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Urban Consumers' Demand for Fruit Attributes: A Conjoint Analysis

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ABSTRACT

Identification of consumer preferences is important in designing products with maximum consumer demand to capture the market share. This study evaluated consumers' stated preferences for fruit attributes in four popular fruits among the urban consumers; grapes, sweet orange, pear and pomegranate via conjoint analysis. Obtained ranked data were analyzed using Rank Ordered Logistic Regression (ROLOGIT) model and Relative Importance (RI) of attributes were calculated for product attributes. Crispness was the critical attribute in pear while shelf life with sweet orange. Pomegranate consumers prefer bitter free fruits with soft seeds in their purchasing decision. Safety assured grapes are 3.2 times more likely than cannot be assured grapes. The results highlighted price as a mild influencing factor. Preferences were not much vary with the age of the respondent. When people become older, they get more conscious on health in terms of safety aspects of fruits. The findings may be used as a reference for fruit breeders to design their products.

KEYWORDS: Conjoint analysis, Consumer preference, Fruits, Part-worth, Relative importance

INTRODUCTION

Firms introducing new products into competitive markets need current and extensive information about consumer preferences to develop products most likely to capture the market share. Here, preferences refer to consumers' expressed like or dislike for a product based on an overall evaluation or overall attitude toward the product (Deliza *et al.*, 2005). Information about consumer preferences can be distilled by splitting down products into their constituent attributes. The quantitative measurement of how each attribute function in generating overall consumer use for the product is vital to designing products that maximize consumer demand (Green and Srinivasan, 1990). Consumer preference information can also help firms selling products to develop specific strategies targeting niche markets and increase sales through product diversification (Manalo, 1990).

Studies on consumers' preferences for food product attributes have been conducted to determine the most preferable attributes and identify the critical factors affecting consumers' preferences. Consumer preference identification/ willingness to pay (WTP) estimation methods can be divided into two categories revealed preference, which uses actual or simulated price response data, and stated preference, uses survey data. This study evaluated consumers' stated preferences for selected fruit product attributes using conjoint analysis in an effort to generate information that can be used to design fruit breeding programs very effectively and efficiently.

Dominant fruit species among urban consumers namely, grapes (*Vitis vinifera*), sweet orange (*Citrus sinensis*), pear (*Pyrus communis*) and pomegranate (*Punica granatum*) were used in this study. These fruits are mostly imported to Sri Lanka, either because of unavailability of cultivars adapted to local conditions or less consumer acceptance for the available local types. The objectives were to evaluate fruit attributes, which are important to consumers, and to define overall product with the optimum combination of features. Moreover, the estimates of customer judgments were used to predict preferences for new products. The results have been discussed in relation to marketing and policy implications.

METHODOLOGY

Theoretical Framework

This research implemented a conjoint analysis (CA) to determine consumer preference for fruit attributes. This method measures the satisfaction from a product with multiple attributes (Green and Srinivasan, 1990). The estimation technique measures individuals' preference *via* a systematical variety of product attributes by assigning to each attribute level a value called part-worth that indicates the relative importance of that level to the respondents (Wang *et al.*, 2003; Hair *et al.*, 2010). The importance of one attribute is based on the range of the part-worths (Breidert *et al.*, 2006).

A full profile conjoint approach was applied in this research. In this method, subjects are presented with stimuli that include all attributes and each with one of their levels. This

is the traditional conjoint approach of data collection (Wehmeyer and Lankenau, 2005).

The analysis was carried out in Stata (version 14) using Rank-Ordered Logistic Regression (ROLOGIT) (Beggs *et al.*, 1981). Four separate Rank Ordered Logistic models were developed to independently analyze the results. Underlying random utility function, which is generated by the ROLOGIT model, can be presented as;

$$U_{ij} = \mu_{ij} + \varepsilon_{ij} \quad (1)$$

Where, U_{ij} is the utility of ith respondent generated by jth item and μ_{ij} is the degree to which respondent i prefers item j over other item. ε_{ij} is the Error term (random component).

μ_{ij} can be decomposed into linear function of a set of explanatory variables (Allison and Christakis, 1998) as,

$$\mu_{ij} = \gamma Z_j + \Theta w_{ij} \quad (2)$$

Where, Z_j contains variables that vary across items but are the same for all respondents and w_{ij} contains variables that describe a relation between item j and respondent i .γ and Θ are the coefficients to be estimated.

