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Are Grocery Shoppers of Households with Weight-Concerned Members Willing to Pay More for Nutritional Information on Food?

Tao Ran[a], Chengyan Yue[Φb] and Alicia Rihn[c]

[a] *Research Associate, Department of Applied Economics and Department of Horticultural Science, University of Minnesota, 309Alderman Hall, 1994 Buford Avenue, St. Paul, Minnesota, 55108, USA*

[b] *Associate Professor, Department of Applied Economics and Department of Horticultural Science, University of Minnesota, 316E Ruttan Hall, 1994 Buford Avenue, St. Paul, Minnesota, 55108, USA*
Phone: 612-626-3974 Email: yuechy@umn.edu

[c] *Postdoctoral Research Associate, Food and Resource Economics Department, University of Florida, Mid-Florida Research and Education Center, UF/IFAS Extension, Gainesville, Florida, 32611, USA*

Abstract

This study used eye-tracking technology and an experimental auction to unveil shoppers' visual usage of nutrition information and willingness to pay (WTP) for food. Particular attention was given to primary grocery shoppers of households having weight-concerned members (shoppers included). The results showed that shoppers of household with weight-concerned members were more attentive to nutritional label information. Furthermore, their WTP for roasted peanuts decreased as their visual attention to the fat and sugar content increased. In addition, they were willing to pay more for salad mix compared to other shoppers. Health claims did not have an effect on shoppers' WTP.

Keywords: Experimental auction; eye-tracking technology; nutrition information; WTP

ΦCorresponding author

Introduction

Americans are increasingly concerned about weight gain. According to the National Health and Nutrition Examination Survey, at least two-thirds of U.S. adults are overweight or obese (Flegal et al. 2012)**.** Major contributors to being overweight or obesity are improper dietary intake and physical inactivity (Bonsmann, Storcksdieck, and Wills 2012). Therefore, health professionals have been taking steps to aid consumers in making healthier diet choices.

Nutritional information on food packages assists consumers in making healthier food choices (Drichoutis, Lazaridis and Nayga 2009). Evidence has shown that increased use of food labels is associated with improved nutrient intake and healthier dietary patterns (Kreuter et al. 1997, Neuhouser, Kristal, and Patterson 1999, Satia, Galanko, and Neuhouser 2005, Lin, Lee, and Yen 2004, Kim, Nayga, and Capps 2001). Additionally, most consumers, especially overweight ones, use nutrition panels when purchasing food items (Sliverglade 1997; Bredbenner, Wong, and Cottee 2000; Blitstein and Evans 2006; Drichoutis et al. 2008; Chen et al. 2012). However, conflicting research (Higginson et al. 2002a, 2002b; Mhurchu and Gorton 2007; Bonsmann, Storcksdieck, and Wills 2012) implies that consumers do not view nutritional labels as frequently as reported. Consequently, more studies are needed to assess consumers' actual nutrition information viewing patterns.

In recent years, eye tracking technology has been adopted by researchers to detect consumers' visual usage of nutritional information on food packages. According to Russo (2011), eye tracking technology measures consumers' behavior that other more overt techniques cannot obtain (Karn, Ellis, and Juliano 2000). In their "eye-mind" hypothesis, Just and Carpenter (1976) argue that the cognitive processing in an individual's mind is related to the location where his/her eyes are gazing. One measure of visual attention is eye fixations. Piqueras-Fiszman et al. (2013) define eye fixations as when eyes are relatively immobile. Generally, eye fixations have been characterized by frequency (fixation counts) and duration (time spent on fixation points as well as saccades-when eyes are moving between fixation points). However, research has shown that information acquisition and processing occur primarily during fixations (Pieters, Warlop, and Wedel 2002; Reutskaja et al. 2011), but not during saccades (Rayner 1998). Therefore, fixation counts are often used in eye tracking research to indicate visual attention and processing. It is argued that greater fixation counts occur when consumers are processing information (Velichkovsky et al. 2002; Jacob and Karn 2003) and/or if the information is more important to them (Pieters and Warlop 1999; Wedel and Pieters 2000; Wedel and Pieters 2008; Seiler, Madhavan, and Liechty 2011). Using eye tracking software, Reutskaja, Camerer and Rangel (2011) have found that visual attention plays an important role in choice. Studies using eye tracking technology for food choices include Visschers, Hess and Siegrist (2010), Graham and Jeffery (2011), and Piqueras-Fiszman et al. (2013), among others.

In terms of WTP, studies have shown that consumers are willing to pay more for nutritional information on food products. Loureiro, Gracis, and Nayga (2006) determined shoppers were willing to pay almost 11 percent more to get cookies with nutritional information. Drichoutis, Lazaridis and Nayga (2009) found individuals were willing to pay 5.9 percent more for cookies with nutrition labels. In Ginon et al. (2009) consumers were willing to pay 12% more for a baguette with the label "source of fiber". Hellyer, Fraser, and Haddock-Fraser (2012) also stated

that health claims along with nutritional information positively influence individuals' WTP. Additionally, U.S. consumers were willing to pay more for bison meat after being informed of its nutritional contents (Yang and Woods 2013). In spite of the previous findings, many studies base their arguments on consumers' stated preferences. Furthermore, few studies provided evidence on the effects of specific nutritional information on consumers' WTP.

Recently, experimental auctions have been used to create incentives for people to reveal their "true" preferences (Vickery 1961). In a typical incentive compatible experimental auction, subjects bid to obtain one or more goods. The highest bidder(s) win the auction and pay a price that is determined exogenously from the individual(s)' bid(s). Preferences for a product can then be determined by comparing bids for that specific good to bids for a pre-existing substitute or by directly eliciting bids to exchange a pre-existing substitute for that good (Lusk, Alexander, and Rousu 2007). Recent studies that use experimental auctions to unveil consumers' willingness to pay for food items include: Poole and Martinez-Carrasco (2007) for citrus, Yue, Alfnes and Jensen (2009) for apples, Colson, Huffman and Rousu (2011) for genetically modified foods, and Wang and McCluskey (2010) for wine.

