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Cognitive Dissonance under Food-Borne Risk: A Lab Experiment

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Abstract

An experiment is conducted to identify cognitive dissonance and subsequent responses in eating behaviour under food-borne risk. Results show that the existence of cognitive dissonance depends on the familiarity with the food. With common food (beef sausage), participants tend to bid a higher price, report lower risk assessment and neglect risk information, suggesting cognitive dissonance and confirmatory bias. In contrast, with less familiar food (smoked salmon), participants are more cautious. However, subjects still tend to over-justify their eating behaviour by reporting higher willingness to pay (WTP). In summary, the effectiveness of public information depends on people's initial knowledge and perception.

Keywords: Cognitive Dissonance; Confirmatory Bias; Self-Compliance; Justification

1. Introduction

Food safety issues have become a major concern for both public health in general and the food industry in particular. However, it has long been argued that food safety information is relatively ineffective in changing consumers' behaviour. Previous studies have shown that information does have a small magnitude and short-lived impact on market level demand (Piggott et al [4] and Schlenker et al [5]). Still, little is known regarding the individual consumer decision to purchase, much less consumers' subsequent consumption behaviour and the interaction with risk attitude, etc. This study uses experimental evidence to identify cognitive dissonance and its subsequent behavioural impacts among individuals within the context of food safety. The results of our experiment offer some explanation for why typical consumers are always less responsive to some food safety scares.

Cognitive dissonance is a state of discomfort caused by individual holding two contradictory beliefs (Leon Festinger [1]). A natural tendency to reduce dissonance can lead individual to selectively seek confirming evidence and neglect disconfirming evidence (Frey [2]). This confirmation bias will impact decision making later on.

In our experiment, we find the existence of cognitive dissonance depends on the familiarity with the food. Participants who ate beef sausage, a relatively common food, tend to experience cognitive dissonance. When they

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were later exposed to food safety information regarding beef, they failed to update their beliefs about the potential for food borne illness. A self-compliance tendency appears to mitigate the effect of negative food safety information. Thus individuals fall prey to confirmation bias when considering food safety among familiar food products. Information about previous food recalls had very limited influence on individual beliefs. In fact cognitive dissonance caused many to fail to reassess the safety of the food altogether. In contrast, with a relatively unfamiliar food, such as smoked salmon, people are still cautious enough to overcome cognitive dissonance. Participants in the experiment were very quick to update their beliefs when given information regarding prior food safety incidents. However, being super sensitive to relevant information in this case makes individuals susceptible to external signals that may be exaggerated or wholly untrue (e.g., the safety of MSG).

Within a food consumption context, we test

1) when people are informed of the potential food safety risk but still choose to consume, will they experience cognitive dissonance resulting in a muted belief in the potential for food borne illness?

2) Given cognitive dissonance, does a dissonance-reduction tendency bias consumer's evaluation of future information?

3) If dissonance affects updating behavior, does this failure to update evident influence consumption decisions in the future (does dissonance compound over time)?

In terms of policy, we suggest the impact of information on individual behavior depends on consumer's initial perception and the familiarity with the target food. Information providers, either policy-makers or private companies, should differentiate case by case when offering messages to the public. While the effectiveness of some crucial food safety information could be neglected due to cognitive dissonance, other less relevant information may destroy the emerging market of some newly developed products because of the super sensitivity among less experienced consumers. Thus, small food scares in familiar foods may require a greater effort than larger scares with less familiar foods.

The rest of the paper proceeds as follows: Section 2 reviews the existing literature; Section 3 describes the experimental design and the proposed hypotheses; Section 4 outlines the results; Section 5 provides further discussion and some future improvement of the experiment and Section 6 concludes the paper.

2. Literature Review

Cognitive dissonance theory was originally formulated in the mid-1950s by Leon Festinger and its first complete version was presented in 1957. It is used to refer to the uncomfortable feeling aroused from holding two contradicting attitudes, beliefs or behaviours. In order to reduce dissonance, individual would add consonant cognitions, subtract dissonant cognitions, increase the importance of consonant cognitions or decrease the importance of dissonant cognitions. Another motivational process that was found in line with cognitive dissonance is called **confirmatory bias**. It is an error in information processing and belief update procedure, which refers to a tendency of selectively collecting information to reinforce the initial belief (Frey [2]).

