

A Nutrition Comparison Strategy on Bison Marketing: Do Consumers Really Care?

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Bison has the leanest and the highest nutritional value among commercial meat products. Marketers often apply a nutrition comparison (NC) table as a promoting strategy to highlight the distinguishing features of bison meat. However, do consumers really buy it because of the NC information? A total of 2,644 meat consumers were surveyed in the Ohio River Valley region, including Illinois, Indiana, Ohio, Kentucky, and Tennessee. Results indicate that consumers, especially for those who originally didn't know the benefits of bison nutrition, are significantly influenced by the NC table. Implications from this study suggest that enhancing consumers' bison nutrition knowledge, especially for those who originally don't know the benefits of bison nutrition, would increase bison meat sales.

Keywords: bison, nutrition comparison, nutrition benefits, WTP

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I. Introduction

Bison is also commonly known as buffalo. According to the timeline of American Bison¹, the bison population was estimated at about 30 to 60 million living in North America during 1500s, while in the 1990s the bison only left less than 300,000 herds. Nowadays, marketers have noticed the special characteristics of bison in comparing to the commercial meats. According to the nutrition comparison (NC) table in Table 1 developed by the North American Bison Association, the benefits of bison nutrition include higher protein levels, lower calories, lower fat, and lower cholesterol compared to commercial meats like skinless-chicken, beef, pork, lamb, and salmon. Besides these relatively favorable characteristics, the higher iron and vitamin B-12 levels compared to these other meats have the potential to attract consumers who are used to paying attention to nutrition facts. Furthermore, Figure 1 shows that the bison average price is much higher than beef. Especially, the price differences between bison and beef have enlarged since 2014.

Table 1. NC table used in bison marketing.

NUTRITIONAL COMPARISON					
Per 100 GRAM SERVING – COOKED MEAT					
SPECIES	FAT GRAMS	CALORIES KCAL	CHOLESTEROL MG	IRON MG	VITAMIN B-12 MCG
Bison:	2.42	143	82	3.42	2.86
Beef (choice):	10.15	219	86	2.99	2.65
Beef (Select):	8.09	201	86	2.99	2.64
Pork:	9.66	212	86	1.10	0.75
Chicken (Skinless):	7.41	190	89	1.21	0.33
Sockeye Salmon:	10.97	216	87	0.55	5.80

Source: Buffalo Hills Bison (n.d.).

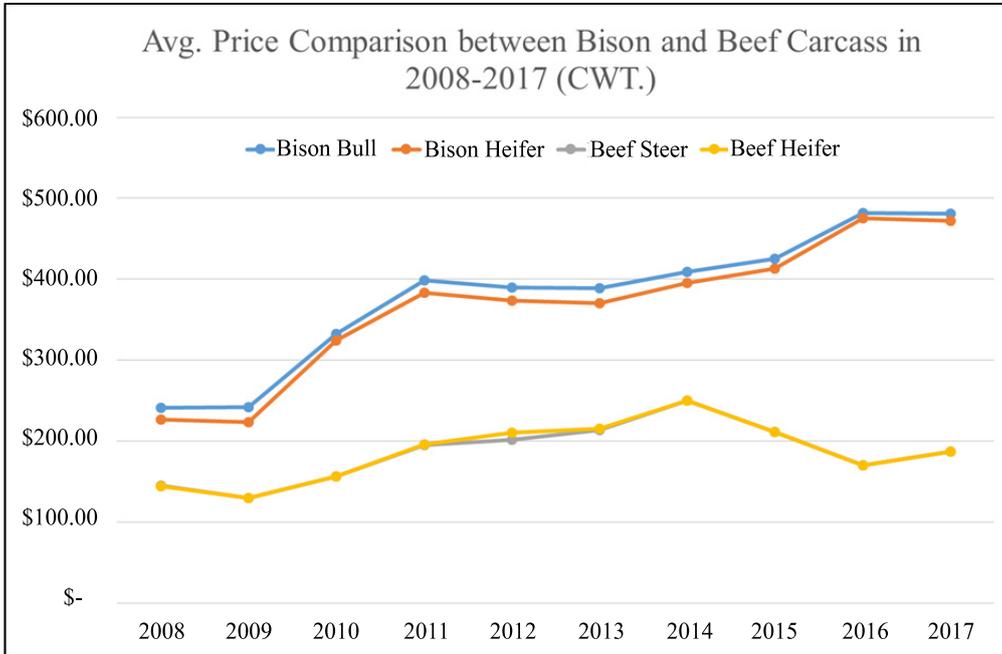


Figure 1. Market price comparison between bison and beef carcass in 2008-2017.

Source: USDA AMS Livestock and Grain Market News Service.