This study used eye tracking technology and an experimental auction[1] to reveal grocery shoppers' actual viewing of health claims and the nutritional label information as well as their true WTP for food items. Participants consisted of primary grocery shoppers from households in Minnesota. Particular attention was given to those from households with weight-concerned members (shoppers included). Salad mix and roasted peanuts were the food items included in the experiment. Research questions include: (1) Does primary grocery shoppers' visual attention to nutrition information have any effect on their WTP for different food items? And, (2) do primary grocery shoppers from households with weight-concerned members (shoppers included) have different viewing patterns and WTP values for nutritional information when compared to others?

Experiment Design

Experiment Set-Up

A three-step experiment was conducted to collect the data. In the first step, participants were familiarized with the eye tracking device and experimental auction procedure. Next, participants completed the eye tracking and experimental auction simultaneously. Lastly, participants were asked to complete a survey.

Salad mix (5 oz.) and roasted peanuts[2] (12 oz.) were used in the experiment. These two products represented commonly available food items with different levels of processing and nutritional

[1] A Becker-DeGroot Marschak (BDM) experimental auction was utilized in this study because participants completed the auctions individually instead of participating as a group (Noussair Kristal, and Patterson 2004; Lusk and Shogren 2007). Individual participation was required to capture participants' eye movements. In a BDM experimental auction, the subject submits a bid. The bid is compared to a price (termed 'binding price') determined by a random number with uniform distribution. If the bid is greater than the binding price, the subject pays the binding price and receives the auctioned item. If the bid is lower than the binding price, the subject pays nothing and receives nothing.

[2] The product name was "Peanuts", but shoppers were able to see in the product image that they were roasted peanuts.

components. For example, salad mix is minimally processed and includes raw chopped up lettuce; while roasted peanuts are moderately processed. Moreover, salad mix is considered healthy and low in fat and calories, while roasted peanuts are considered less healthy due to their higher fat and sugar content. As illustrated in Table 1, each food item had similar categories for production method and origin attributes, but different health claims[3].

Table 1. Products and attribute combinations

Product	Production Method	Origin	Health Claim
Salad mix	All natural	Product of the U.S.A.	High in fiber
	Organic	Product of Mexico*	No label
	No label	Minnesota Grown	
Roasted peanuts	All natural	Product of the U.S.A.	Low in sodium
	Organic	Product of Canada*	No label
	No label	Minnesota Grown	

Note. * The countries used for products with import country of origin labels were based on USDA import statistics indicating where the majority of that product was imported from at the time of the study, including: lettuce from Mexico, and roasted peanuts from Canada (USDA 2012).

Primary grocery shoppers in different households were recruited from Minneapolis-St. Paul and the surrounding area as participants. Primary shoppers were selected because they would take the experiment seriously. Moreover, it ensured that the experiment mimicked real shopping experience, where the primary grocery shoppers would shop for their household members. Hence, primary grocery shoppers' label usage was assumed to influence the food intake of their household members. Additionally, their usage of labels and shopping decisions were assumed to be influenced by their household members' preferences and health conditions (Chang and Nayga Jr. 2011;Vinoles, You, and Nayga 2013).

For the experiment, participants were scheduled every 30 minutes between 9am and 5pm from April 9, 2012, through April 12, 2012. The study took place in a university office where two eye tracking computers were stationed (portable Tobii X1 Light Eye Trackers were used to collect gaze data). Each participant was given a unique ID number and a bid sheet upon arrival. Then they sat in front of the eye tracking computer and were read the consent form and experimental auction instructions. The eye tracker was then calibrated to each participant using a five point system[4]. Afterwards, each participant was reimbursed $30 for their time. Eighty-nine of the 101 participants provided complete, usable information.

Data Collection

To collect fixation information for this study, areas of interest (AOI) were defined in the nutrition panel for each item. Based on the categories of nutrition information defined by the Food and Agriculture Organization, the AOI for salad were determined as: calories, serving size, fat (including total fat, saturated fat and trans fat), vitamins and minerals (including vitamin A

[3] Examples of front-of-pack images for salad mix and roasted peanuts are in Appendix A.

[4] Before an eye tracking recording was started, the user was taken through a calibration procedure. During the procedure, the eye tracking camera measured characteristics of the user's eyes which were used with an internal, physiological 3D eye model to calculate the gaze data. The five point system refers to the method used in calibration, with five points appearing on the computer screen to facilitate the calibration process.

and C, calcium and iron), sodium, protein, sugar, carbohydrate, fiber, and ingredients. The AOI for roasted peanuts were similar, plus allergy information (see Figure 1).

