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Does the order of presentation of extrinsic and intrinsic quality attributes matter when eliciting willingness to pay?

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Abstract: In this study, we estimate consumers' willingness to pay (WTP) for ready meals preserved using microwave assisted pasteurization systems (MAPS)—a novel pasteurization technology, compared to frozen, ready meals. We conducted a laboratory multi-round experimental auction for two samples of ready meal jambalaya in which appearance and sensory evaluation along with extrinsic information was sequentially disclosed to panelists. Our results suggest that when participants tasted the meals and formed an opinion from the meal itself, the liking of appearance and sensory attributes were the most impactful factors for participants' WTP regardless of other available extrinsic (name of the preservation technology and environmental impacts of each technology) attributes. The words "microwave" and "pasteurization" did not negatively impact the WTP. The order in which intrinsic and extrinsic attributes were evaluated and presented did not impact absolute WTP values, but the order did impact the weight of each attribute type on the WTP.

Practical Application: The sensory perceptions had a larger effect than the name of the preservation technology and environmental impacts on the willingness to pay (WTP) for ready meals. The order of presented information to panelists did not impact absolute values of WTP. The words "microwave" and "pasteurization" did not have a negative effect on WTP.

1 | INTRODUCTION

Food choice happens in context of cognitive information, where the sets of intrinsic and extrinsic attributes are given to individuals for them to make their own food choice decisions. Zhang and Vickers (2014) argue that studies analyzing food choice behavior do not usually focus on both intrinsic and extrinsic attributes, and when they do, the effect of the order in which these types of attributes is typically not studied further. In fact, Zhang and Vickers (2014) conducted a study focusing on fresh apples and found that the order of tasting and presenting information on extrinsic quality (i.e., growing method, conventional vs organic, and name of variety) affected the bidding behavior. Specifically, when the product was tasted before extrinsic information was given, the impact of the extrinsic information was minimal. However, when the extrinsic information was presented before the sensory evaluation, the information influenced the bid amounts. Zhang and Vickers (2014) concluded that to minimize the effect of the order of the extrinsic/intrinsic pieces of information, this information should be presented to participants in a balanced way.

Similar findings were recorded by Botelho et al. (2017). They studied the effect of sequential information on willingness to pay (WTP), including sensory tasting and geographic origin of a variety of pears. They found that extrinsic information influenced hedonic liking scores, confirming that blind sensory taste tests provide greater validity when estimating WTP for sensory quality attributes. They found that the order in which extrinsic information and sensory taste occurred did not affect the WTP. However, the order of the information did affect the weight each piece of information exerted on the WTP. When blind tasting was followed by information, the weight of the information in WTP formation was higher than when information and sensory tasting were given simultaneously. Botelho et al. (2017) concluded that there is a risk of overestimating the WTP for extrinsic characteristics that are sequentially communicated to panelists, potentially due to the presence of sub-additivity effects. Sub-additivity refers to the combined effect of two attributes on the WTP being higher than the effect of each attribute separately. For example, the joint WTP for a product that exhibits both organic and fair-trade labels is higher than the WTP for a product that exhibits only the organic or the fair-trade label.

Different from Zhang and Vickers (2014) who used apples and Botelho et al. (2017) who used pears, we used a convenient ready meal that was processed with a new food preservation technology that reduces environmental impact. This reduction is in terms of the carbon footprint associated with the new technology and compared with freezing, the control technology. Specifically, based on estimations and assumptions from literature, the new food preservation technology would save CO_2 emissions by 19% compared to freezing.

Also, this study analyzes the impact of intrinsic and extrinsic attributes. Intrinsic attributes include the evaluation of appearance, aroma, flavor, and texture. Panelists evaluated the appearance and sensory quality and provided their rating score for each attribute, using a hedonic 7-point liking scale, where 1 = dislike extremely and 7 = like extremely. The extrinsic attributes include disclosing the name of the food preservation technology Microwave Assisted Pasteurization System (MAPS) compared to the control technology freezing and the environmental consequences of using these preservation technologies, expressed in terms of carbon footprint emissions, of both food preservation technologies. The impact of the extrinsic attributes was measured by departures in the WTP when this information was disclosed compared to the WTP when the information was not disclosed.

The new food preservation technology, MAPS, consists of applying microwave energy to precooked and packaged meals to enhance safety and sensory quality in terms of external appearance, taste, and texture, relative to existent preservation technologies such as retort (Tang, 2015). When compared to other preservation technologies such as freezing, MAPS exhibits benefits. For example, freezing is used mainly to extend the shelf life of prepackaged meals. Typically, no pasteurization is applied to the prepackaged meals in food processing plants; thus, the cooking instructions on food packaging needs to be followed to ensure that meals are heated to at least 74°C before consumption. This is to inactivate pathogens such as *Listeria monocytogenes*, because freezing alone does not necessarily kill pathogens (Peng et al., 2017; Resurreccion et al., 2013). In addition, MAPS offers environmental benefits through efficient use of both energy and water. This process eliminates the need for freezing and thawing, reducing energy use during food production and at home (Tang, 2015).

