Appetite 95 (2015) 152–157

Contents lists available at ScienceDirect

Appetite

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

The impact of image-size manipulation and sugar content on children's cereal consumption

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ARTICLE INFO

Article history:
Received 29 September 2014
Received in revised form
22 May 2015
Accepted 5 July 2015
Available online 7 July 2015

Keywords:
Children
Advertising
Image-size manipulation
Cereal intake
Consumption
Front-of-pack marketing

ABSTRACT

Previous studies have demonstrated that portion sizes and food energy-density influence children's eating behavior. However, the potential effects of front-of-pack image-sizes of serving suggestions and sugar content have not been tested. Using a mixed experimental design among young children, this study examines the effects of image-size manipulation and sugar content on cereal and milk consumption. Children poured and consumed significantly more cereal and drank significantly more milk when exposed to a larger sized image of serving suggestion as compared to a smaller image-size. Sugar content showed no main effects. Nevertheless, cereal consumption only differed significantly between small and large image-sizes when sugar content was low. An advantage of this study was the mundane setting in which the data were collected: a school's dining room instead of an artificial lab. Future studies should include a control condition, with children eating by themselves to reflect an even more natural context.

1. Introduction

Young children often eat cereals for breakfast. Most of the child-targeted cereals exceed the daily recommended amount of sugar and kids tend to consume more than the suggested amount of 30 g (Batada, Seitz, Wootan & Story, 2008; Guthrie & Morton, 2000; IOM, 2006; LoDolce, Harris, & Schwartz, 2013; Schwartz, Vartanian, Wharton & Brownell, 2008). The marketing of unhealthy food is known to be an important factor that contributes to childhood obesity (EU-Pledge, 2012; FTC, 2012; IOM, 2006; Persson, Soroko, Musicus, & Lobstein, 2012; WHO, 2012). Although many studies proved that persuasive techniques, such as endorsement, affect children's food attitudes and preferences (Smits, Vandebosch, Neyens, & Boyland, 2015), little attention was paid to the impact of more subtle marketing techniques such as the image-size of food serving suggestions on children's actual eating behavior.

Several experiments have already demonstrated that larger portion sizes and food energy-density (calories/gram) increase food consumption in children (e.g. Rolls, Engell, & Birch, 2000; Fisher, Rolls, & Birch, 2003; Fisher, 2007; Fisher, Liu, Birch & Rolls, 2007b; Leahy, Birch, & Rolls, 2008; Leahy, Fisher, Birch & Rolls, 2008; Spill, Birch, Roe, & Rolls, 2010; Looney & Raynor, 2011; Marchiori, Corneille, & Klein, 2012). Fisher, Liu, Birch, and Rolls (2007), for instance, offered 5–6 year old children a macaroni and cheese meal, and manipulated served portion-size and energy-density in a repeated measures design. They discovered that children consumed significantly more grams when served a larger portion-size, and significantly more calories when energy-density was high. More recently, Looney and Raynor (2011) examined the effects of served snack portion-size and energy-density on preschool children's food intake (grams and calories). In contrast to Fisher's et al.'s study, their experiment only identified a main effect of portion-size on snack energy consumption (calories). However, prior studies focused on actual portion size and energy-density, while the potential impact of marketing prone image-size manipulations and sugar content is still understudied. To date, only one recent article addressed the influence of on-pack serving size recommendations on adult's expected consumption of unhealthy food (Versluis, Papies, & Marchiori, 2015). In this study, pictorial portion instructions reduced adult's expected food intake (Versluis et al., 2015). Many child targeting foods feature such pictorial suggestions on portion size, such as cereal boxes that often display a big bowl filled to the rim with cereals and milk. Nevertheless, intervention studies manipulating such marketed presentation of consumer goods are underrepresented in the literature despite the

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http://dx.doi.org/10.1016/j.appet.2015.07.003
0195-6663/

policy-induced scalability of such interventions should they prove to be successful. To address this gap, the present study examines whether suggestive image-size manipulations on cereal packaging and actual sugar content influence the consumption of cereals among preschool children.

Visual cues such as the image-size of front-of-pack food depictions, are expected to influence children's eating behavior, because children perceive portion-size by food height and diameter (see Fisher & Kral, 2008; Piaget, Inhelder, & Szeminska, 1960). We hypothesized (Hypothesis 1) that children would pour more cereal into their bowl, consume more cereal and drink more milk with their cereal when exposed to a larger image-size manipulation compared to a smaller image-size manipulation.

