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Cognitive dissonance in food and nutrition—A review

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ABSTRACT

The study of cognitive dissonance in food and nutrition has been relatively under-developed. This review paper looks at food and/or food-related studies that have utilized cognitive dissonance as a primary construct in *a priori* theorization and hypothesis-formulation, examining the ways in which the dissonance construct has been used and its corresponding effects on various food-related outcomes in those studies. Current gaps and critical issues underlying cognitive dissonance investigation in food and nutrition research are also identified and discussed.

KEYWORDS

Cognitive conflict; food cognition; food behavior; food psychology

Introduction

Research has shown that poor food choices can lead to increased risks of developing non-communicable diseases (e.g., cancer, heart disease, diabetes, etc.) that affect both developed and developing countries (World Health Organisation & Food and Agriculture Organisation of the United Nations, 2003; Willett, 2012). Given the link between nutrition and health/illness (Ross et al., 2012), many government and public health bodies have increased their efforts over the years in defining and promoting healthy diets (Dibsdall et al., 2002), in the hope that the impact of numerous later-life diseases such as cardiovascular diseases, diabetes, obesity, osteoporosis, and certain cancers may be reduced with greater compliance to such healthy diets (Miller and Casady, 2012). Understanding how and why individuals choose their foods is essential in motivating them to modify their dietary habits toward healthier recommendations (Zandstra et al., 2001).

The study of attitudes is a means by which an understanding of food choice and behavior may be achieved (Ajzen and Fishbein, 1980; Roininen and Tuorila, 1999; Dahm et al., 2009). Indeed, attitudes have been found to affect and/or be related to eating and food behavioral outcomes—whether independently (e.g., Harvey et al., 2001; Zandstra et al., 2001) or as part of a larger theoretical framework such as the health belief model (e.g., Becker and Rosenstock, 1984; Deshpande et al., 2009)—in a positive direction, as exemplified by Lechner and Brug's (1997) study where a positive attitude toward fruit and vegetable consumption (based on the outcomes individuals expect from eating fruits and vegetables) was found to predict higher self-ratings of fruits and vegetables consumption.

Attitude change and cognitive dissonance theory

It is generally acknowledged by researchers interested in optimizing food choices in the direction of health that a change in

dietary behavior might occur through changing food-related attitudes (Nestle et al., 1998; Worsley, 2002; Aikman et al., 2006; Contento, 2012). One of the theories that have been most frequently implicated in the study of attitude change is the theory of cognitive dissonance (Festinger, 1957; Harmon-Jones and Harmon-Jones, 2007). Its central tenet states that when individuals possess two or more inconsistent cognitions, they experience an aversive, psychological state of tension or discomfort called cognitive dissonance. They then seek to remove this unpleasant tension state (i.e., reduce dissonance) through altering one or more of the cognitions, typically those least resistant to change (Harmon-Jones, 2002). Cognition, in this context, may be broadly defined as any belief, opinion, attitude, perception, or knowledge about persons, objects, issues, and so forth (O'Keefe, 2002; Aronson, 2004; Littlejohn and Foss, 2005).

The potential application of cognitive dissonance to eating/food attitude and behavior may be extrapolated from the writings of some food/nutrition researchers. For instance, in a qualitative study of consumers of organic food products, Hjelm (2011) reported that “Respondents expressed the view that television documentaries can be so unpleasant that they make you change your behavior instantly; you simply cannot continue to eat conventional pork after having seen how pigs are treated” (p. 342), prompting him to suggest that reflexive shopping practices “can be sparked by life events (e.g., having children), “shocking news” about conventional food products and similar events, and news capable of creating a “cognitive dissonance” among consumers” (p. 336). Despite such acknowledgement being shared by others (e.g., Bergmann et al., 2010; Pettigrew and Pescud, 2013), the study of cognitive dissonance related to eating/food attitudes and behaviors in the food and nutrition domain has been relatively under-developed, particularly with

respect to influencing healthy food behaviors in the area of public health (Worsley, 2002).

Purpose of review and literature search process

The purpose of this paper is to review the study of cognitive dissonance in the food and nutrition domain by examining its use and effect(s) in food-related studies, and critically evaluating the conceptual and methodological issues in such studies.

To meet this objective, a literature search was conducted (1st March 2014 to 1st October 2014) using (1) Newcastle University Library's search engine that encompassed databases (including major databases like Compendex, EBSCO, JSTOR, Medline, Ovid, ProQuest, Scopus and Web of Knowledge, as well as others like Oxford University Press, Library of Congress, etc.), E-journals and E-books, and (2) Google Scholar. The search terms used were (a) "cognitive dissonance," (b) "eating," (c) "food," and (d) "nutrition," in which (a) was combined separately with (b), (c), and (d) before all search terms were combined in a single search, for a total of four search cycles. The search results were sieved by the first author for duplication and relevance through title and abstract screening, after which the full texts of short-listed articles were downloaded and scanned through to further ascertain the relevance of each article for the review. When applied, the original set of inclusion and exclusion criteria—the core inclusion requirement being cognitive dissonance having been *explicitly manipulated, measured and examined as a primary investigative construct* (used in *a priori theorization* and *hypothesis-formulation* as a *focal concept*) with *food attitudinal outcomes*—returned nil appropriate studies. Thus, a modified set of inclusion and exclusion criteria—the core inclusion requirement being cognitive dissonance having been *examined as a primary investigative construct*, and used in *a priori theorization* and *hypothesis-formulation* as a *focal concept*, with *food-related outcomes*—was eventually adopted instead (see Fig. 1).

Based on the less stringent parameters set out, 14 studies were identified for this review (see Table 1 for a summary).

Current state of cognitive dissonance scholarship in food and nutrition

Limited cognitive dissonance focused research

The literature search shows that there is limited food and/or food-related research that have examined/used cognitive dissonance as a primary, focal construct in *a priori* theorization, and hypothesis-formulation; none of these studies involved examining the utility of cognitive dissonance in influencing healthy food attitudes and behaviors in particular. As evidenced by the 14 selected studies, such primary focus is very frequently, if not always, reflected methodologically through the use of experimental manipulation to evoke cognitive dissonance and then assessing its effects via how the dissonance is resolved. This is that which largely distinguishes the 14 studies from the numerous other studies that had used cognitive dissonance solely as (1) *a posteriori* explanation for research findings (e.g., Hjelm, 2011; Pettigrew and Pescud, 2013), (2) a non-focal part of a larger theoretical framework in *a priori* theorization without

hypothesis-formulation, particularly in exploratory qualitative research (e.g., Jabs et al., 1998; van Dijk et al., 2012), or (3) a non-focal part of a larger theoretical framework in *a priori* theorization and hypothesis-formulation, in which the basis for experimental manipulation (if any) did not relate directly to dissonance (e.g., Schifferstein et al., 1999; Quick and Heiss, 2009). By relegating the status of cognitive dissonance to a secondary level of importance, these latter studies' capacity to contribute to an understanding of the nuances of cognitive dissonance effects in food and nutrition (if any) becomes skewed and diminished, thus precluding them from being classified in the same category of studies used for the current review. At best, these studies provide only supplementary, rather than primary and direct evidence for cognitive dissonance research in food and nutrition. For example, Lin et al.'s (2004) study on fat intake and the search for nutrient information on food labels had often been cited as support for the effects of cognitive dissonance even though the authors themselves had unequivocally acknowledged that the parameters of their study were insufficient to allow for "a test of the cognitive dissonance theory itself" (p. 1962).

