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## Serving Size and Gender Effects on Product (Lemonade) Acceptance and Just-Right Attribute Ratings

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**Abstract:** The serving size and gender effects on product acceptance and ideal attribute (lemonade flavor, sourness and sweetness) ratings of lemonade were investigated using a 15-point hedonic scale and a 5-point just-right scale, respectively. Females (67) and males (68) consumed a 4 oz (118 ml) sample *ad libitum*, or a full 8 oz (236 ml) serving. *Ad libitum* male consumption was not different ( $p>0.05$ ) from female consumption. A low correlation ( $R^2=0.011$ ) was observed between the amount of lemonade consumed and product acceptability or just-right attribute ratings. Neither serving size nor gender had an effect on the overall acceptability ( $p>0.05$ ). However, the interaction of gender and serving size affected the overall acceptability ( $p\leq 0.05$ ) and sweetness ( $p\leq 0.10$ ). Male acceptability scores were lower ( $p\leq 0.05$ ) than female scores under *ad libitum* conditions. Male acceptability scores increased ( $p\leq 0.05$ ) with increased sample size. There was no significant difference observed for lemonade flavor, sourness or sweetness just-right ideal scores as the sample size increased ( $p>0.05$ ). A higher proportion of males rated the sweetness just-about-right as compared to females ( $p\leq 0.05$ ). This study showed that consumption of a standard serving size did not result in sensory specific satiety, but several interesting gender effects were found.

**Key Words:** product attributes, product acceptability, serving size and gender

### Servis Miktarı ve Cinsiyetin Ürün (Limonata) Kabulü ve Tam-Doğru Özellik Sınıflamasına Etkileri

**Özet:** Servis miktarı ve cinsiyetin limonatanın kabul edilebilirliği ve ideal özellik (limonata aroması, ekşilik ve tatlılık) sınıflamasına etkileri sırasıyla 15-noktalı hedonik skala ve 5-noktalı tam-doğru skala kullanılarak araştırıldı. Bayanlar (67) ve erkekler (68) 118 ml örneğin istedikleri kadarını ve 236 ml örneğin tamamını tükettiler. Erkeklerin istenildiği kadar koşulu altındaki tüketim miktarı bayanlarınkinden farklı değildi ( $p>0.05$ ). Tüketilen miktarla kabul edilebilirlik veya tam-doğru özellik puanları arasında düşük korelasyon gözlemlendi ( $R^2=0.011$ ). Servis miktarı ve cinsiyet genel kabul edilebilirliği etkilemedi ( $p>0.05$ ). Fakat servis miktarı ve cinsiyet arası etkileşim genel kabul edilebilirliği ( $p\leq 0.05$ ) ve tatlılık derecesini ( $p\leq 0.10$ ) etkiledi. İstenildiği kadar tüketim koşulu altında erkeklerin ürün kabul edilebilirliğine verdikleri puanlar kadınlarınkinden düşüktü ( $p\leq 0.05$ ). Erkeklerin ürün kabul edilebilirliğine verdikleri puanlar servis miktarı arttıkça arttı ( $p\leq 0.05$ ). Servis miktarı arttığında limonata aroması, ekşilik ve tatlılık tam doğru ideal özellik puanlarında önemli bir değişme gözlenmedi ( $p>0.05$ ). Kadınlara kıyasla tatlılığı tam doğru olarak niteleyen erkeklerin oranı daha yüksek bulundu ( $p\leq 0.05$ ). Bu çalışma, standart servis miktarının duyuşal doyuma yol açmadığını, fakat birçok ilginç cinsiyet etkisinin bulunduğunu ortaya koymuştur.

**Anahtar Sözcükler:** ürün özellikleri, ürün kabul edilebilirliği, servis miktarı ve cinsiyet

## Introduction

During central location sensory testing, consumers are generally asked to evaluate more than one product in order to gain an understanding of the relative advantages and disadvantages of each product, as well as to maximize cost and time efficiency. To maintain sensory sensitivity, participants consume a smaller amount of each sample than they would in a typical home use setting.

In central location tests (CLTs) of beverages, consumers are often served 4 fluid ounces of each product, just enough to take a few sips to provide the required 'mouthfulness' necessary for evaluation of the product. In contrast, in home-use testing (HUT) consumers are generally given only one or two test variants to consume *ad libitum* for evaluation. While the actual serving size consumed in home-use testing is unknown, it is generally assumed to be approximately 8-12 fluid ounces.

