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The effect of the labelled serving size on consumption: A systematic review

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A B S T R A C T

Guidance for food consumption and portion control plays an important role in the global management of overweight and obesity. Carefully conceptualised serving size labelling can contribute to this guidance. However, little is known about the relationship between the information that is provided regarding serving sizes on food packages and levels of actual food consumption. The aim of this systematic review was to investigate how serving size information on food packages influences food consumption.

We conducted a systematic review of the evidence published between 1980 and March 2018. Two reviewers screened titles and abstracts for relevance and assessed relevant articles for eligibility in full-text. Five studies were considered eligible for the systematic review.

In three of the included studies, changes in serving size labelling resulted in positive health implications for consumers, whereby less discretionary foods were consumed, if serving sizes were smaller or if serving size information was provided alongside contextual information referring to the entire package. One study did not find significant differences between the conditions they tested and one study suggested a potentially negative impact, if the serving size was reduced.

The influence of labelled serving size on consumption of non-discretionary foods remains unclear, which is partially due to the absence of studies specifically focusing on non-discretionary food groups. Studies that investigate the impact of serving size labels within the home environment and across a broad demographic cross-section are required.

1. Background

Obesity is a leading cause of morbidity worldwide and a significant risk factor for the development of diabetes, cardiovascular disease, musculoskeletal disorders and some cancers (World Health Organization, 2017). Rates of overweight and obesity are rising rapidly and in 2016, over 1.9 billion adults were overweight; 650 million of whom were obese (World Health Organization, 2017).

The rise in overweight and obesity has increased simultaneously with increasing portion sizes (Young & Nestle, 2002). Internationally, there has been an increased intake of energy-dense, high fat foods (World Health Organization, 2017) and increased food and beverage portion sizes (Nielsen & Popkin, 2003). Increasing portion size has been shown to increase energy intake per meal occasions (Steenhuis & Vermeer, 2009), particularly for energy-dense foods (Kral, Roe, & Rolls, 2004). Portions of major energy-contributing foods in the U.S. diet have all increased since 1970, with many exceeding the U.S. Department of Agriculture (USDA) standards reflected in the Food Guide Pyramid designed to help people meet daily nutrient recommendations. Cookies, for example, exceeded standards by 700% (Young & Nestle, 2002). Marketplace foods, restaurant meals (including fast-food) and even cookbooks have all shown increases in portion sizes (Young & Nestle, 2002).

The selection of larger portion sizes can be due to 'portion distortion', which means a person misperceives large amounts of foods as appropriate for consumption at a single eating or drinking occasion. Further reasons include the drive to attain good 'value for money', the inability of consumers to identify appropriate portion sizes (Steenhuis & Vermeer, 2009) and an increase of pack and tableware size (Hollands et al., 2015). Indeed, larger packs induce a visual distortion that leads to an underestimation of food content and hence, an increase in the amount of served portions. The larger the pack, the larger the portion

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size and resulting consumption. This phenomenon is also known as the 'pack size effect' or 'portion size effect' (Chandon & Ordabayeva, 2009; Hieke, Palascha, Jola, Wills, & Raats, 2016).

Research has shown that consumers are confused about portion sizes and feel they are exposed to conflicting messages about what and how much to eat (Spence et al., 2013). Units for measuring recommended serving amounts may differ and household-measuring units may be ambiguous and open to interpretation (Spence et al., 2013). Food labels containing nutrition information may be powerful tools for educating consumers. The 'Smart Choices' label, for example, has been found to positively influence participants perceived healthfulness of a product (Andrews, Burton, & Kees, 2011).

In agreement with findings from a qualitative study by Spence et al. (2013) and a scoping review on consumer understanding and interpretation of the labelled serving size information on food products (in submission) has identified that consumers are confused about varying terminologies including 'serving sizes' (food units defined by food manufacturers) and 'standard serve sizes' (set amount stated in dietary guidelines) and 'portion size' (amounts as consumed) (Zhang, Kantor, & Juan, 2016).

Previous studies found that consumers assume that the labelled serving size is equal to amounts usually consumed (Dallas, Liu, & Ubel, 2015; Zhang et al., 2016). This may result in the information being used as a basis for determining how many portions they obtain from a product. Therefore, reducing the labelled serving sizes (i.e., increasing the number of servings per package), may lead to reduced intake. Furthermore, there are studies which have demonstrated that changing the labelled serving size may impact on either type or amount of food consumed (Christoph & Ellison, 2017).