Fragmented cognitive dissonance focused research

The diversity of the 14 selected studies, in terms of topical foci and investigated outcomes, suggests potential conceptual (and methodological) fragmentation in the study of cognitive dissonance in the food and nutrition domain. Indeed, in the process of organizing and classifying these studies, it was found that they covered a spectrum of (at times overlapping) topical areas that encompassed food risk/safety, health-nutrition communication, dietary health behavior, food-related consumer behavior, and meat consumption, without a unified theoretical framework to guide and/or logically link the study of cognitive dissonance (in these areas) together. This is exacerbated by partial adherence to only certain aspects of the cognitive dissonance theory across the studies. In particular, although the basic cognitive dissonance process comprises the stages of dissonance arousal and dissonance resolution, only the latter has been meticulously studied, with the former being largely and substantially neglected; the major paradigms associated with dissonance arousal, which include *free choice*, *induced compliance*, *belief disconfirmation*, *hypocrisy*, and *effort justification* (Harmon-Jones, 2002; Harmon-Jones and Harmon-Jones, 2007), have therefore almost always been overlooked in the manipulation of cognitive dissonance onset in these food and/or food-related studies (see Table 2 for paradigm descriptions).

Without a logical, unified conceptual framework in place, the approach to studying cognitive dissonance in food and nutrition is necessarily less systematic and consistent. The end result is fragmented and disparate research findings that do not effectively provide a complete, and integrated, picture (if at all) of the underlying cognitive dissonance mechanics in affecting eating/food attitudes and/or behaviors. The existing diverse research warrants that these, and other related issues, be elaborated upon and discussed through relatively detailed descriptions of the studies within each identified topical area in order to obtain a clearer overall picture.

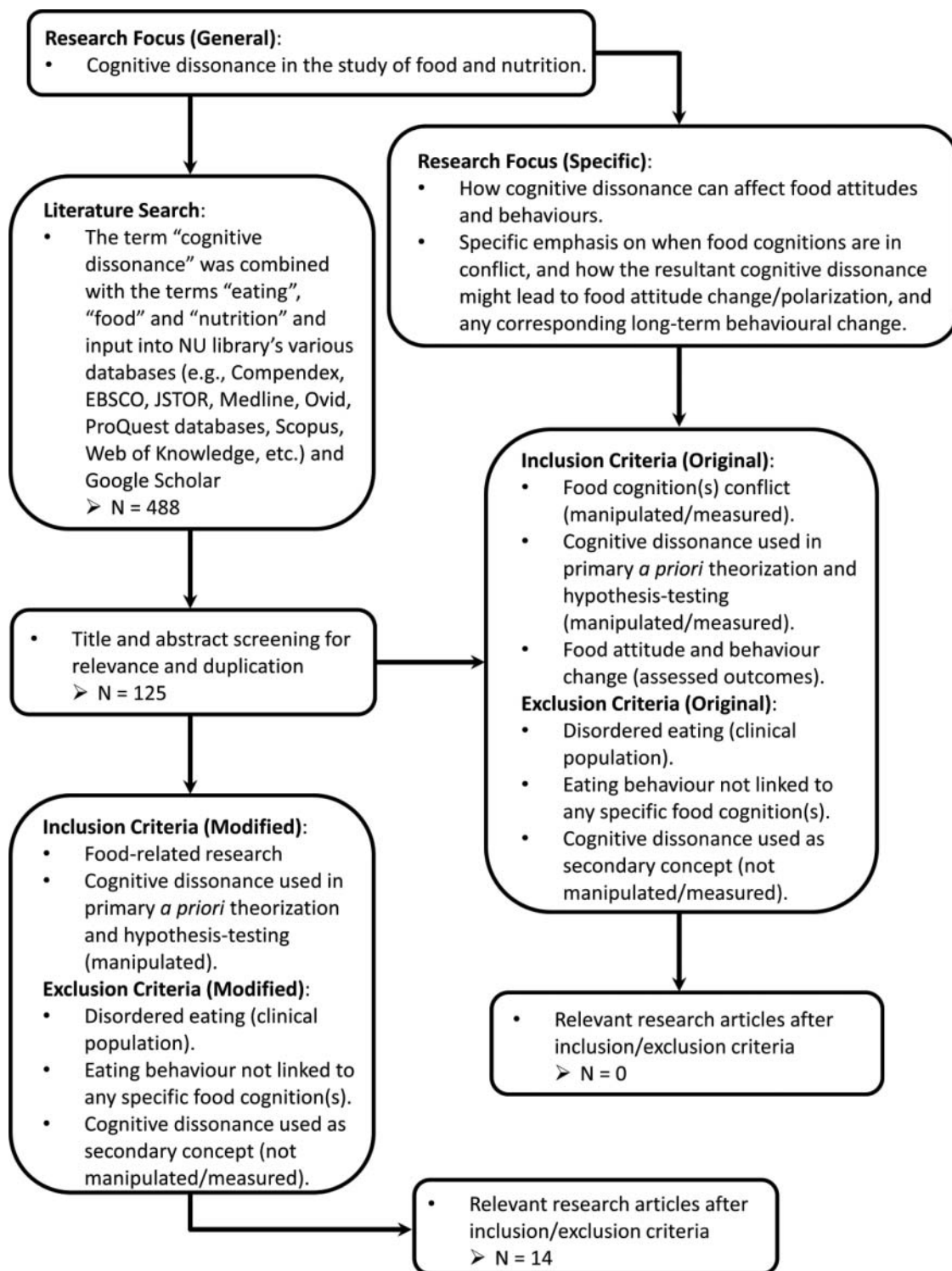


Figure 1. Schematic of literature search via various database(s) using specific parameters.