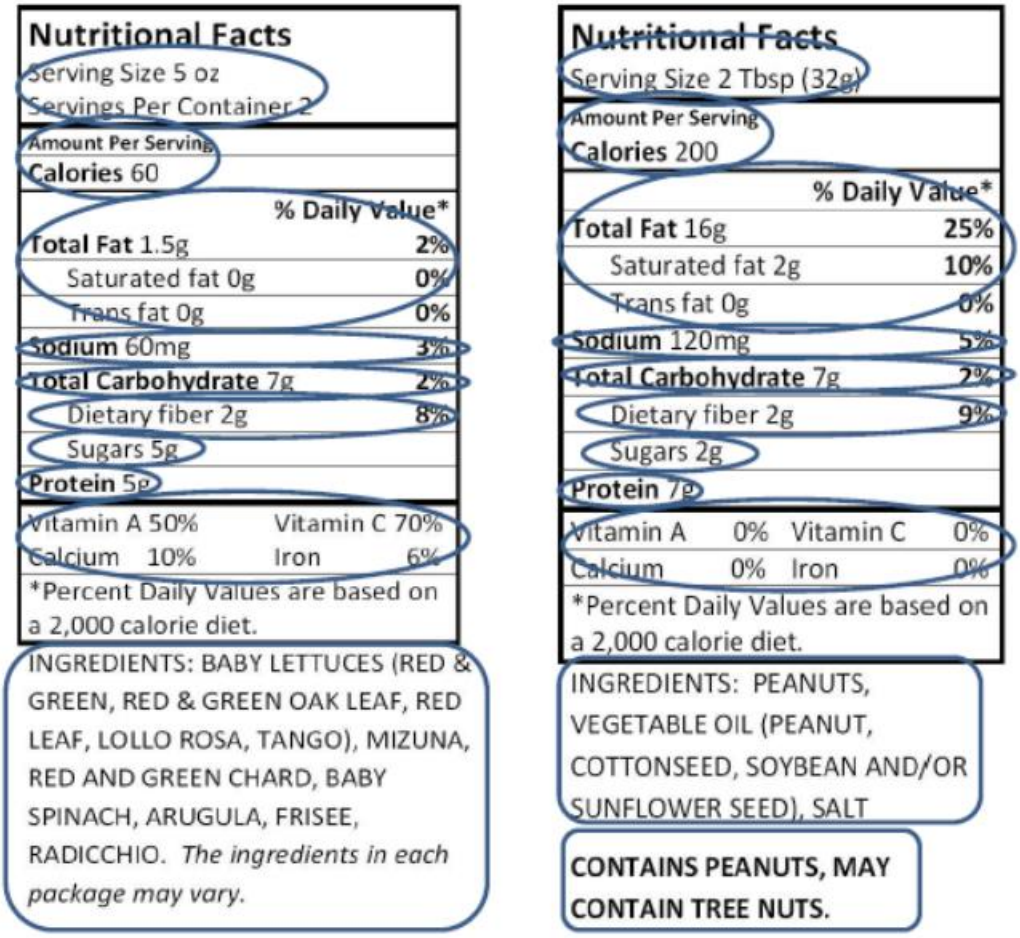


Figure 1. Examples of salad and peanut nutrition labels with areas of interest defined[5]

A mouse click moved the images forward and participants clicked through the images, which gave them adequate time to determine their WTP bids. Four random versions of the 18 images were used to prevent order effect. In addition, all versions began with an introductory slide using an image of a candy bar (as a trial version), followed by a slide asking if they wanted more information (yes or no), then a slide of the candy bar's nutrition information if the participant indicated 'yes' in the previous question, and finally a slide indicating it was time for them to write down their bid[6]. This order was repeated for each product attributes combination – front

[5]The images of the nutrition labels were enlarged on the computer screen to ensure the accuracy in capturing the eye fixations in each AOI.

[6] The purpose of the candy bar in the introduction was to familiarize participants with the technique/technology and give them ample opportunities to ask questions. Additionally, the introduction slides gave the monitor the opportunity to remind participants to wait for the prompt slide to submit their bids. As a result, the data was easier to analyze due to the participants focusing on the image instead of looking down at their bid sheets.

image, the more information question, nutrition information, and the bid prompt[7]. After the participant completed the eye tracking/auction, s/he was asked to complete the survey. While s/he completed the survey, the moderator determined if s/he won the auction by drawing the auctioned item and binding price out of a hat. The binding prices were determined in relation to prices from different stores in the study area.

Then the participants were asked to complete a survey. The survey was administered through Qualtrics Survey Software and consisted of 36 questions including background information on grocery shopping, their attitudes on product origin, production practices, nutrient content claims, and socio-demographics. One important question related to this study was whether the primary grocery shopper or anyone in his/her family had concerns about weight gain. Upon completion of the eye tracking/auction and survey, participants were given their compensation ($30 if they did not win the auction, $30 minus the binding price if they did win the auction plus the item they won) and departed.

Summary Statistics

Table 2 lists the means and standard deviations of the product attributes and socio-economic status variables. On average, all participants were willing to pay around $2.52 for a 5 oz. container of salad mix and $2.61 for a 12 oz[8]. container of roasted peanuts. Most of the households' primary grocery shoppers were approximately 50 years old with at least some college education. In addition, three-fourths of them were female and approximately half of them were married. On average, participants' households had more than two members with an average income of approximately $46,000. Seventy-five percent of them (67 participants) had weight-concerned household members (shoppers included). It is important to note that the socio-economic characteristics of the above-mentioned 67 participants were similar to those of the remaining participants.

Table 2.a Summary statistics of the product attributes

Observations	Salad Mix (5 oz.)				Roasted Peanuts (12 oz.)			
	All (651)		Weight-concerned[a] (497)		All (642)		Weight-concerned (488)	
	Mean	S.d.	Mean	S.d	Mean	S.d.	Mean	S.d.
Price bid ($)	2.52	1.27	2.6	1.28	2.61	1.48	2.7	1.58
Import	0.36	0.48	0.35	0.48	0.35	0.48	0.36	0.48
Minnesota Grown	0.29	0.45	0.29	0.45	0.36	0.48	0.35	0.48
All natural	0.36	0.48	0.35	0.48	0.35	0.48	0.36	0.48
Organic	0.29	0.45	0.29	0.45	0.29	0.45	0.29	0.45

Note. a "Weight-concerned" represents the shoppers who were concerned about their own weight or whose household member(s) had weight concerns.

[7] The eye tracker recorded raw eye movement data points every 16.7 or 8.3 millisecond (depending on whether the sampling data rate was 60Hz or 120Hz respectively). Then the raw data were processed into fixations through a fixation filter by Tobii Studio (the following link provides more details about the software: http://www.tobii.com/ Global/ Analysis/ Downloads/User_Manuals_and_Guides/Tobii_Studio2.2_UserManual.pdf).

[8] The WTP is comparable to what is found in the stores, and the number is calculated with 0 bids.

