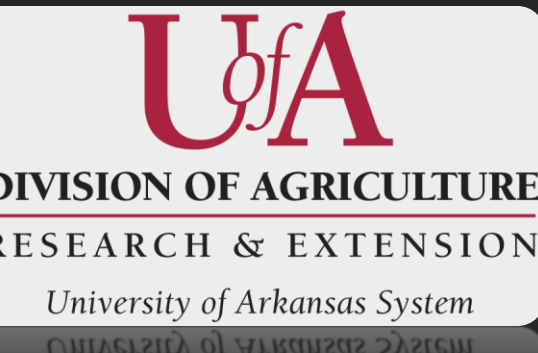


EFFECTS OF TIME PREFERENCE, RISK PREFERENCE, AND ATTRIBUTES NOT “JUST-ABOUT-RIGHT” ON CONSUMERS’ WILLINGNESS-TO-PAY FOR NUTRACEUTICAL-RICH JUICE



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Introduction

- There are increasing concerns among consumers about nutrition and health issues. The emphasis that consumers place on sensory attributes versus nutraceutical attributes can be assessed through valuation tasks, which measure willingness-to-pay (WTP).
- Valuation tasks are non-hypothetical because the winner(s) of the experimental mechanism actually pays for a unit of the product. The mechanisms require the consumer to follow through with his/her stated intentions.
- Psychological factors (e.g., risk preference, time preference) may influence consumer preferences. **Time preference** is a measure of future orientation and is quantified with the time discount rate. Higher time discount rates indicate less future orientation. Conceivably, highly future-oriented individuals (i.e., those with low time discount rates) may be willing to pay more for health-maintaining products. **Risk aversion** refers to an individual's preference for a smaller, more certain reward rather than a larger, less certain reward. Potentially, individuals who are more risk averse may be willing to pay more for products that are supportive of health.

Objectives

A black cherry, Concord grape, and pomegranate juice blend previously optimized on nutraceutical and sensory attributes was used to:

To identify significant WTP predictors (e.g., potentially risk and time preferences)

Describe the penalty in dollars and overall liking for variables not just-about-right

Materials and Methods

Product: Previously optimized juice blend composed of 75% Concord+13% black cherry+12% pomegranate

Panelists: Panelists (n=228) were recruited based on juice consumption (three times per week) and liking of black cherries, Concord grapes, and pomegranates.

Place: University of Arkansas Sensory Service Center, Fayetteville

Sensory Evaluation: Treatment groups were served two ounces of the juice blend to taste. Consumers evaluated overall liking with the 9-point verbal hedonic scale and diagnostic variables (sweetness, sourness, pomegranate flavor, Concord grape flavor, black cherry flavor, astringency, bitterness) with 5-point just-about-right scales.

Treatment Group 1 (Info) received the following antioxidant information about the juice blend: *This juice blend is rich in polyphenolic antioxidants, which are thought to support health.*

Treatment Group 2 (Taste) evaluated sensory attributes of the juice blend.

Treatment Group 3 (InfoTaste) evaluated the sensory properties of the juice blend and received the antioxidant information.

Control Group (Control) neither tasted nor received information about the juice blend.

Statistical Analysis

To identify significant predictors of WTP, random effects regression was performed using relative risk aversion coefficients, discount rates, treatment variables (Taste, Info, InfoTaste, Control), and other covariates that could potentially influence WTP (Stata 11.0, College Station, Texas). Relative risk aversion and discount rates were estimated from a joint model of risk and time preferences following established procedures.

To calculate the penalty in dollars and overall liking for an attribute not just-about-right, two partial least squares regression models (PLSR) were used on data elicited from treatment groups who tasted the product (Taste and InfoTaste). All PLSR models contained JAR variables converted to continuous variables. Conversion to *too little* and *too much* dummy variables is necessary because the middle category (just-about-right) of the 5-point JAR scale is the ideal response. In contrast, the ideal category of the 9-point hedonic scale is the highest category (like extremely). In the conversion process, responses valued 4 and 5 on the *too much* side of the JAR attribute are changed to 1 and 2 respectively. All other responses become 0 for the *too much* dummy variable. For the *too little* dummy variable, JAR responses valued at 1 and 2 are converted to -2 and -1 respectively, and all others become 0.