The objectives of this study are twofold. First, to analyze how different intrinsic quality (appearance and sensory tasting attributes) and extrinsic quality information (name of the food preservation technologies used and environmental impacts related to each technology) affect the bids for two samples of a convenient, prepared meal in a laboratory experiment where sensory taste and experimental auctions are combined. The study uses order of different pieces of information on panelists' WTP using a multiround experimental auction in which different attributes, including intrinsic and extrinsic quality attributes, were disclosed in subsequent auction rounds. After each disclosure of information, panelists were requested to bid for each convenient meal sample. That is, we measure the effects of the sequence of information by randomizing the order of presentation of the four attribute types.

This study centers on convenient, prepared meals. Past literature states that the purchase of everyday food such as apples involves no cognitive evaluation and is often guided by habits (Botelho et al., 2017). However, the question remains: would consumers exhibit the same behavior when faced with convenient, prepared meals? Costa et al. (2001) define ready meals as "pre-assembled main course components of a meal—a protein (animal or plant), a carbohydrate (starch), and a vegetable source—in single or multiple portion containers, designed to fully and speedily replace, at home, the main course of a home-made meal." Given the myriad of ready meal products in the grocery store, Costa et al. (2001) categorized ready meals by preparation time: (1) ready-to-eat (RTE) meals which are consumed as purchased (e.g., sandwiches, salads), (2) ready-to-heat (RTH) meals that require no more than 15 min of heating before consumption (e.g., refrigerated, frozen, dehydrated, and canned meals), (3) ready to end-cook (RTEC) meals that require more than 15 min of heating before consumption, and (4) ready-to-cook (RTC) meals that are minimally prepared and require full cooking. Considering food safety implications, convenient meals are categorized as RTE and non-RTE. RTE includes meals that are pathogen free because they have gone through a process of pasteurization or sterilization. These foods are heated mainly to achieve taste but not to ensure pathogen death. Non-RTE meals have not gone through a strict pathogen control process and are usually frozen or refrigerated to guarantee extended shelf life. In the case of frozen foods that have not been previously pasteurized or sterilized, food manufacturing companies recommend consumers heat the product to 74°C to ensure the product is safe to eat (Peng et al., 2017). According to the above classifications, this study used a convenient, RTH meal, considering the time preparation criterion classification and RTE considering the food safety criterion. Hereafter, we will refer to the product used in this study as a ready meal.

2 | MATERIALS AND METHODS

2.1 | Data collection

A total of 102 panelists of ready meals were recruited in Pullman, Washington, by using the database of the Sensory Evaluation Facility in the School of Food Science at Washington State University (WSU). To qualify for the experiment, panelists had to be at least 21 years old, be the primary grocery shoppers in their household (i.e., they have all responsibility or equally share it), frequently consume convenience meals (i.e., a minimum every 2–3 months), and could not have any allergy, intolerance, or dietary restriction with the ingredients of the food considered in the study. The experimental procedure was approved by WSU's Institutional Review Board (IRB) for the use of human subjects. The IRB number is 17370-001. The sample size in this study (102 individuals) is low compared to studies following hypothetical experimental methods, and it is not representative of the general population. However, the purpose of the study was not to generalize results about willingness to pay but to analyze information effects on bidding behavior.

In relation to the food product used, this study uses a jambalaya ready meal with a shelf life storage of 15 weeks in cold storage after initial manufacture. The jambalaya meal samples weighed 9 oz per package (equivalent to 250 g, or one individual serving) and consisted of a food matrix of 3.5 oz (100 g) of combinations of different meats (in this case, chicken, shrimp, and Andouille smoked sausage) and 5.5 oz (150 g) of sofrito-based tomato sauce (comprising onion, celery, garlic, pasilla pepper), blended with a combination of Cajun spices and other seasonings. This product was used because it consists of a complex food matrix as a mixture of proteins and vegetables resulting in a full meal. Also, jambalaya is suitable for a MAPS pasteurization process of prepackaged heat-sensitive, high-viscous, semisolid, solid, multi-component meals (Tang et al., 2018). Further, this is a meal familiar to panelists as it is available in frozen and refrigerated versions at local grocery stores of the area of study and was being offered at different local restaurants at the time of the study.

The jambalaya ready meal was cooked, and the two after-cooking preservation technology treatments applied were conducted at the Food Sciences Facilities located at WSU in Pullman, WA. The whole batch of cooked jambalaya was poured into polyethylene trays, each receiving 250 g of jambalaya, and sealed under 200°C for 4 s under a vacuum of 65 mbar with a 400 mbar nitrogen flush. The trays with jambalaya were randomly divided in two halves. One half was preserved using the pilot-scale MAPS line at WSU. The MAPS preservation technology consisted of delivering energy using microwave principles for short-time pasteurization for 90°C for 12.8 min (see Tang et al., 2018 and Tang, 2015 for detailed description of the pasteurization process). After being processed, MAPS meals were stored under refrigeration conditions (2°C ±0.5°C). The other half of the trays with jambalaya was preserved using freezing as the control preservation technology. These samples were stored under freezing conditions (−31°C ±2°C). At weeks 1, 8, and 12, microbial analyses were performed. Trays of both jambalaya samples were randomly selected and sent to Micro-chem Laboratories (Seattle, US). The following analyses from AOAC International Official Methods of Analysis were used to detect spoilage via aerobic plate counts (APC) of yeasts and molds and total coliform. To further assure safety before sensory tasting, the samples were also screened for *Bacillus cereus*, *Salmonella*, *Listeria monocytogenes*, and *E. coli* O157:H7. All microbiological tests were negative for the microorganisms listed.