Table 2.b Summary statistics of participants' demographics

Participants	Salad mix (5 oz.)				Roasted peanuts (12 oz.)			
	All (89)		Weight-concerned (67)		All (89)		Weight-concerned (67)	
	Mean	S.d.	Mean	S.d	Mean	S.d.	Mean	S.d.
Price bid ($)	2.52	1.27	2.6	1.28	2.61	1.48	2.7	1.58
Import	0.36	0.48	0.35	0.48	0.35	0.48	0.36	0.48
Minnesota Grown	0.29	0.45	0.29	0.45	0.36	0.48	0.35	0.48
All natural	0.36	0.48	0.35	0.48	0.35	0.48	0.36	0.48
Organic	0.29	0.45	0.29	0.45	0.29	0.45	0.29	0.45
Age	49.83	14.13	49.65	13.89	49.84	13.9	49.65	13.89
Education	3.72	1.44	3.7	1.42	3.72	1.44	3.7	1.42
Gender	0.24	0.43	0.24	0.43	0.24	0.43	0.24	0.43
Marital status	0.53	0.5	0.49	0.5	0.53	0.5	0.49	0.5
Family members	2.6	1.45	2.51	1.36	2.6	1.45	2.51	1.36
Income ($10,000)	4.59	2.25	4.58	2.3	4.59	2.25	4.58	2.3

Note. a "Weight-concerned" represents the shoppers who were concerned about their own weight or whose household member(s) had weight concerns.

Shoppers from households with weight-concerned members (shoppers included) had different nutrition information viewing patterns. Table 3 lists the means and standard deviations of fixation counts for each AOI.

Table 3. Summary statistics of the fixation count variables

	Salad mix (5 oz.)					Roasted peanuts(12 oz.)				
	Weight-concerned[a] (WC) (497 obs.)		Non-WC (154 obs.)		T-test	Weight-concerned (WC) (488 obs.)		Non-WC (154 obs.)		T-test
	Mean	S.d	Mean	S.d.	P-value	Mean	S.d.	Mean	S.d.	P-value
Health claim[b]	0.63	1.42	0.65	1.14	0.42	0.74	1.74	0.81	1.25	0.31
Serving size	2.74	6.39	0.88	1.46	0.00	1.74	3.3	0.64	1.36	0.00
Calories	1.39	2.26	0.64	0.98	0.00	2.19	3.18	1.1	2.01	0.00
Fat	5.21	6.78	4.01	7.65	0.04	7.26	9.18	4.6	6	0.00
Vitamin+mineral	3.47	4.91	2.29	3.49	0.00	3.12	3.93	2.4	2.91	0.01
Sodium	1.28	1.79	1.12	1.73	0.16	1.63	2.38	1.31	1.96	0.05
Protein	1.48	2.42	0.97	1.61	0.00	1.34	2.14	0.86	1.08	0.00
Sugar	1.45	2.34	1.02	2.17	0.02	1.41	2.13	1.06	1.89	0.03
Carbohydrate	1.61	2.48	1.1	2.25	0.01	2.21	3.24	1.56	2.54	0.01
Fiber	1.62	2.47	0.81	1.4	0.00	1.99	2.74	1.32	2.16	0.00
Ingredients	14.46	19.11	13.44	13.75	0.23	7.63	9.59	6.99	6.44	0.17
Allergen						3.65	4.92	2.93	3.23	0.02

Note. a "Weight-concerned" represents the shoppers who were concerned about their own weight or whose household member(s) had weight concerns.
b Health claims included "high in fiber" for salad, "low in sodium" for roasted peanuts.

On average, shoppers from households with weight-concerned members (shoppers included) had more fixations for most of the AOI. One-tail t-tests comparing average fixation counts of shoppers of households with weight-concerned members (shoppers included) and the remaining shoppers also confirms this finding. Specifically, at a 5% significance level, shoppers from households with weight-concerned members (shoppers included) had more fixations on serving size, calories, fat content, vitamins and minerals, protein content, sugar content, carbohydrates, and fiber information for both salad mix and roasted peanuts. However, compared to other shoppers, they did not pay more visual attention to health claims.

Willingness-to-Pay Model

To analyze the influence of shoppers' viewing patterns on their WTP, a linear regression model was constructed as follows:

$$(1)\ y_t = \boldsymbol{\beta X}_{it} + \boldsymbol{\gamma Z}_{jt} + \boldsymbol{\alpha K}_{ijt} + \varepsilon_t$$

where $\boldsymbol{X}_{it}$ represents a vector with the consumer characteristics of income, gender and age; $\boldsymbol{Z}_{jt}$ indicates a vector with the product attributes of origin and production method; and $\boldsymbol{K}_{ijt}$ signifies a vector with individual and attribute-specific information such as the eye fixation counts of each shopper in each AOI. $\boldsymbol{\beta}$, $\boldsymbol{\gamma}$, and $\boldsymbol{\alpha}$ were parameter vectors related to the above-mentioned variables.

Of note, in our study, the dependent variable was the shopper's bid price for the food items. Since the dependent variable might take a zero value, a Tobit[9] model was used for the analysis. To answer research question two, a dummy variable was created, taking value one if grocery shopper indicated that s/he or any household member had weight concern, and zero otherwise. To compare the WTP of shoppers from households with weight-concerned members (shoppers included) to those without, interaction terms of fixation-counts with the dummy variable were created. Marginal effects for the explanatory variables are listed in Table 4 (See Appendix B). Interpretations are presented below based on these results.

Results

Salad Mix

A likelihood ratio test with the null hypothesis that shoppers' WTP was not influenced by their nutrition information viewing pattern was rejected with a P-value less than 0.0001. Therefore, specific nutritional information did have an effect on shoppers' WTP. A second likelihood ratio test with the null hypothesis that there was no distinction between WTP of shoppers from households with weight-concerned members (shoppers included) and others was rejected with a

[9] The assumptions of homoscedasticity and normality were tested to ensure consistency of the estimates. The assumptions only held for the salad mix model. Therefore, CLAD (censored least absolute deviations estimator) method was used to obtain the estimates for the roasted peanuts. The replication for bootstrapping in CLAD method was 5000 times. Ordinary least square (OLS) estimation could also be used for the salad mix. However, the goodness-of-fit of the Tobit model was similar to that of the OLS. Therefore, a Tobit model was chosen for the salad mix data in order to be comparable with the CLAD method for roasted peanuts.