Then, the indirect utility estimation is;

$$U_{ij} = \gamma Z_j + \Theta w_{ij} + \varepsilon_{ij} \quad (3)$$

Odds ratios were calculated from exponentiation of the model's coefficients for easy interpretation of results (Long and Freese, 2006).

Relative importance for product attribute i (RI_i) was calculated based on methods similar to Harrison *et al.* (2002):

$$RI_i = (range_i * 100)/\Sigma (ranges)$$

Where, RI is the relative importance computed for product attribute i. The highest and lowest coefficients for each attribute were subtracted to find the range. It was divided by the aggregate range for all attributes in the model and multiplied by 100 to calculate RI_i.

Breeding programs are long term projects. Preferences can be changed from generation to generation. Therefore, it is beneficial to know the current as well as future demand for fruit attributes. Interaction effects with age variable provides more realistic information in this context. Hence, in addition to the original product attribute only models, additional models were calculated by including variable interactions. The interaction variables were obtained by multiplying the original product attribute variables by age variable.

Stimulus Set Construction

Product attributes and their levels have been selected based on literature review and expert assessment. The price, which normally has a high contribution for the consumer, was taken as an important attribute in each fruit. All attributes had two opposite levels (Table 1).

The CA design resulted in a total of 128 combinations for pomegranate and 64 combinations for grapes, sweet orange, and pear. An orthogonal fractional factorial design used in SPSS (version 23) made the task convenient by reducing profile (stimulus card) number to eight for each fruit. An example of the stimulus cards used in the survey is presented in Figure 1.

Small size Green colour Round shape Sweetness-high Crispness-high 60/=	Large size Green colour Pear shape Sweetness-high Crispness-high 100/=
RANK ☐	RANK ☐

Figure 1. Stimulus cards for pear

Table 1. Attributes and their levels

Attribute	Pear	Pomegranate	Grapes	Orange
Peel Colour	Green, Yellow	Pink, Yellow		Green, Orange
Size	Small, Large	Small, Large	Small, Large	
Shape	Round, Pear			
Sweetness	High, Low	High, Low	High, Low	High, Low
Crispness	High, Low			
Aril Colour		Red, Pink		
Hardness of Seed		Hard, Soft		
Bitterness		Bitter, Not		
Seeds			Have, Seedless	Have, Seedless
Firmness			High, Low	
Safety Assurance			Assure, Not	
Flesh Colour				Orange, Yellow
Shelf Life				High, Low
Price*	100/=, 60/=	250/=, 100/=	100/=, 40/=	60/=, 30/=

*Note: *Per fruit for pear, pomegranate and orange. For grapes, it is for 100g*

External attributes were shown in pictorials to make the exercise more realistic while internal characteristics were verbally explained.

Collection of Data

A questionnaire based face to face interviews were carried out in urban population of Colombo District within three Urban Councils named; Maharagama, Kesbewa and Piliyandala. It covered nine Grama Niladhari (GN) Divisions selected by simple random sampling during the period from February to March, 2016. The research was conducted in households using two different samples to reduce the effects of respondent fatigue. Households were selected randomly by using the Grama Niladhari lists. A respondent evaluated two fruits: either grapes and sweet orange or pear and pomegranate. The respondents' task was to rate each stimulus from one to eight, where one indicates most preferred and eight indicates least for the product described.

RESULTS AND DISCUSSION

Descriptive Statistics of the Samples

The study used two samples. To evaluate grapes and sweet orange 103 completed responses were collected while 102 for pear and pomegranate. Samples were not considerably different from each other. Majority of both the samples were females (> 70%) while > 40% had education up to tertiary level. Mean age was around 40 years and income was in the range Rs. 50, 000-55,000.

Results of Rank Ordered Logistic Regression

All variables were categorical (dummy) except price. Results for dummy variables should be interpreted compared to base levels which are not included in the results (Table 2). Results show that limited number of attributes were significant with a p value of 0.05. However, in grapes, all the attributes other than price were statistically significant at 5% error level. It could be attributed to the availability of a variety of products in the market for consumers to select from when making their purchasing decision. Although some attributes were non-significant their signs are meaningful to discuss. Attributes with positive signs or having an odds ratio >1 indicate that consumers prefer that level of the attribute more than the base category. That is there is a higher probability of choosing the level coded as 1 than the base category which was coded as 0. For attributes with negative sign or odds ratio <1, the opposite is true (Table 2).