2.2 | Experimental design

The experiment was performed at WSU Sensory Facilities in Pullman, Washington, over 2 days, February 28 and March 1, 2019. These days when the data collection took place, marked week 15 of storage of the two samples. The study consisted of 8 sessions, in each session a group of 12 to 15 individuals participated, making a total of 102 participants. Upon qualifying for the experiment, panelists were invited to register via Compusense Cloud to one 60-min session scheduled for each day.

Immediately before each session, the frozen meals were thawed in water at room temperature for 1.5 hr, while the refrigerated MAPS trays were just kept in refrigeration until reheating. To ensure even heat distribution, a food warmer Glo-Ray HATCO Corporation was used. During each session, participants read and signed a consent form from WSU's Institutional Review Board. Each panelist was given a unique identification number and was endowed with a $30 cash token. Also, a unique three-digit code was randomly assigned to the two meal samples presented so that panelists were not able infer differences between them further than the information provided by researchers. At each session, researchers introduced the study and explained the sensory evaluations and second price Vickrey experimental auction. This type of auction consists of asking panelists to submit sealed bids. The panelist who submits the highest bid is awarded the good in question and pays the amount equivalent to the second highest bid. After each round, the winner bid was not disclosed to panelists to avoid reference prices and potentially biased value estimates (Corrigan & Rousu, 2006; Drichoutis et al., 2008). Only at the end of all four rounds in each session, the identification code of the highest bidder and the value of the second highest bid for each meal sample in each of the auction rounds were disclosed to panelists. To avoid the so-called "wealth effect," one round and one sample meal in that round were randomly selected as binding. The panelist with the highest bid in the binding round for the binding meal sample was announced as the auction winner in each session. The winner used the cash token to pay the market price (i.e., the second highest bid of the binding round and sample). In exchange, the participants received one 9 oz package of the jambalaya ready meal auctioned. The winner of the auction took home the cash token ($30) minus the market price of the binding jambalaya sample; the non-winners took home the $30 cash token. The second price Vickrey auction format was selected because it creates a valuation environment with tangent incentives and is relatively easy to understand by participants and implement for researchers (Lusk & Shogren, 2007).

Next, researchers requested panelists—following a random sequence in each session—to evaluate the appearance of the samples, to evaluate the aroma, flavor, and texture of the samples, to acknowledge information provided on the food preservation technology used for each sample, and to acknowledge information provided on the environmental aspects related to each food preservation technology.

For the evaluation of appearance, both samples of jambalaya, identified with the three-digit code, were displayed in the front of the room in trays; for the appearance evaluation, panelists did not have their own trays. These trays had a transparent lid, so panelists were able to visually evaluate and examine the meal content appearance. Panelists were required to rate the appearance using a hedonic 7-point liking scale, where 1 = dislike extremely and 7 = like extremely. For the evaluation of the aroma, flavor, and texture, panelists were provided with 40 g of each of the two jambalaya samples, each identified with the three-digit code. Panelists were asked to rate how much they liked each of the attributes by using a hedonic 7-point liking scale, where 1 = dislike extremely and 7 = like extremely. Water and crackers were distributed for panelists to cleanse their palates between tasting samples. To ensure consistency across panelists for the purpose of describing sensory quality attributes, descriptors of each of the sensory attributes were placed at each individual tasting position. For example, overall appearance was described as the overall perception of how the sample being tested looked, it included all the general visual characteristics to be detected (e.g., color, shape, size, surface texture). Aroma was described as the overall perception of volatile aromas released from the sample being tested and detected through the nose. A specific odor or smell may be described for a particular food (e.g., herby, fishy). Flavor was described as the overall perception of the distinctive taste or flavor of the sample being tested (e.g., meaty, salty). Texture was described as the in-mouth reaction (mouth, tongue) to the feel of the surface of specific components of the jambalaya, the shrimp, chicken and sausage, respectively.

Of the extrinsic information disclosed, researchers provided the name of the preservation technology of each sample (MAPS and frozen), a brief description of each method, and the environmental impact, expressed in terms of carbon footprint, associated with each sample. The carbon footprint estimations used in this study were approximates to be used as references only; that is, we did not conduct a rigorous estimation of carbon footprint. The estimations were entirely based on emission data and assumptions made in the studies of Evans and Brown (2012) and Schmidt Rivera et al. (2014). The stages of the MAPS and frozen chains included were: processing, preservation, storage (before distribution), transport to retailer, retail storage, domestic transport, domestic storage, and domestic cook. Based on estimations and assumptions in the two cited studies, we concluded that the frozen, ready meal jambalaya would produce 19% more CO_2 (in g) emissions compared to a MAPS ready meal jambalaya.

As mentioned previously, the order of the appearance, evaluation of aroma, flavor, and texture, and disclosure of the extrinsic information cues were randomized across each of the eight sessions. The assignation of the order of information across sessions yielded four treatments. Each treatment refers to the sequence or order of presenting each piece of information. There were eight sessions and four treatments; therefore, two different sessions were randomly assigned one same treatment. Table 1 shows the sequence of information disclosure under each treatment. Immediately after each piece of information was disclosed, participants were requested to submit bids for each of the two jambalaya samples; therefore, each session presents one treatment (T) with four rounds of bids (R). Round of bids refers to each instance where a bid was submitted by panelists. At the end of the experi-

TABLE 1 Information treatments presented to panelists in each session

	Piece of information appearing first Round 1	Piece of information appearing second Round 2	Piece of information appearing third Round 3	Piece of information appearing fourth Round 4
Treatment 1 $N = 30$	Appearance	Sensory taste	Technology information	Environmental information
Treatment 2 $N = 27$	Appearance	Technology information	Environmental information	Sensory taste
Treatment 3 $N = 23$	Technology information	Environmental information	Appearance	Sensory taste
Treatment 4 $N = 22$	Technology information	Appearance	Sensory taste	Environmental information

Abbreviation: *N*, number of subjects in each session.

ment, participants were asked to fill out a questionnaire asking sociodemographic characteristics, convenience prepared meals purchasing and consumption habits, and attitudes towards new food technologies.