P-value less than 0.0001. Therefore, compared to others, shoppers of households with weight-concerned members (shoppers included) did have different WTP values for specific product information.

As for the influence of their socio-economic status, generally, if the shopper's income increased, s/he was willing to pay more for salad mix. Furthermore, as the shopper's family size increased, s/he was willing to pay less for salad. One possible explanation was that salad was a common food consumed by many individuals regularly. Therefore, having a larger household implies greater consumption of salad. Given grocery shoppers' budget constraints, they preferred the unit price to be lower so that enough quantity could be purchased for the household, *ceteris paribus*. The same explanation could be applied to married individuals, since they typically have more family members (such as a spouse or children) than single individuals. Consequently, married individuals tended to buy more salad. Interestingly, if the participant was older, s/he was willing to pay less for salad. This result was consistent with findings from an earlier study (Dettmann and Dimitri 2009) on organic salad purchasing, which showed that older people (age over 50) were willing to pay less for salad.

As for product specification, shoppers in general were willing to pay 40 cents more for locally grown salad mix when compared to that from other places in the U.S., or from Mexico. This is probably due to perceptions of improved freshness, nutritional value, and the production methods' effects on the environment for local food (Martinez 2010). In addition, if salad mix was organic, participants were willing to pay approximately 64 cents more when compared to regular or all natural[10] salad mix, since organic salad is often perceived as better quality (Worthington 2001; Lairon 2010).

Shoppers from households with weight-concerned members (shoppers included) were willing to pay approximately 42 cents more than others for salad mix (5 oz.), *ceteris paribus*. Furthermore, if a shopper of the household with weight-concerned members (shoppers included) had an additional fixation on the fat content information, s/he was willing to pay approximately two cents more (14 cents less for non-weight-concerned participants), probably due to her/his awareness that salad mix is naturally low in fat. In addition, a shopper of the household with weight-concerned members (shoppers included) was willing to pay two cents less for salad mix if s/he had one additional fixation on serving size information (while other shoppers were willing to pay 32 cents more). Finally, a shopper of the household with weight-concerned members (shoppers included) was willing to pay one cent less if s/he had an additional fixation on the ingredient information (while others were willing to pay three cents more).

Surprisingly, the estimates of the remaining AOIs were not significant. This might be because salad mix was a familiar food item so that shoppers did not rely much on detailed nutrition information to make purchasing decisions, unless it was their first time reading it (Kreuter et al. 1996). Furthermore, since salad mix was minimally processed and healthy, being locally and organically grown provided sufficient incentives to shoppers to pay more.

[10]Interestingly, for both products, shoppers in general gave more credit to organic food. This indicates that although they were not informed of the difference between organic and all natural production methods during the experiment, they themselves did have prior knowledge or perceptions of distinct differences between the two.

Roasted Peanuts

Pseudo R^2 was used to compare the full model and reduced models since the CLAD model was adopted to analyze the effects for roasted peanuts. When comparing the Pseudo R^2 values of the full and reduced models, results indicate that nutrition information did influence consumers' WTP. Specifically, shoppers from households with weight-concerned members (shoppers included) were different from others in their WTP values, similar to what was found in the salad mix model.

As for socio-economic factors, in general, shoppers from households with more members were willing to pay seven cents more for roasted peanuts; while older, more educated, or married individuals were willing to pay less. This may be due to roasted peanuts being relatively less healthy than other food options and older, better educated individuals are more health conscious (Girois et al. 2001). Similar to salad mix, shoppers generally were willing to pay 17 cents more for locally grown roasted peanuts than for non-local options, and they were willing to pay 29 cents more for organic peanuts than for regular or all natural ones.

Compared to salad mix, detailed nutrition information had more influence on shoppers' WTP for roasted peanuts. Not surprisingly, both shoppers of households with weight-concerned members (shoppers included) and others were willing to pay six cents less after having an additional fixation on the product's fat content information. In addition, both types of consumers were willing to pay seven cents less after viewing vitamin and mineral information, probably because the vitamin and mineral levels were all zero for roasted peanuts. However, all shoppers were willing to pay 24 cents more if they fixated on the sodium content information. This result might be because sodium level reflects salt content (which drastically influences flavor) and many individuals preferred savory roasted peanuts.

Shoppers of households with weight-concerned members (shoppers included) were different from others in their WTP for sugar, fiber and protein content information. First of all, they were willing to pay 12 cents less if they had an additional fixation on sugar content information (18 cents more for others), likely due to concerns about excessive sugar intake. Further, they were willing to pay 12 cents more if they had an additional fixation on fiber content information (16 cents less for others). Interestingly, shoppers of households with weight-concerned members (shoppers included) were willing to pay one cent less if they fixated on the protein information (50 cents less for others). A possible explanation is that better protein sources exist when compared to roasted peanuts. Lastly, shoppers of households with weight-concerned members (shoppers included) were willing to pay 12 cents more if they had an additional fixation on the allergy information.

Summary and Discussion

The research results of this study contributed to a better understanding of households' primary grocery shoppers' nutrition information viewing patterns and the effects of nutrition information on their WTP. Particular attention was given to shoppers of households with weight-concerned members (shoppers included). The results showed that for both salad mix and roasted peanuts, shoppers of households with weight-concerned members (shoppers included) gave more visual

attention to most of the nutritional contents information than other shoppers. Furthermore, detailed nutritional information influenced the WTP of shoppers of households with weight-concerned members (shoppers included) differently compared to other shoppers.

