Appetite 127 (2018) 296–302

Contents lists available at ScienceDirect

Appetite

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

Negative associations of frozen compared with fresh vegetables

Paul M. Connell[a,*], Stacey R. Finkelstein[a], Maura L. Scott[b], Beth Vallen[c]

[a] Stony Brook University, Stony Brook, NY, 11794, United States
[b] Florida State University, 821 Academic Way, Tallahassee, FL, 32306, United States
[c] Villanova University, 800 Lancaster Ave, Villanova, PA, 19085, United States

ARTICLE INFO

Keywords:
Food transformation
Frozen food
Frozen produce
IAT
Implicit association
Vegetable consumption

ABSTRACT

Despite convenience and nutrition advantages of frozen vegetables, consumption of them is low compared with fresh vegetables and continues to decrease. In two studies, we observe a negative bias for frozen vegetables compared with fresh vegetables. In study 1, we used an Implicit Association Test (IAT) to demonstrate that generalized negative associations with frozen vegetables are automatic, robust, and ingrained in long-term memory. In study 2, we conceptually replicate this finding with an explicit measure and extend it by examining the role of transforming the food product in formation of the observed negative bias. We find no improvement in evaluation for frozen spinach when participants contemplate the final cooked product. Instead, we see less favorable evaluations of fresh spinach when participants contemplate the final cooked product. These findings are consistent with previous research that demonstrates that transformation of a food from its "natural" state leads to less favorable evaluations of it.

1. Negative associations of frozen compared with fresh vegetables

Consuming sufficient quantities of fruits and vegetables has been identified as a key route to reducing global risk factors for disease. However, vegetable consumption can be psychologically effortful due to the self-regulatory resources required to choose healthy items over tasty—and often unhealthy—ones (Trump, Connell, & Finkelstein, 2015). The U.S. Department of Health and Human Services (2015) estimates that 87 percent of the population eats fewer than the recommended quantities of vegetables for reasons including lack of access, cost, and perishability. Thus, storage methods that extend shelf life and, in turn, the window for consumption would likely help in increasing vegetable intake. Frozen vegetables offer these convenience advantages over their fresh counterparts and may be stored for longer periods of time without spoiling. Indeed, fresh foods have an increased likelihood of being wasted compared to frozen foods that often have an extended expiration period (Block et al., 2016).

Identifying strategies for overcoming barriers to vegetable consumption is of substantive importance in particular because lower income heads of household report that they avoid buying fresh vegetables because they worry about spending money on fresh foods that will expire before they are consumed by members of the household (Connell, Finkelstein, Scott, & Vallen, 2016, 2017; Daniel, 2016). This is particularly relevant in light of the finding that repeated exposures are typically required before establishing a palate for less preferred items such as vegetables, especially for children (Birch, 1999; Wertz & Wynn, 2014). Frozen foods offer serving flexibility because they allow preference, as opposed to shelf life, to dictate the amount of food prepared. In other words, smaller portions may be meted out to family members in an effort to increase exposure to build preference, while reducing the likelihood of waste. Thus, one recommendation to increase vegetable consumption and avoid waste might be to shift some purchases to frozen items.

Though frozen vegetables offer convenience and waste reduction advantages, grocery shoppers tend to like and select fresh over frozen options (Haynes-Maslow, Parsons, Wheeler, & Leone, 2013; Owen, 2017). Industry reports have shown low enthusiasm for frozen foods in general. Glazer and Thompson (1998) note that only about 8% of vegetables farmed in the United States (excluding potatoes) are frozen before being sold. Data from The Nielson Company (2015) show that while fresh produce sales increased by 5% in 2014 compared with the prior year, sales for frozen grocery items declined. Interestingly, frozen foods often have equivalent or even more nutrients than their fresh counterparts because these foods are often harvested and frozen at peak freshness, when nutrients are at their highest levels (Li, Pegg, Eitenmiller, Chun, & Kerrihard, 2017). A recent study comparing target nutrient levels across vegetables that were either frozen, fresh, or purchased and then stored in the refrigerator for five days revealed few

* Corresponding author.
E-mail addresses: paul.connell@stonybrook.edu (P.M. Connell), stacey.finkelstein@stonybrook.edu (S.R. Finkelstein), mlscott@business.fsu.edu (M.L. Scott), beth.vallen@villanova.edu (B. Vallen).

https://doi.org/10.1016/j.appet.2018.05.134
Received 27 January 2018; Received in revised form 13 May 2018; Accepted 18 May 2018
Available online 19 May 2018
0195-6663/

significant differences between items based on storage. Where differences did occur, frozen produce outperformed fresh or stored counterparts more often than fresh dominated the frozen version (Li et al., 2017). Given the nutritional substitutability of frozen foods, overcoming these perceptions may be an important driver in increasing vegetable consumption.

Industry reports suggest that people cite specific beliefs relative to the healthfulness of fresh versus frozen foods as a key reason driving their preference for the former, as well as concerns that frozen foods may be less palatable. More specifically, when evaluating frozen vegetables, people often incorrectly assume that they are nutritionally inferior and believe that they have a blander flavor relative to their fresh counterparts (Owen, 2017). Research that explores the impact of product transformation (e.g., converting food from fresh to frozen) suggests that people tend not to base evaluations of transformed foods on beliefs about specific product attributes. Rather, perceptions of transformed items as inferior to "natural" (i.e., untransformed) ones are based on more generalized, ideational views that natural foods are "right" and "good." Indeed, in the food domain, preferences for natural foods remain even when nutritional value is equivalent between untransformed and transformed items (Rozin et al., 2004). Based on this, in our research we examine generalized negative associations resulting from the perceived naturalness (or lack thereof) of frozen vegetables due to transformation from their natural state. The primary objective of this research is to empirically demonstrate existing negative associations with frozen versus fresh vegetables. Additionally, we consider whether reducing the salience of this transformation (i.e., presenting food in its finished state vs. as a frozen or fresh ingredient) can work to override the negative associations. If these associations can be overridden, then perhaps it is possible to design interventions for correcting this bias and, in turn, increase intended vegetable consumption.