Nowadays, consumers can find bison products in every state in the U.S. (Hansen, 2012). Therefore, bison meat is one of the new potential choices for those who like to eat meat. However, the bison market has expanded its market share slowly. The sale of bison products has been low compared to other commercial meats (especially about 20,000 head of bison slaughtered annually versus 125,000 cattle slaughtered daily). In order to grow the bison industry through enhanced sales, it is important to understand how to better target potential consumers. In particular, bison marketers have adopted the NC table to enhance consumer awareness via the distinguishing features of bison meat, not only in virtual stores but also in online store websites. More information is needed to know if consumers always respond positively with regard to purchasing behavior when such information is provided. This study examines: first, consumers' awareness and perception of bison nutrition benefits; second, consumers' evaluation of

the bison nutrition benefits in terms of their willingness to pay (WTP); and third, the characteristics of existing bison consumers who already knew bison nutrition benefits.

The majority of bison production concentrates along the border between the West and Midwest region in the U.S. (Raabe, 2011). The relatively favorable nutrition benefits of bison products have attracted some nutrition-conscious consumers who have been made aware of these benefits. The market price of bison products per pound has remained higher than other premium commercial meats. Since the government enacted the Nutrition Labeling and Education Act (NLEA) in 1990 to enhance consumers' nutritional awareness, researchers have found that consumers would have positive WTP for the products if nutrition information is provided (Jacoby, Chestnut, & Silberman, 1977; Loureiro, Gracia, & Nayga, 2006). Nowadays, nutrition information is common for product labeling. However, utilization of the NC table requires further understanding as to whether consumers would be motivated to think of trying or buying the leanest and highest nutritional value meat products.

Consumers may have different responses to the nutrition labeling depending on the amount of time spent (while shopping or at home), relative socio-demographic attributes (like age, gender, income, education, etc.), diet status, prior nutrition knowledge, as well as shopping experience (Bettman & Park, 1980; Nayga, Lipinski, & Savur, 1998; Nayga, 2000; Drichoutis, Lazaridis, & Nayga, 2005; Berning, Chouinard, Manning, McCluskey, & Sprott, 2010; Bialkova & van Trijp, 2010). Consumers would potentially respond more to nutrition information if they are health conscious (Kim, Nayga, & Capps, 2000; Weaver & Finke, 2003; Banterle & Cavaliere, 2014) and concerned about food safety (Saghaian & Reed, 2007; Kennedy, Worosz, Todd, & Lapinski, 2008; Stranieri, Baldi, & Banterle, 2010). These studies reveal that consumers may use nutrition information for many different purposes. It is crucial to understand consumer attitude/perception toward bison nutrition benefits since the bison industry is still relatively small and unknown, and the consumer may not always have a positive attitude/perception of all kinds of nutrition information. Although consumers may not always care or use the nutrition information that is provided to them (Nayga,

1996; Annunziata & Vecchio, 2012), it is important to have a better understanding of consumers' responses to high-priced bison products when they are presented the bison NC table.

This study focuses on the Ohio River Valley region, including Illinois, Indiana, Ohio, Kentucky, and Tennessee. Fresh ground bison was available in the Ohio River Valley region during the research period in July 2012. The price range for fresh ground bison was observed to be between \$8 and \$10 per pound in specialty meat stores and grocers in this region. The most similar meat product, premium ground beef, was sold at \$6 per pound. With the variation between the nutrient knowledge background and the NC table information, this study determines to what extent the meat consumers are influenced by the bison NC table in their revealed WTP. The interaction effects between the NC table and different levels of prior nutrition knowledge are examined in an effort to more accurately measure the marginal WTP for the NC table across prior knowledge groups.

II. Literature Review

Bison are raised on the open range typically with no antibiotics and no growth hormones (USDA/Food Safety and Inspection Service, 2011). Bison production was almost wiped out in the late 1880s, but the actual herd size across North America today is estimated at about 500,000 bison². The National Bison Association (USDA/Food Safety and Inspection Service, 2011) estimates that the annual U.S. per capita bison consumption is about 0.07 pounds per person; a relatively small amount compared with other commercial meats.

The challenge of the bison industry is that the marketing outlets for bison meat are limited. Bison producers have several options for selling directly to consumers, including restaurants, wholesale outlets, cooperatives, and via the internet (Gegner, 2001). Bison producers are subsequently under more pressure to develop marketing

and merchandising plans for their own branding to sell bison products. Although bison prices for producers have stayed near their recent record high (Raabe, 2011), the industry has not responded with significant increases in supply. Part of this issue is connected with limited consumer awareness as well as the limited processing infrastructure for a scale-driven sector.

Consumer awareness of both the product and its nutritional benefits has the potential to be part of an effective merchandising strategy. The labeling of food products can convey information, however, that may not help consumers with their purchasing decision (Caswell & Padberg, 1992). Non-users of nutrition labels tend to be the ones who do not have enough nutrition knowledge (Klopp & Macdonald, 1981). In other cases, the product labeling may not always serve as an efficient and effective information provision for all consumers (Kiesel, McCluskey, & Villas-Boas, 2011). Therefore, consumer knowledge often becomes the main source of decision making when consumers did not receive the product information properly, although consumer eating habits can be influenced and changed by nutritional labeling (Driskell, Schake, & Detter, 2008). Moreover, nutrition-conscious consumers prefer to choose detailed nutrition labels instead of other summary types of nutrition information provided on grocery store shelf labels (Berning, Chouinard, & McCluskey, 2008). Hence, it is important to understand whether the prospective bison consumers would interest the bison meat because of the NC information in Table 1.