Food risk/safety

Cao and Just (2010) conducted arguably the first known, formal research in which cognitive dissonance was centrally studied and examined in terms of how it might affect risk perceptions of and willingness to pay for familiar versus unfamiliar foods through direct experimental manipulation of the cognitive dissonance construct. They set up an experiment in which participants either consumed a familiar food (beef sausage) or an unfamiliar food (smoked salmon), and then completed a survey

afterwards about their risk assessments of beef and salmon as well as their willingness to pay for these two types of foods. The survey had three sections that were successively filled sequentially—Section 1 was completed right after food consumption, section 2 was completed after the participants were provided with additional information regarding the food-borne risk of eating beef and salmon (i.e., the percentage of US individuals who got sick from eating the food, the potential bacteria, the related symptoms, sickness, and resulting consequences) and

Table 1. Summary of food-related studies that had explicitly/directly used cognitive dissonance in a *priori* theorization and hypothesis-testing.

Topic area	Authors	Brief description of study	Sample characteristics	Main result(s)	Cognitive dissonance measurement	Implications for use of cognitive dissonance theory in research into dietary choice and public health
Food risk/safety	Cao and Just (2010)	An experiment to investigate individuals' risk assessment and willingness to pay for familiar food (beef sausage) vs. unfamiliar food (smoked salmon) after food consumption, given negative information about the foods.	Undergraduate students in the United States of America (N = 54).	Across different intensities of potential risk information about beef, beef users reported lower risk estimates and willingness to pay higher prices for the meat than non-users (but these were statistically non-significant) relative to salmon.	Cognitive dissonance was not directly measured but experimentally manipulated and implicitly inferred from the outcome variables instead.	To reduce cognitive dissonance aroused due to discrepancy between eating beef and hearing the food risk of beef, users lowered their risk perception of beef consumption and increased their perception of the quality of the meat via their willingness to bid higher prices for it.
	Cao et al. (2010)	A quasi-experiment to investigate if individuals would continue consuming chicken wings from a local store if they believed that the chicken wings were potentially tainted with Avian-influenza (AI), after having already started eating the food.	Undergraduate students in the United States of America (N = 61).	The more chicken that was consumed, the less study participants agreed that the chicken was AI tainted and the more they attempted to justify their behavior (e.g., by reducing the risk perception of consumption).	Cognitive dissonance was not directly measured but experimentally manipulated (indirectly at best) and implicitly inferred from the outcome variables instead.	Cognitive dissonance caused the individuals to change their perceptions of food risk in the direction of their consumption patterns.
	Cao et al. (2014)	An experiment to investigate individuals' risk perceptions and willingness to pay for chocolates (with Aflatoxin) when given a freedom of food choice in the context of food risk information provision.	Undergraduate students in the United States of America (N = 116).	Presented with food risk information, individuals who freely chose one chocolate type were willing to bid a higher price for the chocolate and had attenuated risk perceptions of the food than individuals who were not given a choice of the chocolates.	Cognitive dissonance was not directly measured but experimentally manipulated and implicitly inferred from the outcome variables instead.	Cognitive dissonance caused the individuals to change their perceptions of food risk in the direction of their food choice patterns and sustain their willingness to pay for such food.
	Fischer et al. (2013)	Experimentally investigated whether providing risk and benefit information to individuals with attitudinal ambivalence toward nanotechnology in food production would cause some of them to become less ambivalent.	General population (nationally representative sample) in the United Kingdom (N = 307; N = 311).	Via two experiments, individuals exposed to both health or health and environmental risk and benefit information on the use of nanotechnology in food production showed reduced attitudinal ambivalence. For many study participants, attitudinal ambivalence actually increased.	Cognitive dissonance was not directly measured but experimentally manipulated (indirectly at best) and implicitly inferred from the outcome variables.	Cognitive dissonance lessened some individuals' food-related attitudinal ambivalence, and moved attitudes toward a more negative direction in the face of health risk and benefit information.
	Heiman and Lowengart (2011)	In a field experiment, studied the effects of health hazard information in food (consumption of chicken) on consumers' choice process.	Supermarket shoppers in Israel (N = 330).	Positive health information regarding chicken consumption resulted in low cognitive effort and low involvement in food choice decision where individuals simply based their decision merely on taste. Slightly negative health information resulted in the use of both taste and convenience for food choice decision whilst very negative health information resulted in the use of taste, convenience and health considerations for making a food choice decision.	Cognitive dissonance was not directly measured but experimentally manipulated (indirectly at best) and implicitly inferred from the outcome variables instead.	Cognitive dissonance from conflicting health information about the consumption of a food was considered to cause individuals to avoid confronting the health aspect of consuming said food.

(Continued on next page)

Table 1. (Continued)

Topic area	Authors	Brief description of study	Sample characteristics	Main result(s)	Cognitive dissonance measurement	Implications for use of cognitive dissonance theory in research into dietary choice and public health
Food-related consumer behavior	Nordvall (2014)	Investigated if the choice between organic and non-organic groceries would lead to cognitive dissonance for the consumer.	Undergraduate students in Sweden (N = 100).	Consumer preference for organic and non-organic groceries was measured before and after purchase, and results showed that preference ratings for the non-organic item increased after selection while ratings for the organic alternative decreased after rejection.	Cognitive dissonance was not directly measured but inferred from the outcome variables instead.	Individuals' motivation to reduce post-purchase dissonance might be capitalized by marketers in providing appropriate <i>ex ante</i> information to support consumer purchase decision toward healthier food choices (i.e., purchase promotion).
	Olson and Dover (1979)	An experiment was conducted to investigate the effects of disconfirming consumer expectations about the bitterness of coffee ground on post-product trial hedonic evaluation.	Married women in the United States of America (N = 38).	Although the post-product trial bitterness ratings of the experimental group did change according to the taste test, they still registered higher "not bitter" and lower "slightly bitter", "fairly bitter" and "very bitter" ratings compared to the control group.	Cognitive dissonance was not directly measured but experimentally manipulated and implicitly inferred from the outcome variables instead.	Cognitive dissonance caused by a disconfirmation of expectations led individuals to assimilate post-product trial ratings in a manner that was closer to the pre-product trial ratings in order to reduce dissonance.
	Stern et al. (2009)	A quasi-experiment to investigate the effects of information provision about wood-based food additives on attitude change in the context of individuals' prior attitudes toward, and pre-knowledge about, the additives.	Consumer population in Austria (N = 263).	The provision of additional (neutral) information about the use of wood lignin in vanilla aroma production led to an improvement in the evaluations of such additives across all experimental groups. However, significant improvement occurred only for those who had pre-knowledge of the additives but was not able to provide an example ("divergent" group) and those who completely did not know about the additives at all ("uninformed" group).	Cognitive dissonance was not directly measured but experimentally manipulated (indirectly at best) and implicitly inferred from the outcome variables.	Cognitive dissonance caused a change in individuals' food-related attitudes in the event that prior attitudes were weak and not definitive.
Health-nutrition communication	Albarracín et al. (2003)	Experimentally investigated whether individuals would heed health messages (regarding the consumption of an alcohol-like product) if they consumed the alcohol-like substance following the health messages.	Undergraduate students in the United States of America (N = 99).	Participants who consumed a simulated alcohol product expressed stronger intentions to use the product in future if they had been exposed to an abstinence-promoting preventive message than a message that urged moderated use.	Cognitive dissonance was not directly measured but experimentally manipulated and implicitly inferred from the outcome variables instead.	Cognitive dissonance due to conflict between behaviour and health message, led to a resistance of the health message, especially one that adopted a total-abstinence stance than a moderate-consumption stance, as a means of reducing dissonance.
	Knobloch-Westernick et al. (2013)	Examined experimentally how health behavior (consuming organic food, coffee, fruits and vegetables, and exercising) might be self-regulated through selective exposure to online health messages.	Undergraduate students in the United States of America (N = 419).	The more individuals engaged in certain health behaviors, the more time they would spend accessing the messages promoting those health behaviors.	Cognitive dissonance was not directly measured but experimentally manipulated (indirectly at best) and implicitly inferred from the outcome variables instead.	The threat of cognitive dissonance was assumed to cause individuals to approach health messages consistent with their health behaviors and to avoid those messages in conflict with their health behaviors.