Industrial sensory studies often report inconsistencies between consumer hedonic responses to products evaluated in CLT and HUT conditions. Response inconsistencies between these two methods of consumer sensory studies can be attributed in part to the different serving size used. It is reported (Cabanac, 1971; Rolls et al., 1981) that the pleasantness of a food tends to decrease as the food is consumed. The hypothesis for this phenomenon, known as alliesthesia, states that stimuli which satisfy a physiological need such as thirst or hunger are perceived as pleasant. However, when the need no longer exist or is satiated, the same stimuli are perceived as less pleasant or unpleasant (Cabanac, 1971). The extent to which there is a decrease in pleasantness with increasing consumption is found to be relatively specific to the food consumed, and is thus referred to as sensory specific satiety since it is not solely dependent on metabolic feedback (Rolls et al., 1983; Drewnowski et al., 1982). If a food product exhibits sensory specific satiety, one might expect that consuming different serving sizes of the product would produce different hedonic responses. Consequently, the hedonic responses obtained under brief exposure CLT conditions may not actually correlate with, and therefore may not predict, consumption in HUT conditions.

Studies on gender differences in adult human food preferences have differed so much in methodology and in the types of foods examined that it is impossible to

determine if conflicting results can or cannot be reconciled (Logue and Smith, 1986). Vickers (1988) reported a lack of gender effect on the hedonic response or attribute ratings in lemonade. In contrast, significant gender effects on food preferences were reported by Rappoport et al. (1993), Logue et al. (1988), Logue and Smith (1986), Wyant and Meiselman (1984), and Einstein and Hornstein (1970).

The objectives of this study were to use one test variant, a situation typical of the consumer drinking experience, to determine the effects of gender and serving size on perceived product attributes and overall product acceptability. The responses to a full eight-ounce serving of lemonade are compared to *ad libitum* consumption of a four-ounce serving. Secondly, the study investigated the correlation between product acceptability, attribute ratings and the actual amount consumed when panelists were instructed to take a few sips of a four-ounce serving.

## Materials and Methods

### Sample Preparation

Lemonade flavored drink mix in powder form was obtained from Kroger (Columbus, OH). Cold water (4°C) was used to prepare the lemonade according to manufacturer's instructions. Powdered lemonade mix (169 g) was measured into a pitcher and 2.2 liters of cold water was added. The solution was stirred to completely dissolve the powdered mix. The prepared drink was covered and refrigerated (8.9-11.1°C) for a maximum of 2 hours prior to serving.

### Panelists

Panelists (n=135) aged 16 to 55 were randomly recruited for the study from among OSU students, staff and faculty. Healthy subjects who were consumers of this product category were selected by a prescreening questionnaire. Sixty-eight panelists (33 female and 35 male) consumed a full 8 oz of lemonade, while sixty-seven panelists (34 female and 33 male) consumed a 4 oz sample *ad libitum*, with instructions to take a few sips.

### Testing Procedure

Panelists were first prescreened using a demographic questionnaire in order to obtain information about their gender, age, and general health conditions before they evaluated the product. The 4 oz and 8 oz samples were

served to selected panelists using completely randomized design.

The weights of the 4 oz samples were prerecorded before serving to the panelists. Panelists that were served the 4 oz samples were instructed to “take a few sips” and then evaluate each sensory attribute and overall product acceptability. After the panelists finished their evaluations, the volume of sample remaining in each cup was weighed to determine the actual amount of sample consumed in a few sips. Panelists receiving the 8 oz sample were instructed to consume the entire sample, and then complete the product evaluation.

### Sensory Ballot

Consumer acceptance was measured using a 15-point hedonic scale where 15 corresponded to “like extremely” and 1 to “dislike extremely”. The intensity of the lemonade flavor, sourness/tartness and sweetness attributes were measured on a 5 point “just-right” scale, where 5 corresponded to “much too strong”, 1 to “much too weak”, and 3 to “just about right”. In addition, a comment column on each ballot was provided. Responses from the panelists provided additional information on factors they considered important.

### Statistical Analysis

Product acceptability scores were analyzed by analysis of variance (ANOVA) using a completely randomized design by SAS (1998). Significant differences between treatment means were compared using Tukey’s multiple comparison test at the 95% and 90% confidence levels (Neter et al., 1990; O’Mahony, 1986). For product attribute ratings, a chi-square test was conducted at 95% and 90% confidence levels (Meilgaard et al., 1991).