2.3 | Data analyses

This study uses a fixed effects ordinary least squares (OLS) regression because there was no evidence of censoring, as the incidence of zero bids was of 0% in the first three rounds, and less than 1% in the fourth round of bids (Lusk & Shogren, 2007). A total of four regressions were conducted. Each regression considered as dependent variable the bids in rounds 1, 2, 3, and 4, and treatments as binary variables under each round, following,

$$Bid_{\mathrm{nir}} = \varphi_{0r} + \varphi_{1r}A_{\mathrm{nir}} + \varphi_{2r}X_{\mathrm{nir}} + \varphi_{3r}S_i + \varphi_{4r}Env_i + \varphi_{5r}T_t + \varphi_{6r}Bidprev_{\mathrm{nir}} + \varphi_{7r}D_{dn} + e2_{\mathrm{nir}}, \quad (1)$$

where Bid_{nir} represents the bid submitted by panelists n for jambalaya meal i in round r ($r = 1, 2, 3, 4$); A_{ni} depicts the appearance liking rating indicated by panelist n after visually evaluating each jambalaya sample i, in round of bids r, X_{nir} is a vector representing the liking rating for aroma, flavor, texture of shrimp, texture of chicken, texture of sausage evaluated by panelist n, for jambalaya meal i, in round of bids r; S_i is a binary variable that equals 1 if jambalaya meal corresponds to MAPS, 0 otherwise; Env_i is a binary variable that equals 1 if the jambalaya meal corresponds to MAPS and the information on environmental impacts associated with MAPS was disclosed, 0 otherwise; T_t is the binary variable for each treatment ($t = 2, 3, 4$), note that treatment 1 is omitted to avoid the dummy variable trap; $Bidprev_{\mathrm{nir}}$ is the bid in the previous round of bids, submitted by panelist n for jambalaya meal i in round of bids r; D_{dn} is the set of binary variables for characteristics of panelists (d = millennials, household size larger than three members, self-perceived healthy, and the Food Technology Neophobia Scale (FTNS) score); $e2_{nir}$ is the error term distribution with mean zero and standard deviation σ^2; φ_0- φ_7 are the coefficients to estimate.

In relation to the characteristics of panelists, the variable binary variable millennial equaled 1 if the panelist was born in 1981 or after, the binary variable for household size was 1 if the panelist household included three individuals or more, the binary variable self-reported as healthy equaled 1 if the panelist indicated a value equal or greater than 4 in a 5-point liking scale (1 = not healthy, 5 = healthy). Previous studies have suggested that age and health factors influence consumer preferences for convenience food (Brunner et al., 2010; Conley & Lusk, 2019; Costa et al., 2001; Geeroms et al., 2008; Zhang & Gallardo, 2018). The FTNS (Cox & Evans, 2008; Matin et al., 2012) score was measured. This is a psychometric scale to classify panelists based on their fears and awareness towards new food technologies. In this scale, panelists are asked to indicate how much they agree to 7-point liking scale with 13 statements. Panelists' individual ratings on each statement are added together resulting in a global score. Cox and Evans (2008) report that the scale can possibly range from 13 to 99, with higher scores meaning more neophobia. They surveyed a sample of 294 individuals in Australia who displayed an average score of 55, and values ranged from 21 to 88 on the food technology neophobia scale. The scale was also used by Matin et al. (2012) who surveyed a sample of 777 individuals in Canada and reported an average score of 58.45 and values ranging from 21 to 91.

TABLE 2 Summary statistics of panelists' sociodemographic information

Item	Units	Sample ($N = 102$)	Pullman	Washington	United States
Female	%	57.8	49.3	50.0	50.8
Race					
White/Caucasian	%	45.1	81.4	81.1	75.5
Black	%	4.9	4.8	5.5	14.0
Asian	%	33.3	10.7	14.9	6.5
Hispanic	%	12.8	7.2	12.5	17.8
Age	years	33.0	22.0	37.6	37.9
Household size	number	2.2	2.3	2.5	2.6
Household annual income	$/year	46,125	52,029	93,847	84,938
Employment status					
University student	%	57.8			
University staff	%	24.5			
University faculty	%	9.8			
Unemployed	%	2.9	6.6	3.4	3.7
Retired	%	1.0	5.4	14.7	15.2
Military	%	0.0	0.1	0.8	0.4
Self-identified as healthy	%	88.2			
Self-identified as physically active	%	56.9			

Notes: Reported age for the experimental sample ($N = 102$) corresponds to mean age while values reported for Pullman, Washington, and the United States refer to median age. Retired population for Pullman, Washington, and the United States correspond to % of population 65 or older.
Source: U.S. Census Bureau, American Community Survey, 2018: ACS 5-year estimates data profiles (TableID DP02, DP03, DP05).