Meat consumption	Bastian et al., (2012)	Examined experimentally if there was denial of mind to food animals by individuals to sustain their meat-eating behavior and to protect culinary practices.	Undergraduate students in Australia (N = 71; N = 66; N = 128)	In the last of three studies, participants who expected to eat meat denied mind to food animals when they were asked to think about the origins of meat. Also, denying minds to animals reduced negative emotions aroused by dissonance between concern for animals and meat eating.	Cognitive dissonance was not directly measured but experimentally manipulated and implicitly inferred from the outcome variables instead.	Cognitive dissonance elicited by the conflict between meat consumption and concern for animals caused a denial of mind to food animals, thereby sustaining meat eating behavior.
	Rothgerber (2014)	Examined experimentally the strategies used by meat eaters to reduce vegetarian-induced dissonance.	Working adults primarily from the United States of America (N = 90; N = 77; N = 77; N = 68; N = 78)	Via four experiments, participants showed different dissonance-reducing strategies when exposed to vignettes depicting various types of vegetarians. In a final fifth study, participants were shown to feel negative emotions if they anticipated moral reproach from the vegetarians.	Cognitive dissonance was not directly measured but experimentally manipulated and implicitly inferred from the outcome variables in the first four studies. In the fifth study, cognitive dissonance was linked to a single measure that combined the emotional states of anxiety, nervousness, tension and discomfort.	Cognitive dissonance elicited by the conflict between meat consumption and vegetarianism concerns (e.g., animal suffering, etc.) evoked dissonance-reducing strategies to excuse, and therefore sustain, meat eating behavior.
Dietary health behavior	Rotenberg et al., (2005)	Examined experimentally the effect of priming thoughts about control on anxiety and food intake and if this was moderated by dietary restraint.	Undergraduate students in the United Kingdom (N = 80).	Participants high in dietary restraint showed greater anxiety when primed for control than when primed for lack of control whereas participants low in dietary restraint showed greater anxiety when primed for lack of control than when primed for control due to cognitive dissonance. The moderating effect of dietary restraint did not occur for food intake.	Cognitive dissonance was not directly measured but experimentally manipulated and inferred from the outcome variables instead.	Cognitive dissonance elicited from inducing incongruence in control thoughts among restraint eaters caused anxiety in them but did not affect food intake.
	Stellefson et al., (2006)	Investigated experimentally if cognitive dissonance created about current physical activity and dietary habits would affect riskworry about those health behaviors, and exercisediet intentions for the future.	Undergraduate students in the United States of America (N = 126).	When cognitive dissonance was created in terms of health thoughts about diet and physical activity, a higher intention to change diet and physical activity was associated with a higher perceived risk of health problems whereas when cognitive dissonance was created in terms of appearance thoughts on diet and physical activity, a higher intention to change diet and physical activity was associated with a lower perceived risk of health problems.	Cognitive dissonance was not directly measured but experimentally manipulated and inferred from the outcome variables instead.	Cognitive dissonance was found to influence the relationship between risk perceptions and intentions for health behaviors (namely, physical activity and dietary habits) differentially, depending on whether cognitive dissonance was based on health or appearance thoughts.

section 3 was completed after intensified food-borne risk information was further related to participants (i.e., details of a specific batch of beef sausages/smoked salmon recently recalled by the US Department of Agriculture). Section 3 included the same questions on risk assessments but instead of willingness to pay, participants were asked to indicate if they would immediately discontinue eating if the food that they had consumed (during the experiment) was the recalled food, and/or if the recalled food was one that they had at home but not yet consumed. The reported results were mostly, if not all, on beef rather than salmon, and although statistically non-significant, showed that while there was no difference in the initial risk assessment of the beef between those who ate it and those who did not, beef users tended to register lower perceived risk and higher willingness to pay a high price for beef after exposure to food-borne risk information than non-users. Beef users were also found to be less likely to stop eating beef immediately even if they found it to be part of the recalled food as compared to non-users. Cao and Just (2010) attributed such behaviors of the beef users to confirmatory bias in a bid to reduce cognitive dissonance.

In a similar vein, Cao et al. (2010) conducted a lab experiment to investigate if individuals would proceed to consume potentially Avian-Influenza (AI) tainted chicken wings from a local store in full knowledge of the fact. Separated into either a group that had prior eating experience (users) at the local store or a group that had no prior eating experience (non-users) at the same store, participants were given normal chicken wings or chicken wings prepared with fish sauce (simulating AI tainting). In the fish sauce condition, users were found to be able to better detect, and had higher tolerance of, taste anomalies than non-users. More pertinently, the more of the fish sauce chicken wings the users consumed, the more they rated the food positively (and the less they rated it negatively) and the lower they rated the perceived risk in consumption, as compared to the non-users. Using the notions of cognitive dissonance and confirmatory bias, the researchers explained that the users had sought to reduce the high cognitive dissonance they experienced as a result of consuming high amounts of the “tainted” chicken wings by changing their ratings of food acceptability and perceived risk to be in line with their consumption patterns.

