



Review

Call for testing interventions to prevent consumer food waste

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ABSTRACT

Over the last decade, practitioners have implemented various interventions against consumer food waste. In contrast, academics have only just started to examine how to prevent consumer food waste. This review synthesizes practical and academic evidence on anti-consumer-food-waste interventions. The basis for this synthesis was a systematic framework of antecedent interventions (informational intervention, prompts, modeling (social norms), commitment) and consequence interventions (feedback, rewards, penalties) that we have drawn from general behavioral change and intervention research. This review shows that (1) informational interventions are the most commonly used intervention type even though evidence indicates that this intervention type is relatively ineffective, and (2) there is a lack of evidence of the effectiveness of anti-consumer-food-waste interventions. With reference to general behavioral change and intervention literature, we suggest that (1) intervention types other than informational interventions should be considered, and (2) anti-consumer-food-waste interventions should be evaluated in a systematic manner; that is, by using a framework with standardized definitions and measurement methods that addresses specific behaviors and change processes and that allows accurate identification of short-term and long-term effects. Overall, this review outlines current conceptual and methodological challenges and sets an agenda for implementing effective anti-consumer-food-waste interventions.

1. Introduction

Food waste is an urgent environmental, social, and economic issue. It causes greenhouse gas production and soil depletion (Knipe, 2005; Quested et al., 2013; Ventour, 2008), compromises global food security (Godfray et al., 2010), and adds to food price inflation (FAO, 2015). In developed countries, consumers are the single biggest producer of food waste (Beretta et al., 2013; Priefer et al., 2016). In the US, for instance, a consumer wastes 0.28 kg of food per day (Thyberg et al., 2015; for a review of food waste estimates across various developed countries, see Thyberg and Tonjes, 2016). Considering that 65% of this waste could be avoided with more sustainable consumer behavior (Farr-Wharton et al., 2014a), the urgent need to change behavior is evident.

“Food waste” has become a media buzzword over the last decade.¹ There are more organizations (e.g., WRAP, FAO) and campaigns (e.g., Love Food Hate Waste) which aim to make consumers aware of food waste and to foster more sustainable food consumption. In contrast to this practical effort, academics have only recently begun to examine anti-consumer-food-waste interventions. So far, academics concerned with consumer food waste have mainly (1) measured the environmental impact (for a review, see e.g., Bernstad et al., 2017), (2) identified

causes, most notably by applying the *Theory of Planned Behavior* (TPB) (e.g., Graham-Rowe et al., 2015; Russell et al., 2017; Stancu et al., 2016; Stefan et al., 2013; Visschers et al., 2016), and (3) proposed policies as well as prevention by calling for awareness campaigns, informational interventions, and education (for a review, see e.g., Hebrok and Boks, 2017; Priefer et al., 2016; Thyberg and Tonjes, 2016). Moreover, some academics have outlined detailed research agendas to better understand the mechanisms underlying consumer food waste (for a review, see e.g., Block et al., 2016; Porpino, 2016). Few studies have evaluated concrete interventions to examine to what extent consumer food waste can be reduced or prevented (for exceptions see, e.g., Kallbekken and Sælen, 2013; Whitehair et al., 2013).

Considering the urgent need to reduce food waste, it is important to understand the current state of knowledge on behavioral interventions against consumer food waste in order to implement effective interventions in the future. This review considers both practical and academic insights in order to provide a systematic assessment of anti-consumer-food-waste interventions with the help of general behavioral change literature (e.g., McKenzie-Mohr, 2013; Schultz, 2014; Steg et al., 2008). So far, the interdisciplinary behavioral change literature has identified many intervention types (e.g., information, prompts) and

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¹ See Google Trends: <https://trends.google.com/trends/explore?q=foodwaste>

Table 1
A Systematic Framework of Behavioral Change Interventions.

Intervention	Description	Example	Effect Size (g)
Antecedent	Informational Prompts	Strategies that aim to increase knowledge and skills	0.31
		Verbal or written messages designed to remind people to perform a target behavior	0.62
	Modeling	Demonstration of a desired target behavior, often building on the influence of social norms	Video portraying certain practices
Consequence	Commitment	Asking people to agree to perform a target behavior	0.40
	Feedback	Providing information about the frequency and/or consequences of a target behavior	0.31
	Rewards	Applying positive consequences for a target behavior	0.46
	Penalties	Applying negative consequences for a target behavior	0.46

Note. Systematic framework of antecedent and consequence interventions with descriptions of intervention types and effect sizes (Hedges' g) from Osbaldiston and Schott (2012) meta-analysis. Note that several of the meta-analyzed studies confound multiple intervention types.

contextual factors that effectively lead to behavioral change (Schultz, 2014). Although behavioral change studies and campaigns are mostly separated by issue (e.g., littering) and focus on specific behaviors, they apply the same or similar theories, concepts, methodologies, and procedures (Mick et al., 2012).