In general, shoppers were willing to pay more for organically produced or locally grown/processed products, including minimally processed salad mix and moderately processed roasted peanuts. Additionally, their WTP for salad mix was not greatly influenced by detailed nutrition information or health claims. This might be because of the healthy nature of salad mix or consumers' general familiarity with salad mix. In comparison, detailed nutrition information had more influence on shoppers' WTP for roasted peanuts. Besides production method and product origin, information such as fat, vitamin and mineral content, and sodium all contributed to their WTP. This may be because roasted peanuts are considered less healthy and more processed than salad mix. Consequently, more information (with regards to nutritional details) is needed for shoppers to make their purchasing decisions. Interestingly, neither health claim (i.e. 'high in fiber' for salad mix and 'low in sodium' for roasted peanuts) had any effect on shoppers' WTP. This might be because of the ineffective design/wording of the health claims, or the ineffectiveness of health claims in tackling risk factors of chronic diseases (Drichoutis, Nayga and Lazaridis 2009).

Shoppers from households with weight-concerned members (shoppers included) were different from others in several aspects. First, they were willing to pay more for salad mix, regardless of the product characteristics. This may be due to the healthy nature of salad mix. Furthermore, they were more responsive to detailed nutritional information of roasted peanuts. For instance, their WTP was positively related to their visual attention to the fiber content, but negatively related to viewing sugar content information. To some extent, this reflects that Shoppers from households with weight-concerned members (shoppers included) appreciated healthy food attributes more than others. On the other hand, they gave less credit to food components contributing to weight gain.

The research results from this study can contribute to more effective marketing of food products. First, detailed nutrition information influences shoppers' purchasing decisions, especially when buying more processed food items (such as roasted peanuts). Therefore, detailed nutritional information (particularly on more processed food) should be easily accessible to shoppers[11]. As health concerns related to weight continue to rise, providing easy to grasp information is likely to become increasingly important. Second, a healthy food section can be set up in grocery stores and supermarkets to assist grocery shoppers with weight concerns or having weight-concerned household members in making easier purchasing decisions. For instance, products in this section could have labels that are easy to visually recognize which communicate weight-related information such as fat content, sugar content, serving size, etc. Similar ideas are being explored in other countries (i.e. the stoplight system in the UK (Sacks, Rayner and Swinburn 2009). Third, since shoppers are not necessarily willing to pay more for all natural food when compared to regular food items, it might be wise not to label a food item as 'all natural' and charge higher prices. Lastly, it is important to note that this study used a sample from the Minneapolis - St.

[11]Recently, the Food and Drug Administration proposed a new nutrition label, emphasizing serving size, calories, as well as fat, cholesterol, sodium, carbohydrates and protein content information; and simplifying the label to make it more user-friendly. This may help in effectively presenting the nutrition information on various food packages.

Paul area. Since the sample demographics were comparable to the demographics of the two cities, the results of this study can be generalized to these two cities and other similar areas. Future studies could explore the impact of visual attention to nutritional information on grocery shoppers' WTP in other regions to test the robustness of the results.

References

Blitstein, J. L., and W. D. Evans. 2006. "Use of nutrition facts panels among adults who make household food purchasing decisions." *Journal of nutrition education and behavior*, 38(6): 360-364.

Byrd-Bredbenner, C., A. Wong, and P. Cottee. 2000. "Consumer understanding of US and EU nutrition labels." *British Food Journal* 102(8):615-629.

Carpenter, J., and J. Bithell. 2000. "Bootstrap confidence intervals: when, which, what? A practical guide for medical statisticians." *Statistics in Medicine* 19(9):1141-1164.

Chang, H. H., and R. M. Nayga. 2011. "Mother's nutritional label use and children's body weight." *Food Policy* 36(2):171-178.

Chen, X., L. Jahns, J. Gittelsohn, and Y. Wang. 2012. "Who is missing the message? Targeting strategies to increase food label use among US adults." *Public Health Nutrition* 15(5):760-772.

Colson, G. J., W. E. Huffman and M. C. Rousu. 2011. "Improving the nutrient content of food through genetic modification: Evidence from experimental auctions on consumer acceptance." *Journal of Agricultural and Resource Economics* 36(2):343-364.

Dettmann, R. L., and C. Dimitri. 2009. "Who's buying organic vegetables? Demographic characteristics of US consumers." *Journal of Food Products Marketing* 16(1):79-91.

Drichoutis, A. C., P. Lazaridis, R. M. Nayga Jr, M. Kapsokefalou, and G. Chryssochoidis. 2008. "A theoretical and empirical investigation of nutritional label use." *The European Journal of Health Economics* 9(3):293-304.

Drichoutis, A. C., R. M. Nayga Jr, and P. Lazaridis. 2009. "Can nutritional label use influence body weight outcomes?" *Kyklos* 62(4):500-525.

Piqueras-Fiszman, B., C. Velasco, A. Salgado-Montejo, and C. Spence. 2013. "Using combined eye tracking and word association in order to assess novel packaging solutions: A case study involving jam jars." *Food Quality and Preference* 28(1):328-338.

Flegal, K. M., M. D. Carroll, B. K. Kit, and C. L. Ogden. 2012. "Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010." *JAMA*, 307(5):491-497.

Genannt Bonsmann, S. S., and J. M. Wills. 2012. "Nutrition labeling to prevent obesity: reviewing the evidence from Europe." *Current Obesity Reports* 1(3):134-140.

Graham, D. J., and R. W. Jeffery. 2012. "Predictors of nutrition label viewing during food purchase decision making: An eye tracking investigation." *Public Health Nutrition* 15(2):189-197.

Ginon, E., Y. Lohéac, C. Martin, P. Combris, and S. Issanchou. 2009. "Effect of fibre information on consumer willingness to pay for French baguettes." *Food Quality and Preference* 20(5):343-352.

Girois, S. B., S. K. Kumanyika, A. Morabia, and E. Mauger. 2001. "A comparison of knowledge and attitudes about diet and health among 35-to 75-year-old adults in the United States and Geneva, Switzerland." *American Journal of Public Health* 91(3):418.

Greene, W. H. 2003. *Econometric Analysis*. India: Pearson Education.