More recently, Cao et al. (2014) reported another experimental study where in the control condition, individuals were presented with three different flavored (plain, peanut, or almond) chocolates and asked to indicate their willingness to pay for each type (through placing a bid) across three stages of differential exposure to risk information (Aflatoxin—food-borne pathogen)—stage 1, where there was no information given; stage 2 where some qualitative information about Aflatoxin, its relation to common food (especially peanut and almond) and health/illness was given; and stage 3 where some quantitative information about Aflatoxin concentrations in different products (especially peanut and almond) was provided. Risk perception of the chocolates was the other outcome assessed across the three rounds of bidding. In the treatment condition, individuals were asked to select just one of the three flavored chocolates and indicate their bids and risk perceptions only for this chocolate type across the three stages. The authors reasoned that the cognitive dissonance experienced by

individuals who had committed to just one type of chocolate would lead them to be willing to pay more for it (despite the risk information) and, via selective information processing due to confirmatory bias, have attenuated perceptions of its food risk/safety level as compared to individuals who had not committed to any single chocolate type. The hypotheses were generally confirmed.

In summary, Cao and colleagues’ experiments show that cognitive dissonance, via confirmatory bias, has the effect of lowering food risk/safety perceptions to sustain food attitudes and behaviors in the direction of the risk—a finding that seems to be in line with results obtained in field studies of food risk/safety that had used cognitive dissonance only as a *posteriori* explanation (e.g., Harvey et al., 2001; Frewer et al., 2003). It should be noted, nonetheless, that their work focused more on the workings of dissonance resolution (i.e., confirmatory bias) than equitably on the intricacies of both dissonance arousal and resolution—a paradigm of cognitive dissonance arousal was only referenced in Cao et al.’s (2014) study while cognitive dissonance onset was not explicitly measured across the three studies reviewed.

Fischer et al. (2013) investigated the effects of contradictory information about nanotechnology applications on attitudes and attitudinal ambivalence toward nanotechnologies. Specifically, the authors hypothesized that providing both risk and benefit information to individuals with attitudinal ambivalence toward the use of nanotechnology in food production would cause some of them to become more positive and some more negative in their attitude toward the issue (i.e., become less ambivalent). This would be the result of cognitive dissonance resolution where a more definitive stand in either a positive or negative direction was adopted in order to reduce the dissonance triggered by conflicting risk and benefit information. Via two experiments, it was found that individuals exposed to both health (plus environmental in the second experiment) risk and benefit information on the use of nanotechnology in food production showed reduced attitudinal ambivalence, in particular in the negative direction, although average attitude did not change. However, for a number of participants, attitudinal ambivalence increased, rendering the cognitive dissonance reduction explanation somewhat problematic. A limitation in this study would be the assumption of cognitive dissonance resolution based on changes in attitudinal ambivalence, in the absence of cognitive dissonance arousal assessment at the outset. It has been argued that attitudinal ambivalence itself represents an instance of internal attitudinal inconsistency that entails negative psychological effects similar to cognitive dissonance (Costarelli and Colloca, 2007; Cong et al., 2013). Thus, the attitudinally ambivalent individuals in Fischer et al.’s study might have already attempted, or at least have an implicit preference, to resolve their dissonant feelings in some way prior to being exposed to both risk and benefit information, thereby accounting for why some of them became more positive, some more negative and some more ambivalent toward food production nanotechnology after exposure to the contradictory information.

In another study, Heiman and Lowengart (2011) examined the effects of health hazard information in food on consumers’ choice process. Here, a between-subjects design was used in which participants were placed into a group that received either

Table 2. The major paradigms of cognitive dissonance (arousal).

Paradigm	Assumption
Free choice	Assumes that once a decision is (freely) made, dissonance may be aroused.
Induced compliance	Assumes that dissonance is aroused when an individual does or says something that contradicts a prior belief or attitude.
Belief disconfirmation	Assumes that dissonance is aroused when persons are exposed to information inconsistent with their beliefs.
Hypocrisy	Assumes that dissonance is aroused whenever individuals are induced to publicly make statements consistent with some normative standards and thereafter, reminded of times when they did not act in accordance with such standards as depicted in the statements made.
Effort justification	Assumes that dissonance is aroused whenever individuals voluntarily engage (i.e., put in effort) in an unpleasant activity to achieve some desired goal.

Source: Harmon-Jones (2002) and Harmon-Jones and Harmon-Jones (2007).

(1) positive, (2) slightly negative, (3) very negative, or (4) no health (hazard) information about the consumption of chicken and then asked to rate chicken, turkey, and beef (along with their ready-to-eat versions) on 10 food attributes that were factor-analyzed into three dimensions (health, taste-value, and convenience) after data collection for analysis. The researchers hypothesized that positive and slightly negative health information would result in low cognitive effort and low involvement in food choice decision where individuals would base their decision on taste alone. It was reasoned that when new information conflicted with prior beliefs, reducing dissonance would be most easily accomplished by ignoring the health information. However, with increasing severity of health information, individuals ought to become more involved and use more cognitive efforts to consider all relevant dimensions for their food choice decision. Results showed that all hypotheses were verified except for the slightly negative information group where convenience was used as another significant dimension for food choice decision. In this case, the authors suggested that the participants looked to the convenience dimension as a means of avoiding confronting the conflict between health and taste in the slightly negative health information condition but could not avoid confronting it when the information became severe. This observation challenged the researchers' original cognitive dissonance-based postulations and underscored the importance of the need for a systematic assessment of cognitive dissonance to facilitate greater precision in hypothesis testing.

Food-related consumer behavior

Cognitive dissonance has been linked to consumer behavior since the 1960s (e.g., Kassarian and Cohen, 1965), particularly in terms of post-purchase dissonance (e.g., Gbadamosi, 2009) and expectancy-disconfirmation (e.g., Schifferstein et al., 1999) studies. Although there appears to be a larger number of food-related studies associated with consumer behavior (particularly expectancy-disconfirmation studies) compared to some of the other topical areas, it must be noted that the goal(s) of the consumer behavior studies are necessarily different and disparate from that of the other topical areas—for instance, in consumer

behavior, the primary goal is generally and largely commercial in nature (e.g., building brand loyalty, influencing and/or sustaining repurchase behavior, etc.) while in food and nutrition, the primary goal is health focused (e.g., developing healthy dietary choices/practices, etc.).