Experimental Design

- The Becker-DeGroot-Marschak (BDM) auction method was used to identify WTP predictors (Figure 1).
- The BDM mechanism with two bidding rounds was used to elicit the learning effect and create more observations. The binding round was randomly selected in each session.
- A price distribution was established based on the endpoints of the highest and lowest reference prices (\$2.10 for Concord juice and \$8.57 for pomegranate juice). For each session, a price was randomly drawn. Participants who had WTPs higher than the drawn price in the binding round were considered winners of the valuation task, and they purchased the juice blend at the drawn price.
- Consumers then completed a questionnaire that included a series of **risk and time preference tasks** (Tables 1 and 2). The moderator explained that for each row, participants had to indicate whether they preferred Option A or Option B. The moderator stressed that all participants had a 10% chance of having one of their preferences awarded. Consumers who were selected in the 10% received a gift card that represented their corresponding preferred amount and time point.
- Also included in the questionnaire were demographics, mood, exercise frequency, home inventory of juice, and fruit juice consumption habits questions.

Results and Discussion

Table 3. Random Effects Regression Modeling on Willingness-to-pay for a Juice Blend^{a,b}

^aTreatment Group 1 (Info) received the following antioxidant information about the juice blend: *This juice blend is rich in polyphenolic antioxidants, which are thought to support health.* Treatment Group 2 (Taste) evaluated sensory attributes of the juice blend. Treatment Group 3 (InfoTaste) evaluated the sensory properties of the juice blend and received the antioxidant information. The Control Group (Control) neither tasted nor received information about the juice blend.

^bShading indicates significance of the effect at $\alpha < 0.10$
^cGender Dummy (1=male)

		Coefficient	P> z
Overall Liking	3	2.10	0.270
	4	0.89	0.642
	5	2.42	0.168
	6	2.06	0.224
	7	2.99	0.071
	8	3.17	0.054
	9	4.30	0.011
Treatment	Info	3.58	0.045
	InfoTaste	0.66	0.712
	Taste	0.18	0.918
Risk		2.15	0.165
Risk*Treatment	Info	-3.68	0.129
	InfoTaste	-1.91	0.424
	Taste	0.41	0.868
Time		4.67	0.155
Time*Treatment	Info	-8.87	0.085
	InfoTaste	-2.39	0.642
	Taste	-0.44	0.931
Round		0.05	0.113
Income	20-29999	-0.27	0.636
	30-39999	-0.04	0.942
	40-49999	-0.37	0.569
	50-59999	-0.34	0.579
	60-69999	-0.21	0.741
	70-79999	-0.29	0.625
	80-89999	1.01	0.137
	90-99999	-1.11	0.186
	More100K	0.17	0.802
Gender ^c	Under15K	-0.82	0.145
		0.43	0.200
Home Inventory (>14 days)		-0.98	0.012

- Overall liking scores of 7 or above were significant and positive predictors of WTP; WTP increased as scores increased.
- The Info treatment had a significant effect on WTP, although Taste and InfoTaste treatments did not.
- An interaction effect between the Info treatment and time preference was observed. The direction of the coefficient (-8.87) indicates that higher time discount rates were associated with lower WTP within the Info group. In other words, individuals in the Info treatment with less future orientation were willing to pay less than those with higher future orientation in the Info treatment.
- Risk preference was not a significant predictor of WTP.
- Home inventory was a significant covariate. Households that had at least 14 days worth of juice or more had lower WTP than households with less juice.
- Demographic variables such as income and gender did not significantly affect WTP.