Overall, this synthesis of practical and academic evidence on general and food-waste-specific interventions reveals two key challenges: First, informational interventions are predominant and it is necessary to conduct other intervention types. Second, there is a general deficiency in evaluating anti-consumer-food-waste interventions, and therefore a need for more systematic evaluation.

The structure of this review is as follows: First, we introduce a systematic framework of established types of behavioral change intervention used to promote sustainable consumer behavior. Second, we review practical and academic evidence on anti-consumer-food-waste interventions and link it to evidence from general behavioral change research. Finally, we discuss key findings and suggest future directions for effective anti-consumer-food-waste interventions for both practitioners and academics.

2. A framework of behavioral change interventions

There is substantial interdisciplinary research on behavioral change interventions which are intended to foster sustainable consumption. Reviews of the behavioral change literature often adopt a wide-ranging classification framework to sketch the variety of intervention types and the contextual factors that determine whether an intervention is effective (e.g., Geller et al., 1990; McKenzie-Mohr, 2013; Michie et al., 2014; Schultz, 2014; Steg et al., 2008). Typically, intervention types are categorized as *antecedent* or *consequence*: antecedent interventions alter (the salience of) the context that precedes the target behavior. The most prominent antecedent intervention types are informational interventions, prompts, modeling, and commitment. Consequence interventions alter (the salience of) the consequences of the target behavior. The most prominent consequence interventions are feedback, rewards, and penalties.

Although this general twofold classification is said to be simplistic (e.g., Mosler and Tobias, 2007), it meets our requirement for a simple framework within which to systematically review a broad range of intervention types (against consumer food waste). For an overview of this framework and definitions of its intervention types, see Table 1. Comprehensive reviews of these intervention types, including findings on their effectiveness, underlying mechanisms and the role of contextual factors, can be found elsewhere (e.g., Abrahamse and Matthies, 2012; Abrahamse et al., 2005; Homburg and Matthies, 1998; Osbaldiston and Schott, 2012; Schultz, 2014).

3. A systematic review of antecedent and consequence interventions against consumer food waste

We used the framework of antecedent and consequence interventions (see Table 1) to collect, group, and analyze practical and academic evidence on anti-consumer-food-waste interventions. The range and nature of this literature strongly determined our search methodology.

3.1. Search methodology

For the literature search of practical evidence of anti-consumer-food-waste interventions, we adopted a case study research approach. Between October 2016 and September 2017, we searched for current gray literature — that is, reports and website information from governments and non-governmental organizations — using the Google search engine. In view of the vast amount of gray literature, we did not intend to obtain a complete inventory of practical anti-consumer-food-waste interventions. We used the search criteria that the gray literature should address anti-consumer-food-waste interventions that were carried out in developed countries and that reached a high degree of popularity. Further, we only used grey literature that was available in English, German, and/or French. The first author of this paper conducted a content analysis of the collected online information. Based on this, the campaigns and interventions were assigned to one of the intervention types in the framework in Table 1.

To find academic evidence of anti-consumer-food-waste interventions, we conducted a systematic literature search between October 2016 and January 2018 using Google Scholar (<https://scholar.google.ch/>) and Peerus (<https://peer.us/>). We used a predefined set of search terms.² For all search terms, we screened the first ten Google Scholar search pages and all search results from Peerus. In that way, we collected all articles published in academic journals that qualitatively or quantitatively examined effects of anti-consumer-food-waste interventions in developed countries. Only articles in English were considered. No further search criteria (e.g., date restriction) were set. The literature search resulted in an academic intervention inventory with articles between 2012 and 2018.

Within our literature search we limited our focus to anti-consumer-food-waste interventions in developed countries, using the United Nations classifications of *developed countries*, *countries in transition*, and *developing countries*.³ The rationale for this geographical focus is that

² The search terms used in Google Scholar were: "consumer food waste", "household food waste", "food waste" + intervention, "food waste" + information + intervention, "food waste" + education + intervention, "food waste" + modeling + intervention, "food waste" + commitment + intervention, "food waste" + feedback + intervention, "food waste" + reward + intervention, "food waste" + penalties + intervention, "food waste" + incentive + intervention

³ See <http://unctadstat.unctad.org/EN/Classifications.html>

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