Purchasing or eating behavior can be highly related not only to socio-demographic characteristics of buyers but also to the product itself related to packaging, branding, and labeling (Burton & Andrews, 1996; Kim et al., 2000; Nayga, 1996; Nayga, 2000; Nayga et al., 1998; Nayga, 1999; Weaver & Finke, 2003). In order to elicit consumer attitude and perception of bison products, it is important to investigate how consumers evaluate the benefits of bison nutrition in terms of their WTP. In sum, this study provides a unique opportunity to contribute to the literature for bison products, specifically to provide a better understanding of consumer WTP and a better understanding of the role of the NC table for bison products.

III. Methodology

3.1 Survey Data

This study employed a web-based survey, which was conducted through an existing consumer panel maintained by Zoomerang.com, an affiliate of Market Tools, Inc., and the primary data was collected during mid-September, 2012. Following Dillman (2007), our survey included three main sections. The first section was designed to investigate respondents' experiences; a set of basic questions associated with general meat consumption were included. The second section focused on respondents' knowledge of bison nutrition. And lastly, the third section attempted to elicit respondents' WTP for fresh ground bison.

In order to understand whether our sample respondents are sufficient representations for each state, our sample descriptive statistics were compared to the state population demographic profile from the 2010 American Community Survey (United States Census Bureau, 2010). We selected four common variables, like gender, white, age, and income. The comparison results for each state between the sample descriptive statistics and the 2010 American Community Survey are presented in Table 2. Basically, respondents with no meat consumption were excluded, so the comparisons in Table 2 simply reveal how much difference between our sample and population. Although the sample proportion of female respondents is higher than the population, it is still making sense since female buyers are usually the grocery shoppers in a household. Some variables in the specific states have no significant differences, but others indicate a significant difference between sample and population. At least the results show that more variables in income categories have no significant differences.

Table 2. Demographic characteristics of representative sample

Variable	Tennessee		Kentucky		Ohio		Indiana		Illinois	
	Sample	State	Sample	State	Sample	State	Sample	State	Sample	State
Number of respondents	461	6,346,105	427	4,339,367	599	11,536,504	597	6,483,802	573	12,830,632
Male (%)	31.8	48.7**	32.7	49.2**	44.7	48.8**	40.8	49.2**	48.5	49.0
White (%)	91.1	77.6**	94.6	87.8**	91.6	82.7**	95.6	84.3**	88.6	71.5**
Age distribution (%)										
20 - 24	2.6	6.7**	3.0	6.7**	3.5	6.6**	2.0	7.0**	3.1	6.9**
25 - 34	10.6	13.0	11.4	13.0	10.5	12.2	9.5	12.8**	11.1	13.8**
35 - 49	29.2	20.8**	30.4	20.7**	26.0	20.2**	26.5	20.3**	23.7	20.8
50 - 64	45.5	19.6**	42.8	19.8**	44.2	20.3**	43.7	19.2**	47.4	18.7**
65 & over	18.6	13.4**	18.5	13.3**	22.2	14.1**	21.6	13.0	21.6	12.5**
Household income distribution (%)										
Under \$15,000	13.2	15.7	8.7	17.5**	8.3	14.0**	7.5	12.7**	5.6	11.5**
\$15,000 to \$24,999	10.0	12.7	11.7	13.0	9.8	11.6	10.6	11.4	8.6	10.1
\$25,000 to \$34,999	11.3	12.0	14.3	11.8	13.0	11.3	11.9	11.8	7.9	9.7
\$35,000 to \$49,999	14.1	15.2	16.2	14.8	16.4	14.9	15.2	15.4	13.1	13.2
\$50,000 to \$74,999	31.2	18.5**	26.9	17.8**	28.7	19.1**	29.3	19.9**	32.3	18.5**
\$75,000 to \$99,999	10.8	11.0	14.1	10.9	11.5	12.1	14.3	12.6	14.3	13.2
\$100,000 to \$149,999	7.4	9.2	4.4	9.4**	8.3	11.0	8.4	10.7**	13.1	13.7
\$150,000 to \$199,999	1.1	2.9**	3.5	2.5	2.3	3.4	1.0	3.0**	3.5	5.1**
\$200,000 and up	0.9	2.8**	0.2	2.3**	1.5	2.8**	1.3	2.4**	1.7	5.0**
Mean household income (\$)	54,555	60,516**	55,538	57,451	59,574	63,477**	59,351	62,491	69,363	76,733**

Source: United States Census Bureau (2010)

Note: 1. Population Statistics for each state are based on the 2010 Census (United States Census Bureau, 2010).

2. The value with ** indicates that the outcomes of the mean comparison test between sample and population at a 5% significant level.