In post-purchase dissonance consumer research, cognitive dissonance is seen to inevitably occur as purchase decisions often entail some degree of compromise (Bose and Starker, 2012). It is notable that food has been infrequently studied in this way compared to other products. Nordvall's (2014) study that examined consumer choice in relation to the purchase of organic and non-organic groceries is an exception. Here, consumer preference for organic and non-organic groceries was measured before and after food selection. Results showed that preference ratings for the non-organic item increased after it was selected while ratings for the organic alternative decreased after it was rejected. Nordvall (2014) attributed the post-decision changes in ratings to cognitive dissonance reduction and proposed that marketers provide appropriate information to capitalize on the post-decision dissonance experienced by non-organic food consumers to get them to switch to the organic alternative before actual purchase. This proposal holds promise given that in a recent non-experimental, survey study designed to statistically test a conceptual model of understanding consumer health information-seeking behavior in relation to a food product (salad dressing), rather than finding postpurchase dissonance supporting and sustaining current purchase practices, Hansen et al. (2013) found post-purchase health-related dissonance to predict the intentions to avoid repeat purchase of the food product. A novel spin on the typical post-purchase dissonance study in which the aim is to support realized (rather than unrealized) purchase decisions, there was, nonetheless, no mention of a formal assessment of cognitive dissonance itself in Nordvall's (2014) study. It is noteworthy that post-purchase dissonance consumer research is perhaps the only area that has seen attempts being made to develop formal measurements of the cognitive dissonance (i.e., post-purchase dissonance) construct (Montgomery and Barnes, 1993; Sweeney et al., 2000).

In contrast, cognitive dissonance has often been referenced in the expectancy-disconfirmation model, originally used in the investigation of consumer satisfaction (e.g., Hansen, 2008) but subsequently employed more frequently in relation to food (product) acceptability (e.g., Behrens et al., 2007) studies. A typical study involves looking at the match/mismatch between consumer expectations and actual product properties/characteristics that include the sensory/hedonic qualities of the product. Olson and Dover (1979) exposed individuals to advertisements that emphasized the non-bitterness of a type of ground coffee before giving them a product trial some days later. Indices of the participants' beliefs and evaluations of the bitterness levels of the ground coffee were taken after exposure to the advertisements (pre-product trial) and after the ground coffee was tasted (post-product trial). A control group that tasted the ground coffee without prior exposure to the advertisements was included to contribute a set of only post-product trial bitterness scores. Results showed that although the post-product trial bitterness ratings of the experimental group did change according to the taste test, they still registered higher "not bitter" and lower "slightly bitter," "fairly bitter," and "very

bitter” ratings (although only the difference in “fairly bitter” ratings were statistically significant) compared to the control group. It appeared that the experimental group tried to reduce cognitive dissonance due to disconfirmed expectations, by assimilating the post-product trial ratings in a manner that was closer to the pre-product trial ratings. Olson and Dover’s (1979) study represented the one early expectancy-disconfirmation research on a food product to have separated the notions of cognitive dissonance and assimilation. Indeed, Zeithaml (2012), while noting that both cognitive dissonance theory and assimilation theory predicted the same effect on expectations, had acknowledged the separateness of the two theories. Lamentably, however, cognitive dissonance theory became largely subsumed under, and indeed, superseded by, assimilation theory in later research (e.g., Korgaonkar and Moschis, 1982; Schifferstein et al., 1999; Behrens et al., 2007)—reflecting, once again, partiality toward dissonance resolution and marginalization of dissonance arousal itself. Furthermore, Zeithaml (2012) noted that it was doubtful that the conditions necessary for dissonance to occur (i.e., firm conviction or volition, public and irrevocable commitment to the product, possibility of unequivocal disconfirmation and occurrence of disconfirmation) were met in typical disconfirmation experiments, “where inconsequential expectations are induced by experimenter-provided product information, little public commitment is made, and rather equivocal evidence is offered” (Zeithaml, 2012, p. 85).

In a slightly different study related to consumer food acceptance, Stern et al. (2009) investigated the effects of additional information provision about wood-based food additives on attitude change in the context of individuals’ prior attitudes toward, and pre-knowledge about the additives. Classifying the participants as “expert,” “divergent,” “misbeliever,” “believer,” and “uninformed” in terms of their pre-knowledge about wood-based food additives, the authors found prior attitude to be more positive for those with accurate pre-knowledge (“expert” group) than those with inaccurate pre-knowledge (“misbeliever” group). More importantly, although the provision of additional (neutral) information about the use of wood lignin in vanilla aroma production led to an improvement in the evaluations of such additives across all groups, significant improvement occurred only for those who had pre-knowledge of the additives but was not able to provide an example (“divergent” group) and those who completely did not have any idea about the additives at all (“uninformed” group). The prior attitude of the “misbeliever” group remained the most negative. In the context of improving the marketing of wood-based additives (particularly in contrast to additives in general), it was concluded that providing information to attempt to change attitudes would be easier for those who did not yet possess a definitive prior attitude as those with strong prior attitudes would block off dissonant information. The strength of Stern et al.’s (2009) findings would have been enhanced if cognitive dissonance had been explicitly measured.

Health-nutrition communication

Health-nutrition communication is an area into which food risk/safety and food-related consumer behavior research may often cross over in terms of cognitive dissonance centric scholarship. In one of two experiments conducted, Albarracín et al. (2003) investigated whether individuals would follow a health message if they

engaged in contradictory behaviors after hearing the health message. Participants were first informed that the study related to an alcohol-substitute product that had similar effects as alcohol but was not legally considered to be alcohol and thus was going to be made available to individuals of all ages. They were then assigned to either a group exposed to a short advertisement with a long elaborated message promoting abstinence or one that promoted moderate use of the product. After message exposure, each group was further divided into a group that tried the product and another that did not. Participants who consumed the simulated alcohol product expressed stronger intentions to use the product in future if they had been exposed to an abstinence-promoting preventive message than a message that promoted moderate use. The authors argued that the conflict between behavior and message led to a resistance of the abstinence-promoting message as a means of dissonance reduction, and recommended that in order to be effective, health messages needed to tread a moderate path rather than take a total-abstinence route. The findings from this study were founded on the assumption of cognitive dissonance onset (from the dissonance resolution outcomes) rather than a direct assessment of cognitive dissonance arousal itself.

Knobloch-Westerwick et al. (2013) examined how health behavior might be self-regulated through selective exposure to online health messages. In this within-subjects experiment, the researchers presented participants with four health topics online (organic food, coffee, fruits and vegetables, and exercise), each with a promoting and an opposing stance from a high and low credibility source. Participants were told to browse through the topics and read whatever interested them. Several hypotheses were made, of which the following related to the notion of cognitive dissonance: (1) The more individuals partook in certain health behaviors, the more time they would spend on the messages promoting those health behaviors, and (2) the more individuals failed to meet perceived standards for health behaviors, the less time they would spend on the messages promoting those health behaviors. The researchers further hypothesized that these effects would be stronger for those messages linked to high than low credibility sources. Results showed the first, but not the second, hypothesis to be supported, regardless of source credibility, and that individuals who engaged in certain health behaviors also spent less time on messages that opposed those behaviors. To account for the two different findings, the researchers suggested that the first hypothesis involved an instance of situational dissonance and the second hypothesis one of pre-existing dissonance. However, it was more plausible that the first hypothesis represented an instance of consistency maintenance and the second hypothesis one of dissonance reduction (which did not materialise). Knobloch-Westerwick et al.’s (2013) study highlighted the current lack of a systematic approach to the study of cognitive dissonance in food and/or food-related research.