Psychological biases such as cognitive dissonance and confirmatory bias have also been extensively applied to consumer behaviour. Empirical research generally falls into two categories: (1) effects of dissonance on attitude change and tendency to repurchase, and (2) effects of dissonance on selective information seeking by consumers. In fields of food safety and public health, Wessells et al [6] uses survey data and shows consumers' perceptions of seafood safety are influenced by their past experiences. Further, the perceptions influence the anticipated changes in consumption under different hypothetical information concerning seafood. Lin et al [3] finds in field that search for fat and cholesterol information on food labels is less likely among individuals who consume more of these nutrients and thus supports the selective information avoidance tendency that has not been justified in marketing literature.

Few studies to date have examined the conditions under which dissonance will and will not work. In our experimental setting, we differentiate consumers' responses based on their familiarities to the food they are dealing with and identify the condition under which dissonance will occur. This will offer some explanations for why some certain consumers are less responsive to public information and help to strategically design more effective policies for food safety issues. Moreover, most studies in the marketing field adopt the free-choice paradigm and argue it is less possible to testify forced compliance paradigm since consumers would not comply with requests of buying sub-optimal goods whenever the best alternative is available. However, in food consumption situation, we could manipulate this by assigning participants to some certain food, induce dissonance and investigate subsequent behaviours later on.

3. Experimental Methodology

We designed a between subject experiment to test our hypotheses. All of the 54 participants are from an undergraduate course Consumer Behavior at Cornell University. We randomly assigned students into 2 groups and gave identical instruction to both groups, asking them to eat only ONE piece of the pre-cut equal-sized meat presented in the front of the classroom. The only difference was that we assigned one group to eat beef sausage and the other one to eat smoked salmon. For simplicity, let us call the group that was assigned to eat beef sausage "the beef group" and the group that ate smoked salmon "the salmon group" in later context.

When the participants finished eating, they were asked to fill out a survey. The survey, identical for both groups, consisted of 3 sections with 4 questions in each section. In section 1, question 1 and 2 asked about their risk assessment of eating beef and salmon on a scale of 0-100, with 0 being no risk at all and 100 being extreme risk (i.e. In general, what do you think is the percentage that people get sick from eating beef sausage?). Question 3 and 4 asked about their most willingness to pay (WTP) in dollar for a 14 oz (396 g) packed beef sausage and a 4 oz (113 g) packed smoked salmon. Different scales were given here because of the difference in unit price of the two foods. This part of questions served as initial judgment for each individual and would be used to compare with the counterparts in section2 and 3.

Section 2 had the same questions as in section 1. The only difference was that in section 2, we offered 2 pieces of information regarding the food-borne risk of eating beef and salmon (i.e. the percentage of people in the US that get sick from eating the food, the potential bacteria, the related symptoms, sickness and the resulting consequences). The information part was sealed in a folded area so the participant would not see it until they finished section 1 and proceeded to section 2.

Section 3 was also in the folded area separated from section 1. The 2 pieces of information regarding food-borne risk of eating each food were further intensified, i.e. Beef sausage/ smoked salmon of brand X/Y with series NO. XXX/YYY is recalled by USDA on mm/dd/2009. The dates for the recall were given pretty close to the time of the experiment. With the information, the participants were again asked about the risk assessment of eating each food. However, the last two questions were replaced by two new ones. The first one was "If the recalled food is just what you ate, will you stop eating the remaining ones immediately?" The second was "If the recalled food is the one you had at home but not yet begun to eat, will you stop eating it immediately?" Both answers were based on a 0-100 scale, with 0 being no stop at all and 100 being stop eating immediately.

4. Experimental Results

50 out of 54 students actually participated in the experiment by eating the food and filled out the survey and the remaining 4 refused to eat meat and indicated in their survey that they are vegetarians. In each survey, before participants answered the questions, they were asked to circle the food they ate in the experiment as manipulation check. 5 out of 25 in the salmon group and 6 out of 25 in the beef group failed to response. We further checked the impact of exposure to information on risk assessment. Results showed risk assessments significantly increased after each information setting.