Overall, the sample statistics of our respondents are moderately representative as the 2010 Census reports. Although readers might caution that the male population for Tennessee and Kentucky are modestly under-represented, it is still appropriate since female shoppers would more likely be the meal planner for the whole family. The population of Caucasians for Tennessee and Illinois is modestly over-represented, and this is common in mailed survey respondents as well (e.g. Sanders, Moon & Kueth, 2007). Among age distribution for each state, although the sample distributions are moderately left-skewed compared to the distributions of the 2010 Census reports, it is common in web-based survey respondents (e.g. Lim, Hu, Maynard, & Goddard, 2013). The household income distributions for each state do have the same shape, but two tails of each distribution tend to be thinner. This may slightly correlate with age sample distribution. Once again, our sample is still a justifiable representation of the population for these five states.

3.2 Survey Design

A total of 2,644 respondents were surveyed and modestly distributed evenly over each state: Illinois (22%), Indiana (22%), Ohio (22%), Kentucky (16%), and Tennessee (18%). In order to investigate how consumers evaluate the benefits of bison nutrition in terms of their WTP, we need to determine how much they know about bison nutrition and whether their WTP would be decided if the NC table is presented. Before asking how much they were willing to pay for fresh ground bison, each respondent was asked to respond the question: “My understanding of the specific health benefits associated with bison products is: (1) “I don’t know,” (2) “I assume it’s about the same as beef,” and (3) “I know most of the specific health benefits.”

Respondents were given a WTP question right after their self-classification of bison nutrition knowledge. The hypothesis of the NC table is that individuals’ WTP is positively affected when they were given the NC table. In order to examine this hypothesis, this study simulates a circumstance that is just like some were receiving the

NC table and others were not during their shopping. Therefore, all surveyed respondents (2,644) were randomly distributed into two different groups in the WTP question. One test group being shown the NC table (Table 1) and reference price for fresh ground bison and premium ground beef (Appendix 1), and the other control group was only being shown the reference price for fresh ground bison and premium ground beef (Appendix 1). A payment card WTP elicitation approach was applied as a way to reveal respondents' intentions. Particularly, the WTP choices cover "I do not wish to buy this product" and positive (starting from \$4 per pound) WTP. Since the \$4 per pound was the cheapest and USDA-certified beef, there is no reason to provide any WTP choice below \$4.

3.3 Pre-Test of Bison Market Profile

The WTPs of surveyed individuals could be influenced by their pre-knowledge of bison nutrition. Following Wells and Haglock (2005), who use the Hartman Group's 2000 survey to study consumer behavior on natural foods consumer lifestyle segments, a market segmentation model is applied to bison consumers based on the observed WTPs. Therefore, consumer groups are divided into four groups based on the levels of WTPs: Don't wish to buy, Periphery (\$4-\$5.99), Mid-Level (\$6-\$7.99), and Core (\$8 above).

The surveyed respondents were randomly split into two groups: the first half (1,324) did not receive the NC table, and the other half (1,320) did receive the NC table. The differences between these two groups regarding their WTP responses are shown in Table 3. In the option of "Don't wish to buy," respondents behave differently. Clearly, respondents were more likely to choose the option of "Don't wish to buy" if the NC table was not provided or observed. The value with an underline in Table 3 also represents a 5% significant difference in a mean comparison *t*-test. This means that when the NC table is not provided, the consumer would have a higher chance to refuse to buy the bison meat. Furthermore, there have some significant differences in the

section of Positive WTP. Especially, consumers who were provided the NC table in the Periphery (\$4-\$5.99) and Mid-level (\$6-\$7.99) group are more likely to pay more for bison meat if comparing to those who were not provided the NC table. Although the Core consumer groups (\$8 above) show no difference between those given and not given the NC table, it may indicate that the NC table would not influence anything in the Core consumer groups. Hence, the NC table is observed to have a potential influence on consumers' WTP choices, especially for those who are in Periphery and Mid-Level groups.

In Table 4, most surveyed respondents are not sure about bison nutrition: about 61% of respondents do not know about the benefits of bison nutrition, approximately 18% of respondents assume that the benefits of bison nutrition are just like beef, and about 21% of respondents know about bison's nutrition benefits. This suggests that 79% of consumers either do not know or are misinformed about the nutritional characteristics associated with bison. At the very least, this suggests a significant need for consumer education. However, whether the NC table could perform a merchandising campaign and further directly change consumers' WTP or not, it is necessary to confirm.

IV. Empirical Models

The empirical models of this study focus on consumers' WTP for one pound of fresh ground bison. Premium ground beef was sold at about \$6.00 USD per pound during the research period and selected as a reference product because both cattle and bison share many things in common, such as grazing ruminants, multiple stomachs, similar reproduction cycle, body size, and red meat. Since beef can be recognized by most red meat consumers, premium ground beef is an ideal reference product for bison.

Table 3. The distribution of bison consumers' WTP between given and non-given NC table (Total 2,644)

The WTP Distribution	Don't wish to buy (1,087)	Positive WTP (1,557)		
		Periphery (693)	Mid-Level (589)	Core (275)
	\$4 - \$5.99	\$6 - \$7.99	\$8 Above	
Non-Given NC (1,324)	577 (53.0%) ^{**}	333 (48.0%) ^{**}	276 (46.8%) ^{**}	138 (50.1%)
Given NC (1,320)	510 (46.9%) ^{**}	360 (51.9%) ^{**}	313 (53.1%) ^{**}	137 (49.8%)

Source: By this study.

