centers for Disease Contr, 2014a; Ogden, Carroll, Kit, & Flegal, 2014). Two of these changes that have been hypothesized to increase energy intake are increased television watching and larger food portion sizes (Centers for Disease Contr, 2014b; Williams, Raynor, & Ciccolo, 2008). Eating while watching television and being provided larger portions to eat are believed to influence consumption outside of awareness (Boulos, Vikre, Oppenheimer, Chang, & RKanarek, 2012; Ogden, Coop, Cousins et al., 2013;

Wansink, 2010). Consumption outside of awareness is not in response to internal cues of hunger or satiation, and consequentially may produce excessive energy intake (Boulos et al., 2012; Ogden et al., 2013; Wansink, 2010).

Five laboratory-based experiments have investigated the effect of watching television on energy intake (Bellisle, Dalix, Slama, 2004; Blass et al., 2006; Braude & Stevenson, 2014; Hetherington, Anderson, Norton, & Newson, 2006; Higgs & Woodward, 2009). These studies found a consistent relationship of increased energy consumption when participants watched television versus other conditions, for example, listening to a recording (Bellisle et al., 2004; Blass et al., 2006) or eating alone in a quiet room (Braude & Stevenson, 2014; Hetherington et al., 2006; Higgs & Woodward, 2009). Many laboratory-based experiments have investigated the effect of portion size on consumption (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004; Rolls, Morris, & Roe, 2002; Rolls, Roe, Kral, Meengs, & Wall, 2004; Rolls, Roe, Meengs, Wall, 2004; Rolls, Roe, Meengs, 2007; Zlatevska, Dubelaar, & Holden, 2014). The studies have shown that when provided a greater portion size, participants eat more food (Diliberti et al., 2004; Rolls et al., 2002; Rolls et al., 2004, 2004, 2007; Zlatevska et al., 2014).

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Though there have been a number of studies investigating the relationship of television watching and portion size separately, to our knowledge, no study has looked at consumption with both factors combined. Both factors have been proposed to interfere with consumption monitoring, thus reducing awareness of amount being consumed, producing increased intake (Steenhuis & Poelman, 2017). This type of eating has been described as “mindless eating.” (Steenhuis & Poelman, 2017) When both factors are combined, they may exacerbate the occurrence of “mindless eating,” more greatly enhancing intake. As watching television while eating large portion sizes may be a common occurrence for many people, understanding if these factors when combined more greatly influence consumption as compared to when each occurs alone is important for developing efficacious interventions.

Therefore, the purpose of the study was to investigate the independent and interactive effects of television watching and portion size on consumption during a meal. It was hypothesized that a when a meal was provided in larger portions or eaten while watching television, more would be consumed as compared to when a meal was provided in smaller portions or eaten while not watching television, respectively. It was also hypothesized that more would be consumed when a meal was provided in larger portions and consumed while watching television as compared to when a meal was provided in smaller portions and consumed while not watching television.

2. Materials and methods

2.1. Study design

To test the influence of watching television and portion size on meal consumption in healthy weight adults, a $4 \times 2 \times 2$ mixed factorial design was used, with a between-subjects factor of order of the conditions and within-subjects factors of television watching (NO TV and TV) and portion size (SMALL and LARGE). Individuals who participated in the study were randomized to one of four orders of conditions. In each condition, participants were given a meal of macaroni and cheese and salad. The dependent variables were gram and calorie amounts consumed during the meal. This study was approved by the Institutional Review Board (IRB) at the University of Tennessee- Knoxville (UTK) and was registered at [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT02505490).

2.2. Participants

Twenty men and women participated in the study. This sample size would provide 80% power, with a two-tailed alpha set at 0.05, to determine a medium effect size ($d = 0.66$) for a two condition comparison (comparisons proposed in the hypotheses). The study was advertised as an investigation of the effect of television watching and liking of food. Flyers were posted around the University of Tennessee, Knoxville (UTK) campus and e-mails were sent out to electronic mailing lists. Interested individuals were screened over the phone.

Eligible participants were between the ages of 18 and 35 years; had a body mass index (BMI) between 18.5 and 24.9 kg/m²; were unrestrained eaters (≤ 12 on the Three Factor Eating Questionnaire [TFEQ-R]) (Stunkard & Messick, 1985); reported a favorable preference for the foods served in the meal (participants rated each food item ≥ 3 during phone screen and ≥ 50 mm on a 100 mm visual analogue scale [VAS] during the initial screening session) (Hill, Magson, & Blundell, 1984); ate before 10:00 a.m. on most days of the week; were able to complete all sessions within eight weeks of the screening session; were non-smokers; were not taking medications that affected appetite or food intake; were not pregnant or breastfeeding; and were not on a dietary plan or had dietary

restrictions that prevent consumption of certain types and/or amounts of food. Exclusionary criteria included self-reported binge eating (assessed by asking, “have there been times when you have eaten a large amount of food in a short time and you had a sense of loss of control about your eating?”) (Robert et al., 2013) and being an athlete in training.

A total of 68 individuals were phone-screened. Of these initially interested individuals, six were no longer interesting in participating after being provided additional details regarding the study. Of the remaining individuals screened for eligibility, 16 had a BMI outside eligibility range, 4 reported disliking foods being used in the study, 1 reported currently dieting for weight loss, 4 were classified as restrained eaters, 3 reported instances of binge eating, 2 reported not consistently eating a breakfast meal, and 1 reported currently breast feeding. After being phone screened eligible 11 potential participants dropped out from the study by not showing up to the initial screening session before signing informed consent. Thus, a total of 20 were screened eligible, signed an informed consent statement (approved by UTK IRB), and participated in this study.

2.3. Procedures

Participants who were phone-screened as eligible were scheduled for a screening session in which they signed a consent form that was approved by the UTK IRB. At the initial screening session, height and weight measurements were taken and participants confirmed liking of foods that were served in the study by taste testing the macaroni and cheese and salad with their preferred dressing and rated them on a 100 mm VAS. At the end of the screening session, participants were randomized to one of four orders, using a random numbers table, and scheduled for four lunch appointments with approximately one week between appointments. Appointments were scheduled between 11:00 a.m. and 3:00 p.m., Monday-Friday. Participants were asked to eat their usual breakfast the morning of the study, but asked to stop eating a minimum of three hours before the scheduled lunch appointment and only consume water during that time. In addition, participants were asked to not complete any physical activity for 24 h prior to their scheduled lunch appointment.

At the start of each lunch appointment, participants completed a dietary recall of all foods and beverages consumed 24 h prior to the appointment and were asked about physical activity that had been completed in the previous 7 days. During the dietary recall and physical activity questioning, if participants did not consume a morning meal, consumed anything other than water within three hours of the appointment, or completed any physical activity within 24 h, the appointment was to be rescheduled for a later date. After recalls had been completed, participants were asked to rate their current levels of hunger, fullness, and liking of the presented foods using a VAS, and then were served a meal of macaroni and cheese, salad with dressing, and water. Participants were given 30 min and instructed to eat as much or as little as they wanted until they were satisfied. During the TV conditions, the television was directly in front of participants while they ate. Following the 30 min, the meal was removed, and participants rated their levels of hunger, fullness, liking of the presented food, and liking of the television show (in TV conditions only). Participants that were in TV conditions were also asked if they had previously seen the specific episode shown in the condition. After all sessions and questionnaires were completed, participants were thanked for their participation and given a \$25 gift card to compensate for their time in the study.

2.4. Meal description

The meal that was served for this experiment was Stouffers[®] macaroni and cheese and salad with dressing (salad dressing

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