Figure 1. Becker-DeGroot-Marschak (BDM) Auction Design

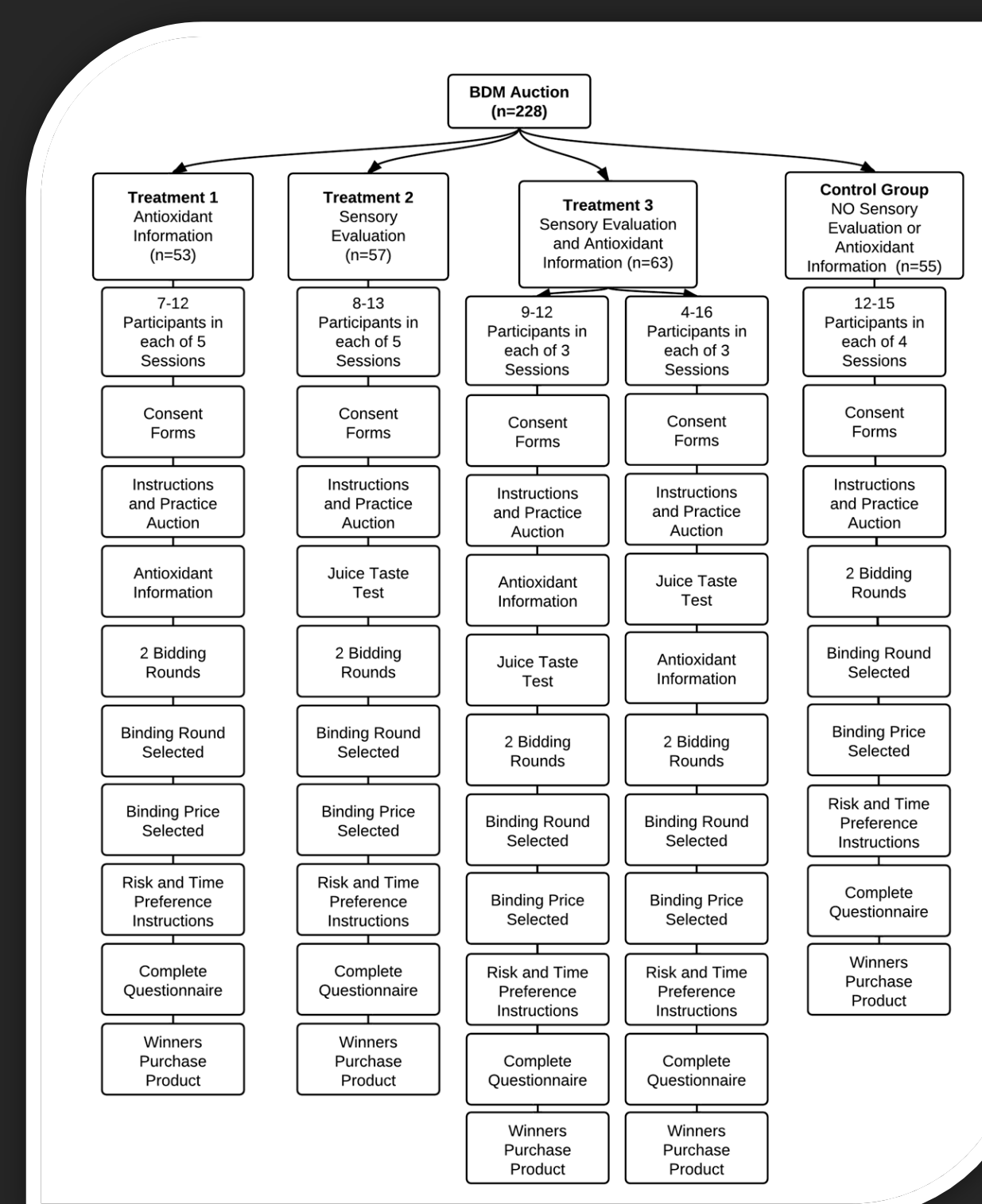


Table 1. Measuring Time Preference

	Option A	Option B	Interest rate
Choice 1	\$300 in one month	\$308 in 7 months	5%
Choice 2	\$300 in one month	\$315 in 7 months	10%
Choice 3	\$300 in one month	\$323 in 7 months	15%
Choice 4	\$300 in one month	\$330 in 7 months	20%
Choice 5	\$300 in one month	\$338 in 7 months	25%
Choice 6	\$300 in one month	\$345 in 7 months	30%
Choice 7	\$300 in one month	\$353 in 7 months	35%
Choice 8	\$300 in one month	\$360 in 7 months	40%
Choice 9	\$300 in one month	\$368 in 7 months	45%
Choice 10	\$300 in one month	\$375 in 7 months	50%