4.1 Cognitive Dissonance

Cognitive dissonance was identified among people who ate beef (treatment) as oppose to people who did not (control). Initially, when asked about risk assessment of eating beef, responses were not significantly different between groups (16.16 vs. 15.91, F=0.00; P=0.95). After they were given some evidence regarding the potential risk of eating beef, people who ate beef reported a lower estimate of risk (mean=18.73) than those who didn't (mean=20), although the difference is not statistically significant (F=0.36; P=0.554). When the risk information got intensified, the difference in risk estimate was even enlarged (24.96 vs. 33.41, F=1.62; P=0.210). This changing trend was consistent with cognitive dissonance. Participants were less willing to admit the potential risk regarding the food they ate. The more dissonance they felt, the larger difference in the risk estimates between groups. Table-1 shows the regression results in column 1, 5 and 9. Constant terms represent the mean level of the risk assessment. And the estimators for treatment suggest the mean difference between two groups. As one can see, both the absolute value and the significant level of the mean difference increase with the intensity of the information. Generally, people reported a lower risk assessment after they ate beef.

The same response of cognitive dissonance was also found in the willingness to pay (WTP) for beef. As we mentioned before, WTP could perform as a way to justify individual's previous behaviour. In this experiment, when subjects ate beef and then realized the potential risk, they bid a higher price for beef so as to rationalize their

previous eating behaviour. By bidding a higher price, they convinced themselves that what they ate was of high quality and of low risk and hence add more consonance to their cognitions.

Table-1: Risk Assessment and WTP in Different Information Settings

	reg-1	reg-2	reg-3	reg-4	reg-5	reg-6	reg-7	reg-8
	Initially				After Mild Information			
	Risk Assessment		WTP		Risk Assessment		WTP	
VAR	beef	salmon	beef	salmon	beef	salmon	beef	salmon
Treatment	0.251	-1.04	-1.666*	-3.246***	-2.727	-5.48	-1.602*	-3.700***
	(4.01)	(5.25)	(0.89)	(1.02)	(4.57)	(4.53)	(0.94)	(1.03)
Constant	15.91***	18.64***	6.369***	7.987***	20.73***	22.72***	6.295***	8.347***
	(2.93)	(3.71)	(0.64)	(0.71)	(3.33)	(3.20)	(0.68)	(0.72)
Obs	47	50	47	49	47	50	46	49
R^2	0.0001	0.001	0.072	0.179	0.008	0.03	0.061	0.217

Table-1 (cont.): Risk Assessment and WTP in Different Information Settings

	reg-9	reg-10	reg-11	reg-12
	Under Recall Information			
	Risk Assessment		Likelihood to Stop	
VAR	beef	salmon	If Eat	If Not
Treatment	-8.451	-9.555	-3.538	-7.45
	(6.64)	(6.87)	(8.74)	(8.51)
Constant	33.41***	35.68***	83.08***	84.20***
	(4.80)	(4.81)	(6.12)	(5.95)
Obs	46	49	49	49
R^2	0.035	0.04	0.003	0.016

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Since in common knowledge, beef is always less expensive than salmon in absolute amount, we took the ratio of the bids for beef and salmon in each of the group. Cognitive dissonance suggests that when people ate beef, they tend to bid a higher price for beef relative to salmon, so the ratio will be closer to 1, or even higher than 1, as oppose to people who did not eat beef, the ratio of the bids (WTP for beef vs. WTP for salmon) will be much less than 1. The results of initial bids (1.245 vs. 0.923, F=1.71; P=0.198) and the post information bid (1.248 vs. 0.879, F=2.20; P=0.145) supported the theory.

4.2 Confirmatory Bias

Confirmatory bias refers to the behaviour of intentionally neglecting conflicting information or discomforting evidence. This is a resulting psychological response from cognitive dissonance. In terms of our result, confirmation bias was identified in three ways.

First, the increase in risk assessment of beef due to negative information is smaller in the beef group than that of salmon group, implying a less willingness to accept the discomfort truth (1.84 vs. 4.84, F=0.9; P=0.347).

Second, due to the emotional drive to reduce dissonance, the individuals who ate the beef tended to have a smaller decrease in their biddings (-0.01 vs. -0.09, F=0.18; P=0.671). Table-2 captures the changes of risk assessment and WTP. While people increased their risk assessment after being exposed to information (significant constant terms), the WTP didn't change accordingly. This implies a tendency of justifying the previous eating behaviours by still biding high for the eaten food.