### Results and Discussion

The percentage of panelists who consumed non-carbonated lemon flavored fruit beverages was determined by preliminary screening. The data indicated that the panelist population was very familiar with the powdered lemonade category, consumed similar products often, and in general enjoyed drinking lemonade-like beverages. Ninety-two percent of the screened panelists reported that they consumed beverages in the category tested. The product was most often consumed on a once weekly basis (32%), followed by daily (29%), and twice-weekly (15%). The recruitment of panelists mainly

occurred on the Ohio State University campus; consequently the largest age group (40%) consisted of 17-to 24-year-olds, the traditional age range for college students. A significant number (35%) in the age range of 25 to 34 years old also participated. Panelists in the 35 to 44, 45 to 54 and 55+ age groups were 12%, 9.6% and 3.6%, respectively.

The actual amounts of lemonade consumed by the panelists in the 4 oz (118 ml) *ad libitum* sip condition were obtained from pre- and post-consumption sample weights when panelists were asked to “take a few sips” and evaluate the beverage. Males sipped an average of  $78.7 \pm 39.3$  ml of lemonade, while females sipped an average of  $60.1 \pm 36.7$  ml. *Ad libitum* male consumption was not statistically different ( $p > 0.05$ ) from female consumption due to the wide range of variation among individuals. A low correlation ( $R^2 = 0.011$ ) was observed between the amount of sample consumed and product acceptability and just-right attribute ratings, which is consistent with the reports of Shepherd et al. (1991), Popper et al. (1989) and Bellisle et al. (1988). These researchers also found no correlation between just-right measures of the preferred level of saltiness and the amount of product consumed *ad libitum*.

The significances of panelist gender, serving size and gender x serving size interaction on product acceptability and product attributes are given in Table 1. The mean scores for overall acceptability are shown in Figure 1. Scores for overall acceptability were not influenced by gender ( $p > 0.05$ ) or serving size ( $p > 0.05$ ). However, the interaction of gender and serving size did influence ( $p < 0.05$ ) the overall acceptability scores (Table 1). While Vickers (1988) also reported that neither the amount of lemonade consumed nor the gender of the subject had an effect on the scores assigned to samples or the just-right sucrose concentration, her study failed to detect a serving size x gender interaction. Our results showed a significant difference ( $p < 0.05$ ) between male and female acceptability scores under the *ad libitum* 4 oz sip condition, with males giving lower acceptability scores than females (Figure 1). Among the male panelists, those in the 8 oz serving size group had a higher average acceptance rating than those in the 4 oz serving size group ( $p < 0.05$ ). However, there was no significant difference ( $p > 0.05$ ) observed between female 8 oz and 4 oz acceptability scores.

Treatment Effect	df	Product Attributes			Overall Liking
		Sweetness	Sourness/Tartness	Lemonade flavor	
Gender	1	0.009**	0.549	0.530	0.30
Size	1	0.427	0.799	0.436	0.35
Gender <sup>x</sup> Size	3	0.057*	0.651	0.785	0.03**

Table 1. Probability table of product responses by gender, size and interactions.

\*\*Significant at  $p \leq 0.05$   
 \* Significant at  $p \leq 0.10$

Table 2. Percent distribution of just-right scale scores given by male and female for product attributes.

Just-Right Score	Sweetness				Sourness/Tartness				Lemonade Flavor			
	Females		Males		Females		Males		Females		Males	
	4oz	8oz	4oz	8oz	4oz	8oz	4oz	8oz	4oz	8oz	4oz	8oz
1	2.9	3.0	0	0	5.9	0	3.0	0	2.9	9.1	6.1	0
2	29.4	15.2	24.2	14.3	17.7	27.3	33.3	34.3	50.0	33.3	48.5	42.9
3	52.9	60.6	75.8	80.0	47.1	54.6	51.5	40.0	47.1	51.5	39.4	48.6
4	14.7	21.2	0	5.7	29.4	15.2	12.1	22.9	0	6.1	6.1	5.7
5	0	0	0	0	0	3.0	3.0	2.9	0	0	0	2.9

Total number of observations: Female (4oz=34, 8oz=33); Male (4oz=33, 8oz=35).  
 1: much too weak 3: just about right 5: much too strong

The percentages of male and female panelists under 4 oz ad *libitum* sip and 8 oz drink conditions reporting scores on the 1-5 just-right scale for the product attributes are given in Table 2. The percentages of “just about right scores” for the product attributes are illustrated in Figure 2. The percentage of just-right ideal scores given for the sweetness attribute was greater than the scores given to other product attributes under all test conditions. Overall, males from both serving sizes gave significantly higher percentages of just-right scores for sweetness than their female counterparts ( $p=0.009$ ) (Table 1). However, the percentages of ideal just-right scores of both female and male panelists did not significantly change as the serving size increased ( $p>0.05$ ).