Note: 1. The parentheses represent the proportions of each consumer group based on with or without the NC information.

2. The value with ** indicates that the outcomes of the mean comparison test at a 5% significant level.

Table 4. Definitions and sample statistics of variables (N = 2,644)

Variables	Description of Variables	Mean	Std. Dev.	Min.	Max.
<i>WTP</i>	The mid-point premium for each chosen WTP	5.97	1.60	4	10.5
<i>Don't know bison nutrition</i>	Binary variable=1 if the respondent indicates that he/she don't know bison nutrition at all	0.61	0.48	0	1
<i>Assume same as beef nutrition</i>	Binary variable=1 if the respondent assumes that bison nutrition is the same as beef nutrition	0.18	0.38	0	1
<i>Know bison nutrition</i>	Binary variable=1 if the respondent knows the specific health benefits of bison nutrition	0.21	0.40	0	1
<i>Given NC</i>	Binary variable=1 if the respondent was given bison NC	0.49	0.50	0	1
<i>Given NC*Same as Beef</i>	Binary variable=1 if the respondent, who is also given bison NC, assumes that bison nutrition is the same as beef nutrition	0.08	0.28	0	1
<i>Given NC*Know bison nutrition</i>	Binary variable=1 if the respondent, who is also given bison NC, knows the specific health benefits of bison nutrition	0.10	0.30	0	1
<i>Age</i>	Continuous variable; years of age	52.81	13.84	15	82
<i>Male</i>	Binary variable=1 if the respondent is male, 0 otherwise	0.40	0.49	0	1
<i>Have kids under age 6 at home</i>	Binary variable=1 if the respondent have kids aged under 6 years old at home	0.17	0.37	0	1
<i>Education</i>	Continuous variable: years of education	14.30	2.12	9	18
<i>Income</i>	Continuous variable; total yearly household income before tax (\$1,000)	60.12	41.14	7.5	237.5

Table 4. Definitions and sample statistics of variables (N = 2,644) (Continued)

Variables	Description of Variables	Mean	Std. Dev.	Min.	Max.
<i>White</i>	Binary variable=1 if the respondent's race is white, 0 otherwise	0.92	0.26	0	1
<i>City</i>	Binary variable=1 if the respondent is from the city, 0 otherwise	0.20	0.40	0	1
<i>Suburb</i>	Binary variable=1 if the respondent is from the suburb, 0 otherwise	0.41	0.49	0	1
<i>Rural</i>	Binary variable=1 if the respondent is from rural, 0 otherwise	0.38	0.48	0	1
<i>IL</i>	Binary variable=1 if the respondent is from Illinois, 0 otherwise	0.21	0.41	0	1
<i>IN</i>	Binary variable=1 if the respondent is from Indiana, 0 otherwise	0.22	0.41	0	1
<i>KY</i>	Binary variable=1 if the respondent is from Kentucky, 0 otherwise	0.16	0.36	0	1
<i>OH</i>	Binary variable=1 if the respondent is from Ohio, 0 otherwise	0.22	0.41	0	1
<i>TN</i>	Binary variable=1 if the respondent is from Tennessee, 0 otherwise	0.17	0.37	0	1

Source: By this study.

A payment card WTP approach on food products is suitable for this study (Hu, Zhong, & Ding, 2006; Hu, Woods, Bastin, & Cox, 2011) because respondents can indicate the dollar amount that fully represents their WTP for fresh ground bison based on the provided information (e.g., the available choices, product, and compared product prices). Additionally, Hu et al. (2011) exhibit that a limited number of values provided in a payment card survey can relax the challenge of an open-end WTP question. Consumers are rational and assumed to choose any possible option that brings to utility maximization. Thus, individuals are assumed to maximize their utility by selecting any WTP choice, y .

An actual price choice for the value amount of WTP on fresh ground bison is used. As shown in Appendix 1, consumers were provided a total of fourteen WTP choices ranges from “\$4.00” to “more than \$10.00”, and including an option of “I do not wish to buy this product.” During the research period in 2012, the market price of fresh ground bison was about \$8-\$10, and premium ground beef was about \$6. Since the scale of bison meat production is much smaller compared to beef and the quality of bison products (Table 1) should give no reason to sell below \$6. However, a market price above \$4 is provided to capture any periphery consumers. Indeed, some consumers may not feel comfortable buying bison meat as their choice, so the option of “I do not wish to buy this product” is provided as well. With the nature of the sample distribution in Table 2, a Tobit model would especially suit this study, since it is a censored-type estimator as well. Normality and homoscedasticity are assumed in the Tobit model.