Meat consumption

Research into meat consumption has risen in recent times, particularly in terms of cognitive dissonance investigation. In one such research, Bastian et al. (2012) investigated if people would continue to eat meat if they ascribed mental capacities (minds) to food animals. The researchers hypothesized that being reminded of the origins of meat would raise dissonance for meat eaters, leading them

to deny minds to food animals, especially if they expected to eat the meat in the near future, therein lessening their moral concern for those animals and reducing negative affect about meat consumption. Across three studies that employed a mix of experimental and questionnaire self-report approaches, the authors assessed (1) participants' perceptions of 32 animals in terms of mental capacities and edibility, as well as, their moral concern and affect about eating each animal in the first study, (2) participants' perceptions of the mental capacities of a cow and sheep after exposure to pictures of the two animals that either depicted and described the animals as merely grazing in a herd in paddocks (control condition) or as being bred to be slaughtered in an abattoir for consumption (experimental condition) in the second study and (3) participants' affective response to the expectation of eating beeflamb (high dissonance condition) or apple (low dissonance condition) after being presented with the same picture stimuli as in study 2 and asked to write an essay about "the processes involved in raising cattle/sheep on the farm right through to the eventual packaging of meat for human consumption" (p. 251) in the third study. Generally, a negative correlation was observed between mental capacities and edibility such that animals considered appropriate for consumption were rated as having lesser mind. At the same time, it was found that the more individuals attributed mind to animals, the worse they felt about eating them and the more morally wrong they perceived the consumption to be. Collapsing the data in study 2 to form the categories of "food animal" and "non-food animal" (since no significant differences were found between cow and sheep), results showed meat eaters significantly denying mind to animal when reminded that the animal would be used as food as compared to when they were not reminded of it. With the data similarly collapsed in study 3, results showed that participants denied minds to food animals when thinking about animal food origins but only in the event that they expected to consume meat (and not when they expected to consume apple). The authors also reported that "denying minds to animals we are about to eat reduces negative emotions aroused by dissonance between our concern for animals and our meat-eating behaviour" (p. 253). The novel results obtained notwithstanding, Bastian et al.'s (2012) research did not measure cognitive dissonance explicitly.

Rothgerber (2014) recently examined the strategies used by meat eaters in reducing vegetarian-induced dissonance. Using online surveys across four studies, meat eaters were hypothesized to experience cognitive dissonance when exposed to various vignettes depicting different types of vegetarians (a pair in each between-subjects study) and had their responses to statements designed to capture various types of dissonance-reducing strategies recorded. In study 1, individuals exposed to a vignette depicting a vegetarian were more likely to attribute lower mind and emotion ratings to animals than those exposed to a vignette depicting a gluten-free person. In study 2, participants exposed to a vignette depicting an authentic vegetarian reported higher consumption of vegetarian meals per week and lower consumption of beef than those exposed to a vignette depicting a fake vegetarian. In study 3, individuals exposed to a vignette describing a freely choosing vegetarian (vegetarianism by choice) denied animals' capacity to feel pain more and believed more in the necessity of consuming meat than those exposed to a vignette describing a restricted-choice vegetarian (vegetarianism by force). In study 4, participants who were exposed to a vignette describing a consistent vegetarian used more

meat-eating justification tactics than those exposed to a vignette describing an inconsistent vegetarian. Recognizing that these four studies did not provide direct evidence of cognitive dissonance experienced, the researcher conducted a final fifth study in which individuals' emotional responses (anxiety, nervousness, tension, and discomfort) to anticipated moral reproach from vegetarians (to their meat consumption) and their ratings of human-animal emotional similarity were measured. Here, it was found that compared to a control group (in which no moral reproach from vegetarians was anticipated), those individuals who expected moral reproach registered higher scores on negative emotions (reflecting dissonance) and lower scores on perceived human-animal emotional similarity. Rothgerber's (2014) work is creditable for recognizing the importance of assessing cognitive dissonance and attempting an indicative measure of it through measuring "emotional states such as anxiety and tension that are associated with the experience of cognitive dissonance" (p. 39). The omission of cognitive discrepancy assessment (Harmon-Jones, 2002; Harmon-Jones and Harmon-Jones, 2007) in such ad-hoc, proxy measures of cognitive dissonance, however, highlight the need for actual, formal measures of the construct, that are founded on sound theoretical principles of the cognitive dissonance framework, to be developed.

Dietary health behavior

This is a key area that most, if not all, health agencies have been focusing their efforts in but yet very little work to date has been done to examine how cognitive dissonance may be used to effect adaptive eating behaviors since Worsley's observation of this same fact back in 2002. Exceptionally, Stelfox et al. (2006) attempted to link cognitive dissonance with intentions to change specific lifestyle behaviors by investigating if individuals would be more likely to assume healthier diets and exercise habits when made to experience cognitive dissonance regarding their diet and exercise behaviors for physical appearance or health reasons. In this study, college students were each asked to complete a questionnaire assessing their (1) physical activity behaviors, (2) dietary habits, (3) perceived risk/worry about health and appearance associated with their diet and exercise habits, and (4) diet/exercise intentions for the future. The questionnaire was completed after they had written an essay on why healthy diet and physical activity were important either to maintaining one's health (dissonance-health condition), or for maintaining an attractive physical appearance (dissonance-appearance condition) or an essay about their favorite movie (control condition). Results showed that while cognitive dissonance had no effect on intentions and risk perceptions, differences were found between the three conditions in terms of the relationship between risk perceptions and intentions. Specifically, an increase in perceived risk of health problems was associated with increased intentions to diet and exercise in the dissonance-health condition but was associated with decreased intentions in the dissonance-appearance and control conditions. In comparison, an increase in perceived risk of appearance issues was associated with increased intentions to diet and exercise for all conditions, with the highest per-unit increase occurring for the dissonance-appearance group. The authors suggested that efforts to influence healthy diet and exercise behavioral intentions via risk perceptions would be facilitated by evoking cognitive dissonance that matched the specific risk type, especially for physical appearance concerns. The results and interpretations, however,

must be taken with caution as these were predicated on the differentiation of appearance- *versus* health-based dissonance, such that “dissonance would be more apparent when college students were encouraged to think about how their health habits influenced their appearance rather than their health” (p. 221), which Stelfox et al. (2006) did not explicitly measure.