Grunert, K. G., and J. M. Wills. 2007. "A review of European research on consumer response to nutrition information on food labels." *Journal of Public Health* 15(5):385-399.

Hellyer, N. E., I. Fraser, and J. Haddock-Fraser. 2012. "Food choice, health information and functional ingredients: An experimental auction employing bread." *Food Policy* 37(3):232-245.

Higginson, C. S., M. J. Rayner, S. Draper, and T. R. Kirk. 2002a. "The nutrition label-which information is looked at?" *Nutrition and Food Science* 32(3):92-99.

Higginson, C. S., T. R. Kirk, M. J. Rayner, and S. Draper. 2002b. "How do consumers use nutrition label information?" *Nutrition and Food Science* 32(4):145-152.

Jacob, R. J., and K. S. Karn. 2003. "Eye tracking in human-computer interaction and usability research: Ready to deliver the promises." *Mind* 2(3):4.

Just, M. A., & P. A. Carpenter. 1976. "Eye fixations and cognitive processes." *Cognitive Psychology* 8(4):441-480.

Karn, K. S., S. Ellis, and C. Juliano. 1999, May. "The hunt for usability: tracking eye movements." In *CHI'99 Extended Abstracts on Human Factors in Computing Systems*, ACM. pp:173-173.

Kiesel, K., J. J. McCluskey, and S. B. Villas-Boas. 2011. "Nutritional labeling and consumer choices." *Annual Review of Resource Economics* 3(1):141-158.

Kim, S. Y., R. M. Nayga Jr, and O. Capps Jr. 2001. "Food label use, self-selectivity, and diet quality." *The Journal of Consumer Affairs* 35(2):346-363.

Kreuter, M. W., L. K. Brennan, D. P. Scharff, and S. N. Lukwago. 1996. "Do nutrition label readers eat healthier diets? Behavioral correlates of adults' use of food labels." *American Journal of Preventive Medicine* 13(4):277-283.

Lairon, D. 2010. "Nutritional quality and safety of organic food. A review." *Agronomy for Sustainable Development* 30(1):33-41.

Lewis, J. E., K. L. Arheart, W. G. LeBlanc, L. E. Fleming, D. J. Lee, E. P. Davila, A. J. Cabán-Martinez, N. A. Dietz, K. E. McCollister, F. C. Bandiera, and J. D. Clark Jr. 2009. "Food label use and awareness of nutritional information and recommendations among persons with chronic disease." *The American Journal of Clinical Nutrition* 90(5):1351-1357.

Lin, C. T. J., J. Y. Lee, , and S. T. Yen. 2004. "Do dietary intakes affect search for nutrient information on food labels?" *Social Science & Medicine* 59(9):1955-1967.

Loureiro, M. L., A. Gracia, and R. M. Nayga. 2006. "Do consumers value nutritional labels?" *European Review of Agricultural Economics* 33(2):249-268.

Loureiro, M. L., S. T. Yen, and R. M. Nayga Jr. 2012. "The effects of nutritional labels on obesity." *Agricultural Economics* 43(3):333-342.

Lusk, J. L., and J. F. Shogren. 2007. *Experimental Auctions: Methods and Applications in Economic and Marketing Research*. New York: Cambridge University Press.

Lusk, J. L., C. Alexander, and M. C. Rousu. 2007. "Designing experimental auctions for marketing research: The effect of values, distributions, and mechanisms on incentives for truthful bidding." *Review of Marketing Science 5*(article 3).

Martinez, S. 2010. *Local Food Systems; Concepts, Impacts, and Issues* (No. 97). Collingdale, PA: Diane Publishing.

Mhurchu, C. N., and D. Gorton. 2007. "Nutrition labels and claims in New Zealand and Australia: a review of use and understanding." *Australian and New Zealand Journal of Public Health* 31(2):105-112.

Neuhouser, M. L., A. R. Kristal, and R. E. Patterson. 1999. "Use of food nutrition labels is associated with lower fat intake." *Journal of the American Dietetic Association* 99(1):45-53.

Noussair, C., S. Robin and B. Ruffieux. 2004. "Do Consumers Really Refuse To Buy Genetically Modified Food?" *The Economic Journal* 114(492):102-120.

Pieters, R., and L. Warlop. 1999. "Visual attention during brand choice: The impact of time pressure and task motivation." *International Journal of Research in Marketing* 16(1):1-16.

Poole, N., and L. Martínez-Carrasco. 2007. "Information and WTP: fruit quality perceptions and consumer satisfaction." In *I Mediterranean Conference of Agro-Food Social Scientists*, 103rd EAAE Seminar 'Adding Value to the Agro-Food Supply Chain in the Future Euromediterranean Space', Barcelona, Spain, April 23rd-25th.

Rayner, K. 1998. "Eye movements in reading and information processing: 20 years of research." *Psychological Bulletin* 124(3):372.

Reutskaja, E., R. Nagel, C. F. Camerer, and A. Rangel. 2011. "Search dynamics in consumer choice under time pressure: An eye-tracking study." *The American Economic Review* 110(2):900-926.

Russo, J. E. 2011. "Eye fixations as a process trace." *A Handbook of Process Tracing Methods for Decision Research* 43-64.

Sacks, G., M. Rayner, and B. Swinburn. 2009. "Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK." *Health Promotion International* 24(4):344-352.

Satia, J. A., J. A. Galanko, and M. L. Neuhouser. 2005. "Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina." *Journal of the American Dietetic Association* 105(3):392-402.

Scarbrough, F. E. 1995. "Perspectives on Nutrition Labeling and Education Act." In *The Nutrition Labeling Handbook*, R. Shapiro, ed. New York: Marcel Dekker, pp.29-52.

Seiler, M., P. Madhavan, and M. Liechty. 2012. "Toward an understanding of real estate homebuyer internet search behavior: an application of ocular tracking technology." *Journal of Real Estate Research* 34(2):211-241.