Tobit is a censored normal regression model for WTP ($WTP = y^* = x'\beta + e$). The y^* is an unobserved (the true latent) WTP that only respondents knew about it. A benefit of the censored model is that all of the observations are included in the estimation. Individuals may not want to consume fresh ground bison, so they would indicate a zero premium for WTP or “unwillingness to buy.” In this case, they would choose the option of “I do not wish to buy this product.” The Tobit estimation is

censored from below at zero ($y = \begin{cases} y^*, & \text{if } y^* > L \\ L, & \text{if } y^* \leq L \end{cases}$), where y is the observed choice of the respondent, and L is the lower bound, less than and equal to \$0³. However, consumers can choose their WTP to be more than \$10.00, so the Tobit estimation is also censored from above at more than \$10.50 ($y = \begin{cases} y^*, & \text{if } y^* < U \\ U, & \text{if } y^* \geq U \end{cases}$), where U is the upper bound, more than \$10.50. The empirical specification for Tobit model is:

$$WTP = y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{17} X_{17} + \varepsilon \quad (1)$$

where the dependent variable, WTP , was the chosen intervals for fresh ground bison, while the β 's were the estimated parameters, and ε was assumed to be a normally distributed error term. Underlying the case of full sample estimation, the WTP for fresh ground bison is accounted for 17 independent variables including those given the bison NC table (Nayga, 1996; Kim et al., 2000; Weaver & Finke, 2003), knowledge of bison nutrition (Bettman & Park, 1980; Nayga, 2000; Nayga et al., 1998), and socio-demographic as well as regional variables (Hu et al., 2011).

The variable *Given NC* shows that 49% of respondents were given the NC table. In addition, we include the interaction terms for NC and knowledge of bison nutrition, i.e. *Given NC*Same as beef* and *Given NC*Know bison nutrition*. The premise here is that the information effect is likely to be different when measured across groups with varying degrees of pre-existing nutrition knowledge.

The socio-demographic variables include *Age*, *Male*, *Have kids under the age 6 at home*, *Education*, *White*, and *Income*. The regional characteristic variables enclose *City* and *Suburb* to compare with rural, such as small-town, countryside (but not a farm), and farm. Four states, i.e. *Illinois*, *Indiana*, *Ohio*, and *Kentucky*, are included to compare with *Tennessee*. The definitions and summary statistics of these variables are presented in Table 4.

Investigating these individuals who already knew bison nutrition would help us to understand what types of consumers would have a higher chance to know about bison

nutrition. Therefore, the socio-demographic characteristics are specifically focused. A simple binary outcome model, i.e., the Probit model, is applied in this examination. The empirical specification as to whether individuals knew about bison nutrition or not is:

$$\text{Know_bison_nutrition} = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \dots + \alpha_{12} X_{12} + \varepsilon \quad (2)$$

where α_s were the coefficient estimates and ε was assumed to be a standard normal distributed error term.

V. Empirical Results

The estimated outcomes of the empirical models can be obtained based on equation (1). The Tobit model estimations were examined, and the empirical results are exhibited in Table 5. The F-test indicate that overall coefficient estimates for each set of estimations are significantly different from zero. The overall results in Table 5 have a consistent expected sign and reject the null hypothesis that the NC table does have a positive impact on an individual's WTP.

The outcomes of average marginal effects in Table 5 represent the actual dollar differences of consumer WTP for fresh ground bison. The variable *Given NC*, showed a 1% significant level, implying that respondents who were given the NC would like to pay about \$0.162 more for fresh ground bison compared to those who were not given the NC. In terms of WTP for fresh ground bison, respondents who know bison nutrition are willing to pay about \$1.218 more as compared with those who do not know bison nutrition at all. Respondents who assume that bison nutrition is just the same as beef are willing to pay about \$0.659 more as compared with those who do not know bison nutrition. As a result, consumers would respond with a positive WTP in accordance with their pre-knowledge of bison nutrition. If consumers know more about the benefits of bison meat, they would have higher WTP.

Table 5. The empirical results of the Tobit model for fresh ground bison

Dependent Variable: <i>WTP</i>	Tobit Coefficients	Average Marginal Effects
<i>Given NC</i>	0.287** (2.39)	0.162** (2.39)
<i>Assume same as beef nutrition</i>	1.167*** (6.91)	0.659*** (6.95)
<i>Know bison nutrition</i>	2.155*** (13.49)	1.218*** (13.80)
<i>Given NC*Same as beef</i>	-0.177 (-0.75)	-0.099 (-0.75)
<i>Given NC*Know bison nutrition</i>	-0.607*** (-2.75)	-0.343*** (-2.75)
<i>Age</i>	-0.037*** (-10.42)	-0.020*** (-10.54)
<i>Male</i>	0.440*** (4.66)	0.248*** (4.67)
<i>Have kids under age 6 at home</i>	-0.259** (-2.05)	-0.146** (-2.05)
<i>Education</i>	0.088*** (3.81)	0.049*** (3.82)
<i>Income</i>	0.005*** (4.48)	0.003*** (4.49)
<i>White</i>	0.037 (0.22)	0.021 (0.22)
<i>City</i>	0.181 (1.43)	0.102 (1.43)
<i>Suburb</i>	0.021 (0.19)	0.011 (0.19)
<i>IL</i>	0.349** (2.41)	0.197** (2.41)
<i>IN</i>	0.094 (0.66)	0.053 (0.66)
<i>KY</i>	0.315** (2.05)	0.177** (2.05)
<i>OH</i>	0.210 (1.48)	0.118 (1.47)
<i>Constant</i>	3.664*** (8.93)	
Number of observations	2,644	
Log-Likelihood	-4,216	
LR χ^2 test	526.740	
Left-censored observation at $wtp \leq \$0$	1,087	
Right-censored observation at $wtp \leq \$10.50$	3	
Pseudo R ²	0.060	

Source: By this study.