The percentages of both females and males rating the sourness/tartness attribute at the just-right ideal showed that there was no significant difference between 4 oz and

8 oz serving sizes ( $p>0.05$ ). Fifty percent of females under the 4 oz ad *libitum* sip condition indicated the lemonade flavor to be below the just-right ideal, while 47.1% indicated the sample had ideal lemonade flavor (Table 2). Increasing the sample size to 8 oz did not impact the female perception of lemonade flavor just-right ideal, as only 51.5% of these panelists rated the 8 oz sample as ideal. Overall, chi-square tests of the just about right ratings show that the gender effect in sweetness was significant at the 0.05 level and gender x size interactions were significant at the 0.10 level.

Following the hypothesis of sensory specific satiety and alliesthesia, one would expect the scores to move away from the just-right ideal as the exposure to the drink was prolonged, as in the 8 oz sample. Instead, there was no significant difference observed for the lemonade flavor, sourness/tartness or sweetness just-right ideal scores as the sample size increased ( $p>0.05$ ).

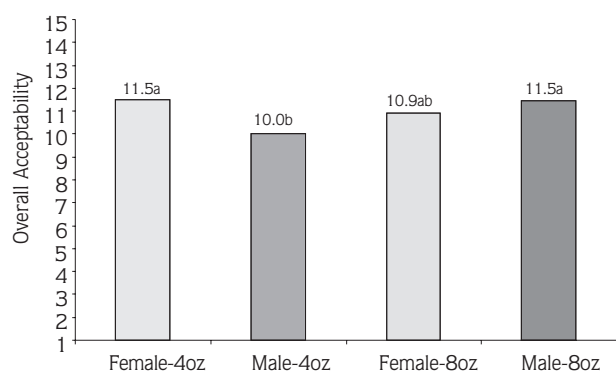


Figure 1. Effects of gender and serving size on overall acceptability. Means followed by different letters indicate that the values are significantly different ( $p \leq 0.05$ ).

These findings are in contrast to the usual finding of sensory adaptation, where intensity ratings decrease with prolonged exposure to stimulation. In accordance with previous studies (Vickers, 1988), our data showed that lemonade did not cause sensory specific satiety.

In summary, our results suggest that the typical serving size used in short exposure central location taste tests may give a different estimation on some attributes when used to project product acceptance in home-use conditions, and panelist gender contributes significantly to this difference. Our results are in contrast to those of Shepherd et al. (1991), Griffin and Stauffer (1990), and Vickers (1988), who reported that the results of CLT and HUT tests, which differ in the panelists' exposure time to the product(s), relate reasonably well with no gender difference. In contrast to our study, panelists in these studies evaluated a series of different test variants (with or without varying sample size), with the conclusion that liking or preference ratings from short exposure (CLT) conditions, were similar to those from longer exposure (HUT) conditions. Our study indicates that once product optimization has occurred, male consumer acceptability

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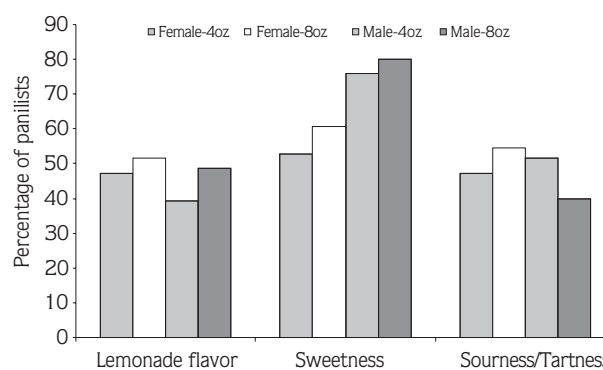


Figure 2. The percentages of "just about right scores" for product attributes (just about right score: 3 on 1 to 5 just right scale).

scores of the "ideal" product will vary significantly when the product is compared using serving sizes typical of CLT and HUT tests. An additional issue of concern is the tendency of female panelists to give lower acceptability scores in conditions typical of HUT tests, as a shift in the just-right ideal may occur when larger volumes of the product are consumed. Since there are few reported studies that evaluate a single test variant under conditions that simulate CLT and HUT test conditions, further studies investigating female subject's acceptability should be conducted in the future.

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