Furthermore, despite the inconsistent findings concerning the consumption effect of energy-density (Fisher & Kral, 2008), we can expect children to prefer sugary cereals over less sweet cereals because children have an innate soft spot for sweets (Cowart, 1981). We thus expected children to eat more cereal in the higher sugar content conditions (Hypothesis 2). In addition we aimed to explore possible interaction effects between image-size and sugar content. Finally, we controlled for the effects of BMI, overall liking of cereal and feelings of hunger.

2. Methods

2.1. Participants and procedure

Twenty-two Flemish parents of children between four and five years old from a Belgian elementary school gave informed consent to let their child participate in the experiment ($M_{age} = 4.36$, $SD = .49$, 10 boys and 12 girls). Parents of all 26 children of the same class got a letter asking for informed consent. This letter conveyed information about the study. None of the parents indicated their child was allergic or didn't like cereals. However, parents of four out of the 26 children didn't give informed consent and therefore their kids did not participate in the experiment. The institutional review board of the Leuven university (Social and Societal Ethics Committee) approved the protocol of this study. A 2 × 2 × 2 mixed experimental design, similar to Looney and Raynor's (2011) design, was used: image-size manipulation (small vs. large) x sugar content (low vs. high) x presentation-order. Image-size and sugar content were manipulated within-subjects, presentation-order was manipulated between-subjects to counterbalance spurious effects due to presentation order: the group of 22 children was divided in two and experienced the four within-subjects conditions in different orders. Children were randomly assigned to one of the two order conditions.

Two different cereal packages were designed (Adobe Photoshop CS5) differing only in image-size manipulations (see Fig. 1). The cereal box measured 19 × 29 cm and the design was based on an Italian brand unknown to the participating children: Mr. Kanny™. Furthermore, two types of cereal, also unknown to the participating children, were used. These differed in sugar content: Crownfield's Frosted Flakes™ (9 g sugar/30 g), and Crownfield's regular Corn Flakes™ (1 g sugar/30 g). The four sessions took place on Wednesday mornings at the school's lunch room where a buffet of cereal breakfast was served, with the experimental cereal box clearly visible at the center. Parents were instructed not to feed their child breakfast the days of the experiment. At the start of the first session, children were measured and weighed.

The children were told a new brand wanted to sell cornflakes on the Belgian market and wanted to find out whether children would like it or not. The children were led to believe they were test-subjects who had to taste the new brand. For every child coded (stickers) bowls, spoons and jugs of milk (250 ml) were presented at the table. The children were called one by one to the breakfast buffet. Each child got the same instruction: *"I have some cornflakes, take a good look at the box first and then take as much as you want to eat. You may also refill later"*. The children then ate together with their classmates.

This process was filmed to control for unexpected circumstances such as children eating from each other's bowls (only the bowls and cups were visible). The sessions took about 30 min to complete.

3. Measures

The first dependent variable was the amount of poured cereal. The box of cereal was weighed before the experiment. Each time a child poured cereal, the box was weighed again and the remaining weight was listed separately for each child. The second dependent variable, eating behavior, was measured at the end of the experiment: all bowls were weighed separately. The remaining quantity in the bowl was deducted from the total amount they poured in their bowl. Thirdly, the poured and consumed quantity of milk was measured. All children had their own jug of milk (250 ml) so the remaining amount of milk in both the jug and the bowl could be measured after the experimental sessions.

Covariates were BMI, overall liking of cereals, and feelings of hunger. BMI was measured by dividing the children's body weight by the square of their height (Quetelet, 1835). BMI criteria differ between children and adults, with childhood criteria based on percentiles rather than absolute scores. From the 85th percentile children are considered overweight (Barlow, 2007). Overall liking of cereals in general was measured during the first session only, before exposure, on a three-point cartoon Likert-scale (Birch, 1979; Fisher et al., 2007; Looney & Raynor, 2011). Children were asked to indicate which smiley expressed how tasty they found cereals, ranging from 'not tasty' to 'very tasty'(1–3). Hunger was measured before each session with a series of three cartoon drawings developed by Birch (Birch & Fisher, 2000), ranging from 'not hungry' to 'very hungry'(1–3).

3.1. Analyses

To test the effects of image-size manipulation on the amount of cereals children poured into their bowl, and the amount of cereal and milk consumption, we performed three different mixed Anova analyses (without covariates). The first dependent variable was the amount of poured cereal. The box of cereal was weighed before the experiment. Each time a child poured cereal, the box was weighed again and the remaining weight was listed separately for each child. The second dependent variable, eating behavior, was measured at the end of the experiment: all bowls were weighed separately. The remaining quantity in the bowl was deducted from the total amount they poured in their bowl. Thirdly, the poured and consumed quantity of milk was measured. All children had their own jug of milk (250 ml) so the remaining amount of milk in both the jug and the bowl could be measured after the experimental sessions.

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