3 | RESULTS AND DISCUSSION

3.1 | Sociodemographic characteristics and consumptions habits

Table 2 compares our sample of panelists' demographics to U.S. Census data for Pullman, Washington State, and nationwide. Our sample of panelists was 57.8% female, 45.1% Caucasian, and the average age was 33 years old. Students represented 57.8% of the sample. The average household size was two members and the average income per year was $46,125. Compared to the Pullman census, our sample overrepresents females, underrepresents Caucasian, but overrepresents Asian and Hispanic groups. Compared to the Pullman census, our sample is older in age and has a lower annual income. Compared to the Washington State and the U.S. Census, our sample overrepresents females, underrepresents Caucasians, overrepresents Asians, is younger in age, and displays a lower annual income. With regards to self-reported health and physical status, 88% of the sample identified themselves as healthy and 57% as physically active.

Food purchasing and eating habits are presented in Table 3. Overall, 99% of the sample of panelists was the primary shoppers, with 80 trips per year to grocery stores. The major orientation when purchasing food is taste (74% of respondents) followed by health (54% of respondents). When asked about how healthy they considered food prepared at home compared to food away from home, 68% indicated that food prepared at home was healthier than food away from home. Seventy-six percent of respondents considered family meals as important. When asked about the important factors for food purchasing decisions, taste was the most important factor (97% of respondents indicated taste), followed by price (85%), nutrition/healthfulness (83%), safety (77%), and appearance (60%). Forty percent of respondents indicated convenience and 32% environmental impacts.

With respect to convenience meal consumption, participants indicated that they consumed these foods at least 57 times per year. The reasons for consumption were mainly convenience—saves time (79%) and saves energy (14%). Sixty-three percent of respondents indicated they consumed mostly frozen meals, followed by 19% who indicated they consumed mostly refrigerated meals, and 15% who expressed they consumed canned meals. Ninety-five percent indicated they bought the convenience meals at the grocery store. Fifty-two percent indicated that dinner was the time they consume convenience meals, followed by lunch time (38% of respondents). Forty-two percent indicated that convenience meals are mostly consumed at home alone, while 26% indicated they consumed at the workplace alone, and 23% at home with family. Sixty-four percent indicated it takes less than 10 min to prepare the

TABLE 3 Summary statistics of panelists' food purchasing and eating habits

Item	Unit	Sample ($N = 50$)
Primary shopper	**%**	**99.02**
Trips to grocery store	number/year	80.16
Major orientation to food		
Taste	%	73.53
Health	%	53.92
Convenience	%	19.61
Do not care	%	0.98
Food prepared at home is healthier than food away	%	67.65
Family meals are important	%	76.47
Important aspects for food purchasing decisions		
Taste	%	97.06
Price	%	85.29
Nutrition/healthfulness	%	83.33
Safety	%	77.45
Appearance	%	59.80
Naturalness	%	55.88
Familiarity	%	42.16
Convenience	%	40.20
Environmental impact	%	32.35
Fairness	%	24.51
Novelty	%	23.53
Origin	%	18.63
Social image	%	5.88
Frequency of RTE meals consumption	number/year	57.36
Main reasons for consuming RTE meals	Convenience – saves time	
Convenience—saves time	%	79.41
Convenience—saves energy	%	13.73
Flavor liking	%	1.98
Price	%	1.96
Health	%	0.98
Lack of/dislike cooking	%	0.98
Other		0.98
Type of RTE meals consumed	Frozen	
Frozen	%	62.75
Chilled/refrigerated	%	18.63
Canned	%	14.71
Ambient (dehydrated)	%	3.92
Place where RTE meals are mostly bought	Grocery store	
Grocery store	%	95.10
Sit-down restaurant	%	1.96
Take-out restaurant	%	1.96
Meal delivery service	%	0.98
Time when RTE meals are mostly consumed	Dinner	

(Continues)

TABLE 3 (Continued)

Item	Unit	Sample (*N* = 50)
Primary shopper	%	**99.02**
Dinner	%	51.96
Lunch	%	38.24
Breakfast	%	5.88
Snack	%	3.92
Place where RTE meals are mostly consumed	At home, alone	
At home, alone	%	42.16
At workplace, alone	%	25.49
At home, with family	%	22.55
At workplace, with colleagues	%	8.82
Other (school & camping)	%	0.98
Length of time that it takes to prepare RTE meals	Less than 10 min	
Less than 10 min	%	63.73
Between 10–20 min	%	25.49
Between 20–30 min	%	7.84
More than 30 min	%	2.94
Packaging information frequently consulted	Date labels	
Date labels	%	72.55
Ingredient list	%	42.16
Nutrition facts	%	41.18
Statements about health	%	19.61
Statements about sustainability	%	11.76
Technology issues	%	8.82
Statements about fairness	%	1.96
Food Technology Neophobia Scale (FTNS)	Index	
FTNS	Average	44.22
	Range	24–68

convenience meal, while 25% indicated it took between 10 and 20 min. When asked about labels, 73% indicated they looked at date labels, followed by 42% who indicated ingredient lists, and 41% who indicated nutrition facts.

The mean FTNS score for our sample of panelists was 44.22, and the range was 24–68. This result suggests that our sample of panelists present a lower phobia to new food technologies, compared to Cox and Evans (2008) who reported an average score of 55 with values ranging from 21 to 88 and compared to Matin et al. (2012) who reported an average score of 58.45 and values ranging from 21 to 91.