Table-2: Changes of Risk Assessment and WTP

	regression-1	regression-2	regression-3	regression-4	regression-5	regressi
VARIABLES	dinfo_ra_beef	dinfo_ra_salmon	dinfo_wtp_beef	dinfo_wtp_salmon	drec_ra_beef	drec_ra_s
Treatment	-2.978	-4.44	0.0805	-0.454	-8.167	-8.0
	(3.13)	(2.92)	(0.19)	(0.32)	(5.53)	(6.7
Constant	4.818**	4.080*	-0.0909	0.36	17.50***	17.04*
	(2.28)	(2.06)	(0.14)	(0.22)	(4.00)	(4.7
Observations	47	50	46	49	46	49
R-squared	0.02	0.046	0.004	0.042	0.047	0.02

Standard errors in parenthesis

*** p<0.01, ** p<0.05, * p<0.1

Third, a positive relationship between risk assessment and WTP should also suggest confirmation bias. Rationally, people should pay less for the good if they perceive higher risk. However, after the subjects ate the potentially risky food, the relationship came to be positive, since the higher risk they perceived, the stronger the dissonance they felt and thus, the higher the tendency to justify behaviour by bidding a higher price. Table-3 demonstrates this result.

All of the above evidence supported confirmatory bias, which mitigated the effect of information regarding food safety. In general, the mitigation attenuates the effectiveness of the information even when the information is true, making subjects being less responsive.

4.3 Sticky Behaviour

An individual with cognitive dissonance would tend to reduce his discomfort feeling either by neglecting conflicting information or by justifying what he did before. All these self-compliance responses would make the individual being less sensitive to the changing situation, thus, less likely to adjust the future behaviour even when it would be to his benefit to do so.

In the result, we compared the likelihood that participants stop eating the recalled food (beef) between groups. When people ate the food before, it is less likely for them to stop eating immediately than those who did not eat the food at all (79.54 vs. 84.20, F=0.16; P=0.687). Justification of previous behaviour due to cognitive dissonance made people stick to whatever they did, even though that might not be right any more.

In Table-1, regression 11 and 12 tell us the self-reported tendency to stop eating the recalled food. Regression 11 measures the case when people ate the recalled food before, while regression 12 measures the case when people had the recalled food at hand but had not yet eaten it. In general, subjects in beef group always reported lower possibility to stop (estimators for treatment), suggesting a higher magnitude of dissonance feeling and behavioural bias. Further comparing the two columns, we can find that people on average reported lower

possibility to stop (i.e. constant terms) when they ate the food before (regression 11) than when they did not eat (regression12), implying sticky behaviour. Risk assessment doesn't guide people's decision about behaviour changing too much. Instead, previous behaviour has a larger impact.

Table-3: Pool Regression of WTP on Risk Assessment

	regression-1	regression-2	regression-3	regression-4
VARIABLES	intitial_wtp_beef	intitial_wtp_salmon	info_wtp_beef	info_wtp_salmon
Treatment (beef=1)	-1.666*	-3.220***	-1.474	-3.679***
	(0.89)	(1.02)	(0.94)	(1.05)
int_ra_beef	0.0579*			
	(0.03)			
int_ra_salmon		0.0173		
		(0.03)		
info_ra_beef			0.0444	
			(0.03)	
info_ra_salmon				0.00367
				(0.03)
Constant	5.465***	7.665***	5.375***	8.264***
	(0.83)	(0.88)	(0.92)	(1.04)
Observations	46	49	46	49
R-squared	0.134	0.186	0.107	0.217

Standard errors in parenthesis

*** p<0.01, ** p<0.05, * p<0.1

4.4 Sensitivity due to Unfamiliarity

What we still need to note is that cognitive dissonance and its subsequent psychological bias do not emerge unconditionally. In this experiment, the existence of cognitive dissonance highly depended on participants' familiarity with the food they were dealing with. With the common food that is easily seen almost everywhere every day, like beef sausage, people experienced cognitive dissonance as we stated in the previous part. However, when referring to some less familiar food, people were still sensitive enough to the related information and reacted in a normal and rational way. This was the case with smoked salmon, as a relatively more exotic food.

First, people were very sensitive to risk when they ate exotic food with which they were relatively less familiar. This was opposite to what we found in the beef case. In the beef case, when people ate beef, they tended to believe there was less risk. However, with smoked salmon, since people had less knowledge about it and perceived it as some uncommon food, those who ate it became more sensitive and tended to believe themselves being involved into some potential risk. In contrast, those people who didn't eat smoked salmon (subjects in beef group) thought the risk was less salient since neither did they eat nor even saw the smoked salmon presented in front of their eyes.