The most favorable combination of attributes for each fruit could be identified. A small, pear shape, crisp pear with a yellow peel and a sweet-sour balanced taste is preferred at a cost of 60/=. Pink colour large pomegranates costs 100/= with soft seeds covered by red, low sweet but bitter free arils will satisfy the customer to a great extent. Safety assured, large, very sweet and high firm grapes at a low cost is the most favored. Seedless grapes were tended to be rejected. Seeded grapes contain additional protein, minerals and fat (including omega -3s) compared to seedless grapes. This may be the reason for prefer seeded grapes. People like a seedless, high sweet orange with a high shelf life per cost of 30/=. Also their peel should be green in colour and the flesh need to be orange.

Estimated ROLOGIT coefficients (Table 2) were used in the calculation of relative importance (RI) of attributes to the total product (Figure 2).

Table 2. Results of the Rank Ordered Logistic Regression

	Pear			Pomegranate			Grapes			Sweet Orange		
Var.	Coef.	Odd	P Val.	Coef.	Odd	P Val.	Coef.	Odd	P Val.	Coef.	Odd	P Val.
PC	-0.028[a]	0.97	0.72	0.011[b]	1.01	0.89				-0.115[c]	0.89	0.15
LS	-0.089	0.91	0.27	0.137	1.14	0.08	0.247	1.28	0.00			
PS	0.065	1.06	0.41									
VS	-0.040	0.96	0.63	-0.040	0.96	0.63	0.311	1.36	0.00	0.203	1.22	0.01
C	0.588	1.80	0.00									
RA				0.011	1.01	0.89						
SS				0.339	1.40	0.00						
NB				0.360	1.43	0.00						
S							-0.188	0.82	0.02	0.070	1.07	0.39
FL							-0.255	0.77	0.00			
SA							1.163	3.19	0.00			
OF										0.003	1.00	0.97
HSL										0.729	2.07	0.00
P	-0.005	0.99	0.01	-0.001	0.99	0.07	-0.002	0.99	0.13	-0.005	0.99	0.05

Note: Prob > chi2=0.0000 for all four models, Var.-Variable, Coef.-Coefficient, Val.-Value, PC-Peel Colour, LS-Large Size, PS-Pear Shape, VS-Very Sweet, C-Crisp, RA-Red Aril, SS-Soft Seed, NB-Not Bitter, S-Seedless, FL-Firmness -Low, SA-Safety Assured, OF-Orange Flesh, HSL-High Shelf Life, P-Price, aBase product attribute for comparison: yellow, bBase product attribute for comparison: yellow, cBase product attribute for comparison: green