On a slightly different note, Rotenberg et al. (2005) examined the effects of activating thoughts about control on anxiety and food intake, as well as, the moderating role of dietary restraint on such effects. Female undergraduates were first put through a priming task where they were either primed for control or lack of control thoughts, after which they completed a questionnaire that encompassed measures of dietary restraint and perceptions of control over consumption before being finally presented with a taste test that required them to consume different brands of ice-cream (and rating these on several hedonic attributes) as a means of measuring food intake. Pre-test state anxiety was measured at the start of the experiment (before the priming task) and measured again after the completion of the questionnaire (post-test state anxiety). Results showed that (1) individuals primed for lack of control thoughts perceived less control over consumption than those primed for control thoughts, (2) higher levels of dietary restraint were associated with lower perceived control over consumption, (3) individuals with high levels of dietary restraint showed greater anxiety when primed for control than lack of control thoughts (the reverse was true for low dietary restraint participants), and (4) individuals primed for lack of control thoughts had higher food intake than those primed for control thoughts. The pattern of results obtained prompted the authors to suggest that women who were high in dietary restraint might not respond well to clinical interventions that emphasized the adoption of control cognitions over food consumption. The failure of the researchers to find an effect of priming incongruity in control cognitions in restraint eaters on actual food intake, however, weakens the practical value of such a recommendation.

Main issues—Summary and consolidation

As evidenced from the literature review, not only is there a lack of cognitive dissonance focused research in the food and nutrition domain currently, but the existing, limited studies also appear conceptually fragmented due to the absence of a logical, unified theoretical framework—one that integrates the basics of cognitive dissonance theory with the domain-specific features and realities of food and nutrition—to guide and facilitate systematic, consistent research. This has resulted in disparate findings where, in particular, two possible but completely opposite responses to cognitive dissonance emerge—(i) individuals ignore contradictory information and instead, seek out congruent information to support their pre-existing food and/or food-related inclinations; (ii) individuals confront important health considerations in food (or related to food) and in certain situations, particularly in the absence of a strong, initial stance, change their pre-existing food and/or food-related inclinations in the direction of the health considerations. These two opposing patterns of results exist within and across the various topical areas—the first is seen in food risk/safety, food-related consumer behavior, health-nutrition communication and meat consumption and the second in food risk/safety, food-related consumer behavior and dietary health

behavior. It has to be noted that all findings obtained in the reviewed studies must be taken in the context of the fact that cognitive dissonance itself was rarely directly assessed or measured but instead inferred from “observable manifestations of attempts to reduce it” (Carlsmith and Aronson, 1963, p. 151). Aforementioned, “While important, these demonstrations only offer indirect support for a dissonance-based explanation” (Rothgerber, 2014, p. 38), additionally highlighting the inequitable focus on dissonance resolution at the expense and neglect of dissonance arousal in the study of cognitive dissonance in food and/or food-related research. It is likely that the disparate findings achieved within and across the various topical areas are partly due to this.

Recommendations for future cognitive dissonance research in food and nutrition

Consistent with Worsley’s (2002) position on the potential applicability of cognitive dissonance to changing dietary beliefs, Hamilton-Ekeke and Thomas (2011) proposed using cognitive dissonance to aid children to rethink their “prior views concerning healthy eating” (p. 70). In a series of studies that possibly captures how Worsley (2002) probably envisioned the utility of cognitive dissonance to be (in influencing adaptive dietary health behaviors), Stice and colleagues (Stice et al., 2000, 2001) developed a dissonance-based eating disorder prevention program through which disordered eaters were made to experience dissonance in terms of their thin-ideal by critiquing it. The researchers’ rationale that the dissonance aroused would reduce the idealization of female thinness, leading subsequently to decreases in body dissatisfaction, dieting, negative affect, and ultimately, bulimic symptoms, were largely borne out in their studies (e.g., Stice et al., 2000, 2001, 2003, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014) and in the extension studies of others (e.g., Becker et al., 2010; Ramirez et al., 2012). However, in a recent systematic review of dissonance-based interventions for non-clinical health behaviors, Freijy and Kothe (2013) reported no peer-reviewed, published study that related to dietary health behaviors.¹

In order to develop similar dissonance-based programs to alter dietary health behaviors through changing food and/or food-related attitudes, a clear understanding of the mechanisms underlying cognitive dissonance within a food and nutrition context is required. To this end, there are two recommendations for future cognitive dissonance scholarship in food and nutrition going forward. First, there is a need to give equitable attention to the dissonance arousal portion of the cognitive dissonance process beyond just focusing on dissonance resolution. This not only means making appropriate references to the various cognitive dissonance paradigms when attempting to evoke dissonance but more importantly, developing direct measures of cognitive dissonance beyond relying on proxy emotional measures. It is only through a direct measure of cognitive dissonance that potential dissonance evoking situations may be

¹ The reported study closest to being relevant was from an unpublished thesis (Hammons, 2010) on dissonance-based intervention for high-risk alcohol use, which the authors of this review paper felt bordered on being a clinical behaviour similar to disordered eating rather than a clear, non-clinical dietary-related health behavior.

precisely identified and the subsequent dissonance resolution processes/strategies be suitably contextualized, leading to increased accuracy in attained findings. In other words, it is necessary to understand, and be able to assess, the basic, preceding event of dissonance arousal before a precise understanding of how dissonance is resolved (i.e., specific dissonance resolution strategy) may be attained as it is possible that the specific dissonance resolution strategy adopted may depend on how the dissonance has been aroused in the first place (i.e., paradigms of cognitive dissonance) and the extent that dissonance is then felt or experienced.

Second, in order to derive a direct cognitive dissonance measure that is relevant to the food and nutrition domain, there is a prior need to construct a logical, unified theoretical framework based on the basic principles of cognitive dissonance theory and relevant domain-specific theorizations in food and nutrition (e.g., conceptual model for understanding factors influencing food choice—Krebs-Smith and Kantor, 2001). Beyond guiding the development of a direct, domain-specific measure of cognitive dissonance, it is only through the use of such a unified and integrated theoretical framework that cognitive dissonance research in food and nutrition can proceed in a more systematic manner, potentially resolving the apparent disconnect amongst studies across the various topical areas. A more precise understanding of the nuances of the workings of cognitive dissonance in food and nutrition may consequently be achieved.

Conclusion

The review has shown that the potential of cognitive dissonance to influence attitudes and behaviors in food and nutrition has yet to be fully explored and exploited. It is thus in the interest of food science and nutrition scholars to become more engaged in cognitive dissonance research applied in the area of food choice and dietary practice, with the ultimate goal of optimizing the utility of cognitive dissonance in the design of effective policies and promotional strategies in public health.

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