Note: Asterisks indicate levels of significance: *=0.10, **=0.05, and ***=0.01.

In order to interpret the coefficient estimates, we further provided an average marginal effect (AME) which is slightly different from the marginal effect at the mean (MEM) (conditional means). With the AME, the marginal effect is calculated for each case and then all the calculated effects are averaged. Since the computed effect in the MEM is only computed at the means, an outcome of the AME⁴ would be more appropriate in a non-linear estimation.

The variable *Given NC*Know bison nutrition* explains an indirect effect among respondents who already know bison nutrition and were also given the NC. The result of the variable *Given NC*Know bison nutrition* reveals that if respondents who already know bison nutrition and were given the NC, they would like to pay about \$0.343 less per pound for fresh ground bison compared to those who don't know bison nutrition and were given the NC. This confirms that nutrition merchandising programs are going to be most impactful among those who don't know the benefits of bison nutrition.

Younger male respondents with higher education and higher income are more likely to have positive WTP for fresh ground bison. If individuals are younger by one year, they have an additional \$0.02 in actual WTP for fresh ground bison. Male individuals are willing to pay about \$0.248 more than female consumers. Education also has a positive effect. Each year of education contributes an additional \$0.049 in WTP for fresh ground bison. Respondents have slight income sensitivity. Each additional \$10,000 in annual household income suggests an additional \$0.003 in actual WTP for fresh ground bison. However, if individuals do not have kids under the age six at home, they would like to pay more about \$0.146 per pound for fresh ground bison compared to those who have kids under the age six at home. Although regional residence factors do not suggest significant differences (*City* and *Suburb*), respondents from Illinois and Kentucky are willing to pay about \$0.197 and 0.177, respectively, more than those who are from Tennessee.

The important finding in Table 5 shows that consumer knowledge of bison nutrition contributes the most significant portion of WTP, about \$1.22 more. However,

consumers with knowledge of bison nutrition and provided with an NC table at the same time may receive a negative impact on their WTP. Therefore, the next step is to discover the relevant socio-demographic characteristics associated with the knowledge of bison nutrition. The estimation outcomes with the marginal effects for the Probit model are presented in Table 6. The results show that older white males with higher education are the major consumers who would have a higher chance to know about bison nutrition. Since individuals who already have the knowledge of bison nutrition and provided an NC table are less likely to pay a positive WTP for bison meat, it is important to figure out who are the potential consumers should be more focused when the NC table is applied as the merchandising programs. Comparing the results of age characteristics between Tables 5 and 6, this study suggests that non-white and younger female consumer groups would be an effective target for the marketing strategy.

In sum, the bison mean with the NC promotion is quite important to the bison industry. Consumers in this study reveal positive responses in terms of their WTPs, particularly if they know about the benefits of bison nutrition in the beginning. This implies that potential growth in the bison industry can be expected but challenged because of the high pricing strategy. Although consumer behavior may correspond to current bison nutrition marketing and merchandising campaigns, still about 41% of respondents revealed they were less likely to purchase bison products. Hence, focusing on the potential consumer groups, such as Periphery and Mid-Level group, bison marketers should possess the current potential bison buyers, such as younger male consumers with higher education as well as higher income. Especially, individuals live in Illinois and Kentucky and do not have kids under the age six at home should be more focused. Since the information on the NC table can highly enhance consumers' WTP for the bison meat, the future bison merchandising campaigns should focus on non-white and younger female consumers.

Table 6. The socio-demographic characteristics for consumers who know bison nutrition

Dependent Variable: <i>Know bison nutrition</i>	Probit	Marginal Effects
<i>Age</i>	0.006 ^{***} (2.82)	0.002 ^{***} (2.82)
<i>Male</i>	0.123 ^{**} (2.12)	0.034 ^{**} (2.02)
<i>Have kids under age 6 at home</i>	-0.070 (-0.84)	-0.019 (-0.87)
<i>Education</i>	0.072 ^{***} (5.09)	0.020 ^{***} (5.15)
<i>Income</i>	0.001 (0.98)	0.000 (0.98)
<i>White</i>	0.232 ^{**} (1.99)	0.064 ^{**} (2.00)
<i>City</i>	-0.040 (-0.49)	-0.011 (-0.50)
<i>Suburb</i>	0.106 (1.63)	0.030 (1.56)
<i>IL</i>	0.131 (1.46)	0.038 (1.39)
<i>IN</i>	0.014 (0.16)	0.004 (0.16)
<i>KY</i>	0.072 (0.74)	0.020 (0.72)
<i>OH</i>	0.086 (0.97)	0.024 (0.94)
<i>Constant</i>	-2.584 ^{***} (-10.00)	
Number of observations	2,644	
Log-Likelihood	-1,312	
LR χ^2 test	80.990	
Pseudo R ²	0.029	

Source: By this study.