3.2 | Hedonic liking ratings

Table 4 presents the average hedonic liking rating for the set of intrinsic quality attributes: appearance, aroma, flavor, texture of the shrimp, texture of the chicken, texture of the sausage, and overall liking for each MAPS and frozen samples, separately by sample. The table also presents the results of a pairwise *t*-test to infer if the hedonic liking scores between each sample are statistically significant and different. Overall results indicate that average liking ratings are higher for the MAPS compared to the frozen sample for all intrinsic quality attributes. The *t*-test results suggest that only the liking scores for appearance and overall liking are statistically different. Except for appearance and overall liking, from a hedonic perspective, consumers did not perceive differences between the two samples.

3.3 | Summary of bids across treatments

Table 5 reports the average bids by rounds. Pooling all the four rounds of bids, the average bid was $4.01 for the refrigerated MAPS and was $3.60 for the frozen sample. Results from a pairwise t-test confirmed that the bids for the MAPS sample are statistically significant and are

TABLE 4 Sensory attribute liking ratings across samples

Sensory attribute	Average liking rating(1 = "dislike extremely," . . . , 7 = "like extremely" MAPS	Frozen	Pairwise t-testMAPS-frozen *p*-value
Appearance	5.19 (1.04)	3.60 (2.15)	0.071
Aroma	5.60 (1.17)	5.36 (1.13)	0.146
Flavor	5.43 (0.95)	5.25 (1.08)	0.216
Texture of shrimp	5.25 (0.125)	5.10 (1.51)	0.451
Texture of chicken	4.60 (1.54)	4.50 (1.61)	0.657
Texture of sausage	5.57 (1.22)	5.39 (1.26)	0.311
Overall liking	5.32 (0.98)	5.00 (1.18)	0.034

Note: Values in parentheses are standard deviations.

TABLE 5 Average bids for two samples of jambalaya convenience meals, across four bid rounds

Auction round	Average bids ($/9 oz unit) MAPS	Frozen	Pairwise *t*-testMAPS-frozen *p*-value
All 4 rounds	4.01 (2.44)	3.60 (2.15)	0.010
Round number			
Round 1	4.03 (2.65)	3.71 (2.25)	0.356
Round 2	4.00 (2.47)	3.68 (2.13)	0.317
Round 3	4.05 (2.35)	3.58 (2.16)	0.139
Round 4	3.98 (2.29)	3.43 (2.09)	0.077
Pairwise *t*-test comparisons between rounds			
	p-value		
	MAPS	Frozen	All samples
Round 1—round 2	1.000	1.000	0.999
Round 1—round 3	1.000	0.974	0.995
Round 1—round 4	0.999	0.802	0.898
Round 2—round 3	0.999	0.988	1.000
Round 2—round 4	1.000	0.855	0.941
Round 3—round 4	0.997	0.964	0.968

Note: Values in parentheses are standard deviations.

higher than the bids for the frozen sample. Note that average bids are within the bounds of prices of refrigerated and frozen ready-to-eat jambalaya meals of similar size ($2.25–$4.48) available at grocery stores in the area of study, Pullman, Washington.

Results are different when considering each of the four rounds of bids separately; there were no statistically significant differences between the bids for the MAPS and the frozen samples, except for the fourth round of bids where the average bid for the MAPS sample ($3.98) was $0.55 higher than the bid for the frozen sample ($3.43). Recall that when bidding in the fourth round, panelists received all four cues of information given to panelists: visual appearance, sensory taste, technology features of the preservation method, and environmental benefits associated with each technology. However, when comparing bids between rounds, for example, comparing bids in round 1 with bids in round 2; there were no statistically significant differences between bids in each round, for both MAPS and frozen samples. Bids in round 4 showed no statistically significant differences from bids in previous rounds, proving the absence of sub-additive effects in this study, as suggested by Botelho et al. (2017), who implied that the WTP is directly related to the amount of information presented to individuals. If sub-additive effects were present, then bids in round 4 were statistically significant different and higher than bids in rounds 1, 2, and 3.

Table 6 reports the average bids by information treatment, that is, the order in which the four pieces of information were presented to participants. In general, there

TABLE 6 Average bids for two samples of jambalaya meals, across information treatments presented to panelists

Information treatment	Average bids ($/9 oz unit) MAPS	Frozen	Pairwise *t*-testMAPS-frozen *p*-value
T1: Appearance—sensory taste—tech. inf.—env. inf.	3.57 (2.58)	3.27 (2.11)	0.322
T2: Appearance—tech. inf.—env. inf. —sensory taste	4.40 (2.21)	4.03 (2.17)	0.209
T3: Tech. inf.—env.inf.—appearance—sensory taste	4.16 (2.01)	3.61 (1.66)	0.043
T4: Tech. inf.—appearance—sensory taste—env. inf.	3.98 (2.81)	3.51 (2.55)	0.248
Pairwise *t*-test comparisons between information treatments			
	p-value		
	MAPS	Frozen	All samples
T1—T2	0.049	0.039	0.001
T1—T3	0.296	0.667	0.165
T1—T4	0.624	0.851	0.477
T2—T3	0.895	0.507	0.471
T2—T4	0.618	0.336	0.182
T3—T4	0.959	0.991	0.941