Silverglade, B. 1997. "Using food labelling to improve diet and health: An examination of the US Nutrition Labeling and Education Act." *European Food Law Review* 97(4):430-436.

Variyam, J. N. 2008. "Do nutrition labels improve dietary outcomes?" *Health Economics*, 17(6):695-708.

Velichkovsky, B. M., A. Rothert, M. Kopf, S. M. Dornhöfer, and M. Joos. 2002. Towards an express-diagnostics for level of processing and hazard perception. *Transportation Research Part F: Traffic Psychology and Behaviour* 5(2):145-156.

Vickrey, W. 1961. "Counterspeculation, auctions, and competitive sealed tenders." *The Journal of Finance* 16(1):8-37.

Vinoles, M. V., W. You, and R. M. Nayga Jr, 2013. "Parental Nutrition Label Usage and Children's Dietary-related Outcomes." Paper presented at AAEA annual conference, Washington D.C. August 4-6.

Visschers, V. H., R. Hess and M. Siegrist. 2010. "Health motivation and product design determine consumers' visual attention to nutrition information on food products." *Public Health Nutrition* 13(7):1099-1106.

Wang, H., and J. McCluskey, 2010. "Effects of information and country of origin on Chinese consumer preferences for wine: an experimental approach in the field." Paper presented at AAEA annual conference, Denver, Colorado. July 25-27.

Wedel, M., and R. Pieters. 2000. "Eye fixations on advertisements and memory for brands: A model and findings." *Marketing Science* 19(4):297-312.

Wedel, M., and R. Pieters. 2008. "A review of eye-tracking research in marketing." *Review of Marketing Research* 4(2008):123-147.

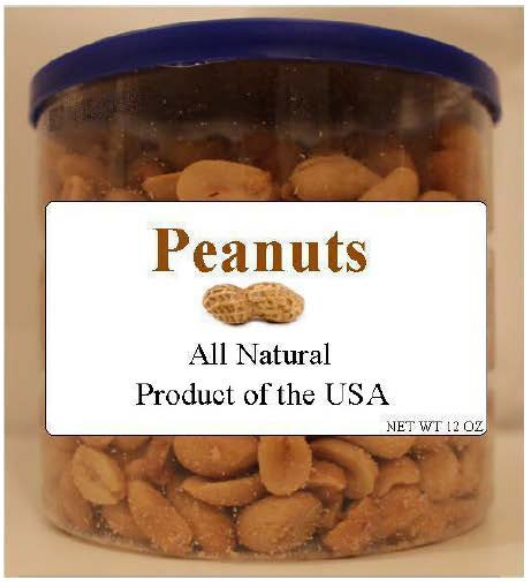
Worthington, V. 2001. "Nutritional quality of organic versus conventional fruits, vegetables, and grains." *The Journal of Alternative & Complementary Medicine* 7(2):161-173.

Yang, S. H., and T. A. Woods. 2013. "Assessing Consumer Willingness to Pay for Ground Bison Given Nutrition Information." Paper presented at the annual meeting of Southern Agricultural Economics Association, Orlando, Florida, February 2-6.

Yue, C., F. Alfnes and H. H. Jensen. 2009. "Discounting spotted apples: investigating consumers' willingness to accept cosmetic damage in an organic product." *Journal of Agricultural and Applied Economics* 41(1):29-46.

Appendix A

Examples of front-of-pack images



Appendix B

Table 4. Marginal effects of salad mix and roasted peanuts (Tobit model)

	Salad Mix	**Roasted Peanuts**
Age	-0.029***	-0.017*
Education level	-0.023***	-0.176*
Gender	-0.118	-0.180
Marital status	-0.359***	-0.301*
Household member	-0.109***	0.044
Income	0.098***	0.073
Non-weight-concerned	**Salad Mix**	**Roasted Peanuts**
Import	-0.202	-0.062
Minnesota Grown	0.403*	0.175*
Naturally produced	0.319	0.211
Organically produced	0.640***	0.286*
Fixation count (health claim[a])	0.011	0.057
Fixation count (serving size)	0.317***	0.064
Fixation count (calories)	0.076	0.038
Fixation count (fat)	-0.140***	-0.060*
Fixation count (vitamins and minerals)	-0.006	-0.076*
Fixation count (sodium)	-0.022	0.238*
Fixation count (protein)	0.148	-0.498*
Fixation count (sugar)	-0.021	0.186*
Fixation count (carbohydrate)	0.031	0.014
Fixation count (fiber)	0.167	0.162*
Fixation count (ingredients)	0.032***	0.021
Fixation count (allergen)		-0.044
Weight-concerned[b]	**Salad Mix**	**Roasted Peanuts**
Weight conscious shopper indicator	0.417*	-0.054
Import	-0.134	-0.030
Minnesota Grown	0.403*	0.175*
Naturally produced	0.071	0.000
Organically produced	0.640***	0.286*
Fixation count (health claim[a])	0.019	0.000
Fixation count (serving size)	-0.019***	0.027
Fixation count (calories)	-0.007	-0.061
Fixation count (fat)	0.015***	-0.060*

Table 4. *Continued*

Weight-concerned[b]	**Salad Mix**	**Roasted Peanuts**
Fixation count (vitamins and minerals)	-0.019	-0.076*
Fixation count (sodium)	-0.041	0.238*
Fixation count (protein)	-0.025	-0.012*
Fixation count (sugar)	0.029	-0.120*
Fixation count (carbohydrate)	0.107	0.019
Fixation count (fiber)	-0.018	0.118*
Fixation count (ingredients)	0.013*	0.004
Fixation count (allergen)		0.121*
Censored	12	20
Likelihood	-960.02	
Sigma	1.069	

Note. [a] Health claim for salad is "High in Fiber", and that for roasted peanuts is "Low in Sodium".
[b] "Weight-concerned" represents the shoppers who were concerned about their own weight or whose household member(s) had weight concerns.
*, **, *** indicate significance level of 10%, 5% and 1%, respectively.