Note: Asterisks indicate levels of significance: **=0.05 and ***=0.01.

VI. Discussion and Conclusion

The bison industry is still relatively small in the U.S. consumers are willing to buy bison products if they know about the specific benefits of bison nutrition or if they don't know the bison nutrition but were offered the bison NC table. Consumers are less likely to buy bison products if they don't know the specific benefits of bison nutrition and were not offered the bison NC table. Therefore, promoting and enhancing consumers' knowledge of specific benefits of bison nutrition can potentially increase bison products' market sales.

The market for bison products is relatively new and limited compared to other commercial meats because of the scale of bison production. Our empirical findings suggest that promoting the benefits of bison nutrition (shown in Table 1) will have enormous opportunities to expand its market, especially for those who don't know about the benefits of bison nutrition. Meanwhile, current consumers should be maintained and future consumers should be better targeted. Especially, the Mid-Level and Periphery consumer groups were potentially and highly willing to give a positive WTP when they were provided the bison NC table.

The empirical results show that the current consumers should focus on younger male consumers with higher education as well as higher income and individuals with no kids under the age six at home. These potential consumers do care about the bison meat and are willing to exhibit positive interests and WTPs for fresh ground bison. Furthermore, these potential consumers do reveal geographic differences within the Ohio River Valley region. In particular, Illinois and Kentucky consumers are willing to pay for fresh ground bison meat more than Tennessee consumers. However, Illinois and Kentucky consumers can be affected if they have knowledge of bison nutrition as well as provided an NC table. Therefore, a future market of bison products should be better targeted.

The future market of bison meat should be paid more attention to those who do not know the benefits of bison nutrition. Especially, for those who are young female and non-white consumers should be treated as future market development. Since young female and non-white consumers would have a higher chance and do not know about the benefits of bison nutrition, these consumer groups should be better targeted and promoted. The bison markets in the Ohio River Valley region seem to be promising and potential. The implication of this study can help bison marketers target potential markets and consumers. However, those who knew about the benefits of bison nutrition and face the same NC table information may not continually purchase bison meat, so a further study is suggested to form an effective and comprehensive strategy to accomplish its goal.

Endnotes

1. Timeline of American Bison: <https://www.fws.gov/bisonrange/timeline.htm>.
2. The estimated bison population across North America can be derived from: <https://defenders.org/bison/basic-facts>.
3. Respondents can indicate the option of “I do not wish to buy this product” to represent their choice of a zero premium for WTP or “unwillingness to buy.” Since we don’t know the exact value (Y , *dependent variable*) when the option of “I do not wish to buy this product” is chosen, a censored model with a value at zero when respondents chose the option of “I do not wish to buy this product” is appropriate.
4. The average marginal effects are estimated as the average of the individual marginal effects.

It can be described as:
$$\frac{\partial E(y|x)}{\partial x} = \left[\frac{\partial F(\beta'x)}{\partial \beta'x} \right] \beta,$$

where $E(y|x)$ is the conditional mean function, and F denotes a cumulative distribution function and β denotes the parameters.

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Appendix

Appendix I. The Willingness to Pay of Payment Card Question for Fresh Ground Bison

What is the MAXIMUM price you would be willing to pay for:

One (1) pound of fresh ground bison?

For comparison purposes: One (1) pound of premium fresh ground beef is typically sold for \$6/pound. One (1) pound of fresh ground bison is typically sold for between \$8-\$10/pound in a grocery store.

Please indicate your choice (maximum price willing to pay) below: (\$/pound)

I do not wish to buy this product

- \$4.00
- \$4.50
- \$5.00
- \$5.50
- \$6.00
- \$6.50
- \$7.00
- \$7.50
- \$8.00
- \$8.50
- \$9.00
- \$9.50
- \$10.00
- more than \$10.00

Source: by this study.

行銷北美野牛肉的營養比較策略： 消費者真的在意嗎？

楊上禾*、Timothy A. Woods**

在許多商業肉產品中，北美野牛肉有最精的瘦肉以及有非常高的營養價值，許多行銷人員經常採用營養價值比較表作為推廣策略以強調北美野牛肉的特殊特色。然而消費者真的會買北美野牛肉的原因是因為這個營養價值比較表的資訊提供嗎？總共有 2,644 位有在吃肉的消費者接受調查訪問，這些消費者主要來自美國俄亥俄河谷地區，包含：伊利諾州、印第安那州、俄亥俄州、肯塔基州以及田納西州。研究結果顯示尤其是那些尚未得知北美野牛肉營養益處的消費者是顯著性會被營養價值比較表所影響，本研究意涵建議顯示提升消費者對北美野牛肉的營養知識能提升該其銷售，尤其該針對那些還不知道有關北美野牛肉營養益處的消費者為主要推廣目標。

關鍵詞：北美野牛肉、營養價值比較、營養益處、願付價格

JEL Codes: Q13

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