Note: Values in parenthesis are standard deviation.

were no statistically significant differences between the bids for MAPS and the bids for frozen at each of the information treatments. Except for treatment 3, where the bids for the MAPS sample were statistically significantly higher than the bids for the frozen sample. Results are slightly different; when comparing differences between bids corresponding to each treatment (for example, bids in treatment 1 compared to bids in treatment 2), there were no statistically significant differences in bids between treatments with one exception. For the MAPS, frozen, and the whole sample, bids in treatment 1 showed statistically significant differences from bids in treatment 2. Recall that in treatment 1, the sensory information was presented before the technology and environmental information, whereas in treatment 2 the sensory information came after the technology and the environmental information. In summary, the results are different according to: (1) comparing overall pooled across treatments and round of bids, bids for each sample, (2) comparing rounds of bids by separate, and (3) comparing bids across treatments for each round.

3.4 | Fixed effects results

Table 7 presents the fixed effects parameter estimates for four regressions, considering bids in round 1, round 2, bids in round 3, and bids in round 4 as the dependent variables (four regressions depicted in equation 1). For the regression showing the bids in round 1 as the dependent variable, the liking ratings for appearance were positive and statistically significant. Treatment 2 compared to treatment 1 had a positive effect on bids in round 1. For the regression showing the bids in round 2 as the dependent variable, the liking ratings for appearance were negative, whereas the liking ratings for flavor, texture of the shrimp, texture of the chicken, and texture of the sausage were positive. Bids in round 1 had a positive and statistically significant effect for bids in round 2. Compared to treatment 1, treatment 2 had a negative effect on bids and treatment 4 had a positive effect on bids, whereas treatment 3 had no statistically significant effect. With respect to panelists' characteristics, the coefficient for household size with three or more members had a negative effect on bids. Also, the coefficient for self-perceived health status was negative, implying the healthier panelists perceived themselves, the lower the bids for round 2.

For the regression using bids in round 3 as a dependent variable, the coefficients for the liking ratings for appearance, the liking ratings for aroma, and the liking ratings for the texture of the chicken were negative. The coefficient for the information on the technology was positive. Also, the coefficients for the bids in round 1 and 2 are positive for bids in round 3. Compared to treatment 1, treatments 2, 3, and 4 had a positive effect on bids in round 3. In relation to panelists' characteristics, being a millennial had a positive effect, whereas self-perceived health status had a negative effect for bids in round 3.

For the regression using bids in round 4 as a dependent variable, the coefficients for the liking ratings for appearance, the liking ratings for texture of the shrimp, and the liking ratings for the texture of the sausage were positive and statistically significant. The coefficient for the information on technology was positive. The bids in round 1 have a negative effect, whereas bids in round 2 and 3 have a positive effect on the bids in round 4. Treatments 2, 3, and 4 had a positive effect on bids in round 4, com-

TABLE 7 Fixed effects parameter estimates depicting treatment effects on bids in each round

Variables	Round 1	Round 2	Round 3	Round 4
Constant	−1.199	−0.550	1.008***	−0.928***
	(0.676)	(0.414)	(0.330)	(0.321)
Liking appearance	0.554***	−0.245***	−0.107***	0.116***
	(0.066)	(0.035)	(0.026)	(0.026)
Liking aroma	–	−0.051	−0.071**	0.036
		(0.042)	(0.029)	(0.031)
Liking flavor	–	0.229***	−0.038	−0.054*
		(0.048)	(0.031)	(0.032)
Liking text. shrimp	–	0.173***	0.011	0.066***
		(0.030)	(0.024)	(0.021)
Liking text. chicken	–	0.098***	−0.062***	0.016
		(0.027)	(0.020)	(0.015)
Liking text. sausage	–	0.109***	0.033	0.064**
		(0.028)	(0.023)	(0.027)
Info. tech./MAPS	0.039	0.102	0.242***	0.384***
	(0.157)	(0.071)	(0.060)	(0.066)
Info. environment	–	–	–	0.013
				(0.068)
Bid round 1	–	0.892***	0.334***	−0.210***
		(0.016)	(0.032)	(0.050)
Bid round 2	–	–	0.602***	0.302***
			(0.034)	(0.047)
Bid round 3	–	–	–	0.705***
				(0.055)
Treatment 2	0.705***	-0.236**	0.319***	0.451***
	(0.237)	(0.114)	(0.078)	(0.097)
Treatment 3	0.186	−0.003	0.294***	0.368***
	(0.228)	(0.090)	(0.074)	(0.090)
Treatment 4	0.109	0.193**	0.218**	0.357***
	(0.257)	(0.085)	(0.095)	(0.118)
Millennial	0.009	−0.001	0.222***	−0.164**
	(0.206)	(0.098)	(0.085)	(0.077)
HH size ≥ 3	−0.131	−0.311***	−0.058	−0.181**
	(0.227)	(0.119)	(0.085)	(0.076)
Healthy	0.290	−0.281**	−0.355***	−0.171**
	(0.236)	(0.123)	(0.088)	(0.078)
FTNS	0.041***	−0.006	0.005	0.008**
	(0.009)	(0.005)	(0.005)	(0.003)
N	816	816	816	816
Adj. R-sq	0.085	0.823	0.869	0.831

Notes: Values in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) denote significance at the 10%, 5%, and 1% levels.

pared to treatment 1. Being a millennial and those with a household size of three or more members had a negative effect on bids in round 4. In this regression, the FTNS had a positive effect on the bids; that is, the higher the neophobia score, the higher the bids. It is possible that having all the four pieces of information reversed the expected rejection to the new compared to the status quo technology.