To date there has been little research conducted into the influence that food labels have on actual food and beverage consumption. The aim of this systematic review was to summarise the scientific evidence on the influence of serving size and portion size labelling on food and beverage consumption. Secondary aims were to compare if effects differ between discretionary (any foods not forming part of a healthy diet) and non-discretionary foods (foods constituting a healthy diet) and to collate recommendations for improvements in serving size labelling to promote healthier consumption habits.

2. Methods

This systematic review was conducted in accordance with the *Preferred Reporting Items for Systematic Reviews and Meta-analyses* (PRISMA) statement (Liberati et al., 2009).

2.1. Eligibility criteria

Participants. No population groups were excluded from this systematic review.

Interventions. Studies that assessed how portion size, serve or serving size information in food label format influences the consumption of food were considered for inclusion in this systematic review. Studies that only assessed the influence of nutrition information or health claims on consumption were excluded. If the information was not provided in label format (e.g., plain text sticker on a plate indicating that portion size is "small" or "large"), the study was excluded. If the study compared the absence vs. presence of labelled serving/portion size only, the study was excluded.

Comparator conditions. All types of conditions (study arms) that were used to compare groups, including cross-over designs and experimental designs without a control group, were included in this review.

Outcomes. Outcome measures had to assess the intake/consumption of food or beverages, reported as energy (kilojoules or Calories), mass (grams or ounces) or quantity (pieces, slices, etc.) of the food product or meal consumed. Any measures based on recall of food consumption, or where food selection for *intended* consumption or perception (*estimated* consumption) was assessed but no actual assessment of consumption/intake was provided were excluded.

Study types. To be eligible for review, studies had to be published in a peer-reviewed scientific journal between 1980 and present (05/03/2018) in the form of an English language full-text report of original research. Thus, studies could not be included, if they were conference abstracts or reports published in non-scientific/non-peer reviewed literature (e.g., magazines, websites, blogs). Dissertations and theses were excluded.

2.2. Study selection & screening

Following initial pilot-testing of key search terms in Medline (core database), specific search strings were developed and tailored to conform with each of the designated electronic databases: Medline (Ovid), Embase (Ovid), PsycInfo (Ovid), CINAHL, Business Source Ultimate, Cochrane and Scopus (see supplemental material S1). All records identified during these searches were exported to EndNote X8 (Clarivate Analytics, Philadelphia, USA) and duplicates removed using a combination of automatic and manual procedures.

The de-duplicated list of records was imported to Covidence (Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org) and shared with the team of reviewers. Titles and abstract were screened independently by two reviewers and a third reviewer was available to resolve conflicts. Title and abstract screening was conducted in an inclusive fashion to avoid incoherent de-selection. Where it was unclear from the title and abstract if actual food intake/consumption was assessed, full-texts were retrieved to determine eligibility for inclusion. Full-text reports of all relevant records were then assessed against the pre-specified eligibility criteria. Two reviewers completed this step independently and consulted a third reviewer, where conflicts in study selection needed to be resolved.

2.3. Data extraction

A data extraction tool was created by the authors, including six general categories: 1) study description (author names, year of publication, country); (2) study design (study type, sample size, study duration, setting); (3) sample characteristics (age, gender, BMI, diet status); (4) study characteristics (label type/s, food type/s); (5) study outcomes (influence of label on understanding/perception, influence of label on consumption, differentiation between serving size and portion size guidance; and (6) insights (main conclusions, recommendations for label usage/display, other findings). If necessary, authors of eligible studies were contacted to request missing information. Where a report provided data from several nested studies, only the data from individual studies focusing on the effect of serving size on food intake/consumption were extracted. Data was extracted by one reviewer with a second reviewer checking the accuracy and correctness of extracted data and a third reviewer resolving conflicts, as they arose.

2.4. Study quality

Two reviewers independently assessed study quality using the *Quality Criteria Checklist for Primary Research* by the Academy of Nutrition and Dietetics (2016). This tool is used frequently for the appraisal of study quality in reports that are synthesised as part of a systematic review (Bucher et al., 2016). Study quality is assessed for relevance and validity (risk of bias). As opposed to a numerical score, each study is assigned an overall score that is either *positive, negative* or *neutral*.

2.5. Synthesis

This study aimed to examine the 'effect' of serving size food