Table 2. Measuring Risk Preference

	Option A	Option B
10% chance of winning \$2, 90% of winning \$1.60		10% chance of winning \$3.85, 90% of winning \$0.10
20% chance of winning \$2, 80% of winning \$1.60		20% chance of winning \$3.85, 80% of winning \$0.10
30% chance of winning \$2, 70% of winning \$1.60		30% chance of winning \$3.85, 70% of winning \$0.10
40% chance of winning \$2, 60% of winning \$1.60		40% chance of winning \$3.85, 60% of winning \$0.10
50% chance of winning \$2, 50% of winning \$1.60		50% chance of winning \$3.85, 50% of winning \$0.10
60% chance of winning \$2, 40% of winning \$1.60		60% chance of winning \$3.85, 40% of winning \$0.10
70% chance of winning \$2, 30% of winning \$1.60		70% chance of winning \$3.85, 30% of winning \$0.10
80% chance of winning \$2, 20% of winning \$1.60		80% chance of winning \$3.85, 20% of winning \$0.10
90% chance of winning \$2, 10% of winning \$1.60		90% chance of winning \$3.85, 10% of winning \$0.10
100% chance of winning \$2, 0% of winning \$1.60		100% chance of winning \$3.85, 0% of winning \$0.10

Table 4. Partial Least Squares Regression Modeling on Willingness-to-pay and Overall Liking for Converted Just-About-Right Variables^{a,b,c}

^aAbbreviations: Treatment group (n=63) who received antioxidant information and who completed the sensory evaluation (InfoTaste), Treatment group (n=57) who only completed the sensory evaluation (Taste), Pomegranate Flavor (Pom Fl), Concord Flavor (Con Fl), Black Cherry Flavor (BlkCh Fl), Astringency (Ast)

^bShading indicates significance of the variable in the PLSR model at $\alpha < 0.05$

^cStudent's T-test models with treatment as x-variable and either overall liking, average WTP, or JAR dummy variables as y-variables indicated differences between treatment groups for overall liking only (InfoTaste: 7.00, Taste: 7.61)

- Patterns were similar for WTP and overall liking when treatment groups were combined. Reductions in overall liking and WTP occurred because of too little sweetness, too much black cherry flavor, and too much bitterness. Reductions in overall liking also occurred because of too much sourness.
- Coefficients indicated the magnitude of the effect on the response variable.
 - For example, the 1.16 *not sweet enough* coefficient for combined groups' overall liking indicated that for every unit of increasing sweetness over the *too little* region (1 to 3), overall liking increased by 1.16. For the same unit and attribute, WTP increased \$0.25 for every unit increase in sweetness over the *too little* region.
- The intercept indicates the maximum liking score or WTP if all variables were JAR.

	InfoTaste+Taste		InfoTaste		Taste	
	WTP	Overall Liking	WTP	Overall Liking	WTP	Overall Liking
Intercept	\$3.56	8.23	\$3.44	7.7	\$3.66	8.33
Too Sweet	0.03	-0.04	-0.03	0.06	0.12	-0.44
Not Sweet Enough	0.25	1.16	0.25	0.84	0.32	1.15
Too Sour	-0.09	-0.56	-0.12	-0.59	-0.32	-0.59
Not Sour Enough	-0.03	0	-0.06	-0.03	-0.05	-0.23
Too Much Pom Fl	-0.03	-0.39	-0.11	-0.17	0.37	-1.51
Not Enough Pom Fl	0.08	0.13	0	-0.06	0.14	0.28
Too Much Concord Fl	0.1	-0.34	-0.07	-0.17	0.25	-0.05
Not Enough Concord Fl	0.11	0.45	0.16	0.28	0.03	0.13
Too Much BlkCh Fl	-0.2	-0.67	-0.29	-0.7	-0.31	-0.01
Not Enough BlkCh Fl	-0.06	0.24	-0.17	-0.14	-0.01	0.23
Too Ast	-0.13	0.1	-0.18	-0.17	0.17	0.08
Not Ast Enough	-0.02	0.15	0.04	-0.03	-0.19	0.88
Too Bitter	-0.29	-0.48	-0.23	-0.59	-0.6	0.26
Not Bitter Enough	-0.06	0.12	-0.16	0.06	-0.07	-0.37

Conclusions

- Information about antioxidants associated with a nutraceutical-rich juice blend increased WTP, which reinforces previous work showing that consumers respond positively to antioxidant information.
- When given information about antioxidants, individuals with less future orientation (i.e., higher time discount rates) were willing to pay less than those with more future orientation. Moreover, findings imply that novel functional food products could be targeted to those who have lower time discount rates (i.e., those who are more future-oriented).
- The WTP penalty analysis method utilized in this study to identify variables not just-about-right (i.e., optimal) could provide more concrete direction to product developers than traditional penalty analysis because monetary units are less abstract than overall liking. The breakthrough of this methodology is that it relates WTP directly to specific sensory attributes.