3.5 | Discussion

The results from the fixed effects model suggest that when the sensory taste (evaluation of aroma, flavor, and texture) happened last—treatment 4 in round 3, and treatment 2 and 3 in round 4—the variable treatment has a positive and statistically significant effect on bids in such rounds (Table 7). These results suggest that when participants tasted the product, their bid tended to increase. In other words, our results support the claim that intrinsic attributes (e.g., appearance, aroma, flavor, and texture) are more impactful than extrinsic attributes (e.g., name of the technology and environmental impacts) on the bids for a ready meal (objective 1).

It is possible that our sample size was not large enough to capture the effect of the information on the preservation technology and the environmental effects of each preservation technology. Also, the less impactful effects of the disclosure of information of the technology on the bids compared to the effects of the evaluation of appearance and sensory quality could be related to the panelists' familiarity with the words "microwave" and "pasteurization." Lusk et al. (2014) considered that new food technologies are perceived as riskier and are less likely to be accepted, among other reasons, when "early names given to and discussion of the technology are emotional and negative and are more available to consumers" and that the "food technology is perceived as unnatural or impure." In this sense, the words "microwave" and 'pasteurization," given their widespread use, do not elicit the negativity of other food technology terms such as "genetic modification." Moreover, consumers expect that when consuming a ready meal, a level of processing and preservation is expected; that is, there is an expectation that the food will not be "natural" and that this will be affected in some degree with "human technological advances" (Lusk et al., 2014).

This study also adds to the evidence of previous studies in that the order of the presentation of attributes affects the final WTP estimates in food preference elicitation studies (objective 2). Our results somehow concur with Zhang and Vickers (2014) that when sensory properties of products are presented before extrinsic attributes, the impact of the extrinsic information is minimal. This is observed in treatment 4, where sensory is presented before environmental information: the latter was not statistically significant. We cannot conclude the same as Zhang and Vickers (2014) in that when the extrinsic information is presented before the sensory evaluation, the information can bias the bid amounts; in any case, it can affect the perception or the sensory liking ratings. Finally, our results agree with Botelho et al. (2017), in that the order in which extrinsic information and sensory taste happened did not affect the WTP per se. In this study, there were no statistically significant differences between bids in each treatment across all rounds, except for bids in treatment 1 and 2 (results in Table 6). However, when analyzing rounds separately, there is an effect of treatments on the bids as presented in Table 7. Also, our results are aligned with Botelho et al. (2017) in that the order of the information did affect the weight each piece of information exerted on the WTP. Fixed effects results in Table 7 lead us to conclude that the order (treatments) does affect the weight of each piece of information on the final bids. Different from the cited authors, this study does not find evidence of sub-additivity effects of the information presented.

4 | CONCLUSION

Our results suggest that when experiments include sensory taste evaluation, the liking ratings of sensory attributes (including appearance, aroma, flavor, and texture) are impactful to bids regardless if extrinsic information is available and independent of the sequence in which information is provided. In addition, we found that the sequence in which information is presented affects the impact each piece of information exerts on bids, when analyzing the effects by rounds of bids. However, the sequence of information does not affect the overall bid magnitudes. With regards to extrinsic information, the environmental benefits associated with either food preservation technology did not have an effect on bids.

This study concludes that the order of information in studies aiming to depict food choice behavior is important, especially when aiming to measure the effect of both intrinsic and extrinsic quality impacts on WTP. It is possible that the weight that extrinsic information has on the WTP depends on the type of information and the food product being studied (for example, foods that are purchased as habits versus foods that are not). Also, when analyzing food choice behavior, it is important to mimic as close as possible a realistic food purchase situation. Botelho et al. (2017) suggest that consumers are usually presented with information in a simultaneous and not sequential manner and that sensory tasting is not part of the initial set of information that triggers purchase. Therefore, one should be cautious when concluding on the real effects of each piece of information on the WTP or purchase intention. Given the limitations on the sample size of panelists participating in this study, our results cannot be generalized to provide insights useful to design commercialization and promotion strategies aimed to introduce foods produced with new preservation technologies.

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AUTHOR CONTRIBUTIONS

Conceptualization-Equal, Formal analysis-Equal, Methodology-Equal, Resources-Equal, Software-Equal, Writing-review & editing-Equal: Dolores Garrido Garcia. Conceptualization-Equal, Data curation-Equal, Formal analysis-Equal, Funding acquisition-Equal, Investigation-Equal, Methodology-Equal, Project administration-Equal, Resources-Equal, Software-Equal, Supervision-Equal, Writing-original draft-Equal, Writing-review & editing-Equal: R. Karina Gallardo. Funding acquisition-Equal, Methodology-Equal, Resources-Equal, Supervision-Equal, Validation-Equal, Writing-review & editing-Equal: Carolyn Ross. Formal analysis-Equal, Methodology-Equal, Resources-Equal, Writing-review & editing-Equal: Maria Montero. Funding acquisition-Equal, Project administration-Equal, Resources-Equal, Supervision-Equal, Writing-review & editing-Equal: Juming Tang.

CONFLICT OF INTEREST

None to declare

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