Initially, as soon as people ate smoked salmon, they reported a slightly higher risk of eating salmon (18.64 vs. 17.60, F=0.04; P=0.844). When given some relevant risk information, those who ate salmon raised their risk perception immediately; while those who didn't eat even lower the perception a little bit, since their caution about this unfamiliar food remained not triggered. This yielded a larger difference in risk assessment (22.72 vs. 17.24, F=1.47; P=0.232). When the risk information was intensified, those who ate the salmon increased their risk

assessment dramatically and those who didn't eat only reported a mild increase, resulting an even larger gap (35.68 vs. 26.13, F=1.94; P=0.171). Regression 2, 6 and 10 in Table-1 also show this changing trend.

Interestingly, even though people were sensitive to potential risk and relevant information, they still rationalized their eating behaviour by bidding a higher price when they ate it (both initially and after being exposed to risk information) than when they did not (7.99 vs. 4.74, F=10.24, P=0.003; 8.35 vs. 4.65; F=13.03; P=0.000). These higher bids were regarded as a justification (or self-compliance) for eating something that was potentially risky.

Even though people bid high for the unfamiliar food they ate, when it turned to the case that the food was under recall, they were more likely to switch their behaviour. The caution due to unfamiliarity prevented the "sticky behaviour" from happening to some extent. When people ate the exotic food under recall, they were more likely to stop eating (83.08 vs. 76.75, F=0.50; P=0.483).

5. Discussion

Except for the results presented above, there are a few points that need to be further discussed:

First, participants' responses were subject to some anchoring or reference group effect. Take WTP as example, when asked to bid for the most willingness to pay for beef and salmon, the bids in beef group were uniformly lower than those in salmon group. This suggests that participants tend to use the food at hand as reference point to make bids. Since market unit price for smoked salmon is much higher than beef sausage, in our experiment, participants presented with salmon bid higher prices for both salmon and beef than those in beef group. This limited us to identify cognitive dissonance and justification behaviour only by taking the ratio of both bids in the same group (as discussed in 4.1) and check for the relative bids, rather than using the absolute value of bids directly.

Second, sensitivity effect is another concern for the results. As mentioned in the previous section (section 4.4), since smoked salmon is a relatively unfamiliar food for most people, a natural tendency is to enjoy the food, but with particular caution. In this sense, the unfamiliarity triggered a sensitivity effect to the participants in the salmon group and made them being more responsive to the testing information. Actually, results showed that absolute changes in both WTP and risk assessment in salmon group due to exposure to information were always higher than those of beef group. Because of this, we could only say people in salmon group experience more sensitivity effect relative to cognitive dissonance, rather than merely denying the existence of this psychological bias. Similarly, this sensitivity effect would also potentially inflate the possibility to identify cognitive dissonance in beef group when we used salmon group as a benchmark.

A few amendments to the experiments could possibly address the above problems. Adding new control group would be the first choice. We could either use a group of people who do not eat any food but fill out the same survey as the benchmark; or assign a group of people to eat some other similar food, say using turkey sausage to compare with beef sausage and using another exotic food to compare with smoked salmon; or both.

Further improvement would involve controlling for demographic and relevant background variables. Hunger, educational level, format of the information and initial familiarity and preference of the food could all be factors that influence the results. Moreover, external validity also needs to be addressed when one considers the difference between student lab participants and real household decision makers. Finally, in terms of the experimental design, we also expect to see the different responses between cases where people are assigned to eat some certain food and where they are free to choose to eat any food from a menu list.

6. Conclusion

This study aimed to identify cognitive dissonance and its subsequent responses among individual eating behaviours. It has long been argued that information is relatively ineffective in changing consumers' behaviours. And this study offered a reason why typical consumers are always less responsive to some certain information.

In our experiment, participants who ate beef sausage, as a common food, tended to experience cognitive dissonance. When they were later exposed to risk information regarding beef, a self-compliance tendency mitigated the effect of information and further leaded people to confirmation bias. As food recall notice was posted, the influenced information processing procedure and the previous justification behaviour even caused the subjects to "stick" to their previous behaviours although it was to their benefits to change. In contrast, with relatively unfamiliar food, such as smoked salmon, people were still cautious enough to overcome cognitive dissonance. However, being super sensitive also made these people susceptible to external signals, even when they might not be true.

In summary, the impact of information on individual behaviours depends on consumers' initial perception and the familiarity of the targeting subject they are dealing with. Information providers, either public organizations or private sectors, should differentiate case by case when offering messages to the public. While the effectiveness of some crucial food safety information could be neglected due to cognitive dissonance, other less relevant information could even destroy the emerging market of some newly developed products because of the super sensitivity among consumers.

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