2. Implicit associations for fresh versus frozen vegetables

Previous research has revealed that people often have learned, automatic responses to concepts such as an individual's age, race, gender, weight, mental health, or sexual orientation (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). Similarly, we argue that negative associations toward frozen versus fresh vegetables operate at an implicit level and are generalized, automatic, and non-conscious. Dual-process theories of memory suggest that prior experiences can be encoded, stored, and retrieved in either a deliberate or automatic manner (Schacter, 1987; Schacter, Chiu, & Ochsner, 1993; Smith & DeCoster, 2000). Whereas explicit memory involves conscious and intentional recall of prior experiences from specific episodes, implicit memory involves unintentional learning of general regularities and is recalled outside of conscious awareness (Schacter et al., 1993; Smith & DeCoster, 2000).

Previous research has also demonstrated that, although individuals may not be aware of them, implicit memory processes can have long-term effects on beliefs and attitudes. Examples include the truth effect, whereby repeated exposures to a message lead to a greater likelihood in believing that message to be true (Hasher, Goldstein, & Toppino, 1977) and the mere exposure effect, whereby repeated exposures of a stimulus lead to greater liking of the stimulus (Zajonc, 2001). Understanding implicitly held associations is important because they may provide a better predictor of behavior than explicitly reported attitudes, especially when actions are spontaneous and under less conscious control (Correll, Park, Judd, & Wittenbrink, 2007; McConnell & Leibold, 2001). Furthermore, changing associations that are strongly ingrained in memory requires considerable mental effort (Devine, 1989). In the context of our research, if people maintain strong negative associations of frozen (versus fresh) vegetables, then these associations are likely to influence actual consumption behavior and could help explain the comparatively low market share of frozen vegetables relative to fresh ones.

3. Exploring the role of product transformation

If transformation-based biases do exist and impact food evaluations, it would be useful to examine the psychological processes underlying them. Such insight could prove helpful in developing effective interventions for correcting these biases which may, in turn, increase vegetable consumption. Along these lines, in this research we examine the influence of perceived product transformation on resulting evaluations of frozen vegetables. Because freezing food is a transformation, we propose that people will implicitly associate fresh vegetables with positive attributes and frozen vegetables with negative attributes. That is, people demonstrate an inherent preference for "natural" items, in particular foods that have not been subjected to transformation or processing (Rozin et al., 2004). Interestingly, while people may attribute this preference to the perceived healthfulness or taste of natural foods relative to transformed ones, this partiality remains even when healthfulness is made equivalent for natural and transformed foods. This suggests that the preference for non-transformed items is ideational (i.e., based on the idea that non-processed forms are inherently better or "right"), rather than instrumental in nature (i.e., based on perceptions of superior functional attributes, such as nutritional value or taste; Rozin et al., 2004). While the specific type of transformation matters (e.g., chemical transformations result in greater reductions in perceived naturalness than physical ones), it remains that processing food items impacts naturalness, which in turn impacts evaluations of food products (Rozin, 2005; 2006).

Since the purchase mode of frozen food does not match the actual preparation and consumption mode for frozen vegetables (i.e., individuals generally do not consume vegetables in a frozen state, but might consume fresh vegetables as purchased without further transformation), it is possible that associations could change once the product is prepared or if one contemplates the final preparation of the food. However, it is difficult to make specific predictions about how these associations might change from the existing literature. It is possible that considering the final preparation could reduce or eliminate negative bias toward frozen (versus fresh) vegetables because salience of their frozen (i.e., transformed) versus fresh state is reduced. On the other hand, it is possible that just one transformation of food makes it perceived as less natural and thus less desirable. In this case, it is possible that fresh vegetables become as undesirable as frozen ones once transformed to a cooked food. Finally, it is possible that the number of transformations that take place matters. In this case, frozen vegetables would retain lower desirability when compared with fresh because the food would have been transformed twice (i.e., from fresh to frozen, and then from frozen to cooked), whereas fresh vegetables would have been transformed only once (i.e., from fresh to cooked).

4. Summary of the current research

In the current research, we explore associations with frozen versus fresh vegetables to investigate whether, in fact, processing foods via freezing leads to less favorable generalized evaluations and whether that effect is attenuated or accentuated when the product is further processed via preparation. In our first study, we use an Implicit Association Test (IAT) task to reveal that individuals have strong associations between negative concepts and frozen (vs. fresh) vegetables. Our second lab study replicates and extends this finding with explicit measures, demonstrating that evaluations of frozen vegetables are more negative than they are for fresh vegetables.

Study 2 also examines the role of transformation on negative bias toward frozen vegetables. Extending prior literature on naturalness, we demonstrate that the natural bias occurs only when foods are presented as unprepared. That is, when food is shown prepared and in a serving dish (vs. in its packaging) there is no difference in the evaluation of a fresh versus frozen vegetable. We find that this effect is driven by reduced desirability of the fresh product once it has been cooked. This