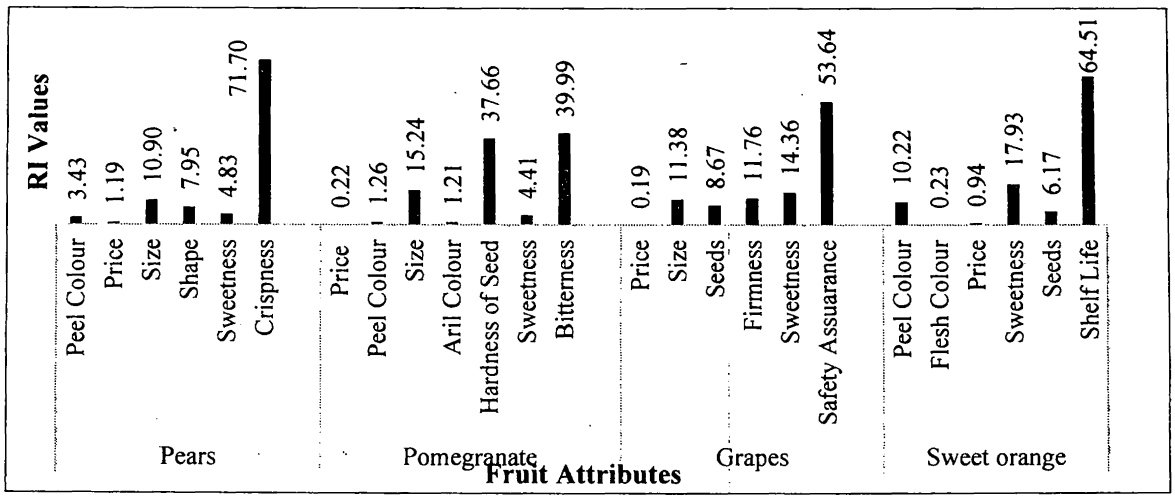

Figure 2. Relative Importance for fruit attributes

Crispness is the critical attribute in pear; it is almost seven times as important as size. This suggests that the pear breeders' strategic priority should be to produce crisp pear. Ignoring other attributes, a crisp pear will increase the customer utility in 1.88 times (Table 2) in comparison to a non-crisp pear. If the consumer is offered a pomegranate with bitter and hard seeds but at a lower price, the worth to the consumer is increased in 0.1 times (Table 2). However, if they are provided pomegranate with soft seeds their worth will be increased with 1.43. Non-bitter pomegranates were increased the consumer utility by 1.40 times than bitter varieties (Table 2). Consumers of grapes demonstrated their preference ranking of product attributes as: Safety assurance (53.70), sweetness (14.37), firmness (11.77), size (11.39), seeds (8.68) and finally price (0.10). If the consumer is offered safety assured grapes their utility can be increased by 3.2 times than not-assured grapes (Table 2). People have a general impression that local fruits are safer than the imported ones. Therefore, if the local production can be increased, it is likely to satisfy consumers although the local grapes are smaller and less sweet compared to their imported counterparts. In terms of orange, people concern more about shelf life (64.51%) of an orange in their purchasing decision followed by sweetness (17.93) and peel colour (10.22). The results revealed that price was the least important attribute among all four fruit types other than sweet orange.

Only a few attribute-age interactions were significant at 5% error level (Table 3). It tells that age not much affect for the purchasing decision. However, consumers apparently more concerned about safety aspects when they are becoming older. When age increases by one year the probability of preferring safety assured grapes is 0.004 amount at 5% error level. A similar effect was observed with sweetness. Elderly consumers prefer less sweet fruits of pomegranate and grapes. Controlling for all other variables, for each unit decrease with age, consumers prefer bitter free pomegranate.

Table 3. Results of the Rank Ordered Logistic Regression-with interaction effect

Variable	Pear		Pomegranate		Grapes		Sweet Orange	
	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value
Peel Colour _age	0.008[a]	0.165	-0.006[b]	0.339			-0.004[c]	0.440
Large Size_ age	-0.009	0.127	0.001	0.849	0.005	0.408		
PearShape _ age	-0.005	0.337						
VerySweet _ age	-0.005	0.415	-0.013	0.026	-0.011	0.050	-0.006	0.261
Crisp_ age	-0.011	0.062						
Red Aril _ age			-0.007	0.249				
Soft Seed_ age			-0.008	0.170				
Not Bitter_ age			-0.015	0.013				
Seedless_ age					0.003	0.621	0.000	0.979
Firmness-Low_ age					0.000	0.972		
Safety Assured_ age					0.019	0.004		
Orange Flesh _ age							0.003	0.619
HighShelf Life_ age							0.012	0.037
Price_ age	-0.000	0.684	0.000	0.030	-0.000	0.952	-0.000	0.712

Note: Prob > chi2=0.0000 for all four models, aBase product attribute for comparison: yellow, bBase product attribute for comparison: yellow, cBase product attribute for comparison: green

CONCLUSIONS

This study investigated the consumer preference for fruit attributes using a conjoint analysis. Results show that people are concerned only on a few key attributes in their purchasing decisions. Therefore, breeders may concentrate on the attributes that are relatively important from the point of view of the customer and make a significant effect in customer purchasing decision. Among the attributes included in the conjoint study, price is the least important. Rather than lowering the price to capture market share, it is important to include the desired features while breeding new fruit varieties. Thus, the findings is useful as a reference for fruit breeders to design their products.

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REFERENCES

Allison, P. D. and Christakis, N. A. (1994). Logit models for sets of ranked items. *Sociological methodology,* **24**, 199-228.

Beggs, S., Cardell, S. and Hausman, J. (1981). Assessing the potential demand for electric cars. *Journal of econometrics,* **17** (1), 1-19.

Breidert, C., Hahsler, M. and Reutterer, T. (2006). A review of methods for measuring willingness-to-pay. *Innovative Marketing,* **2** (4), 8-32.

Deliza, R., Rosenthal, A., Abadio, F. B. D., Silva, C. H. and Castillo, C. (2005). Application of high pressure technology in the fruit juice processing: benefits perceived by consumers. *Journal of Food Engineering,* **67** (1), 241-246.

Green, P. E. and Srinivasan, V. (1990). Conjoint analysis in marketing: new developments with implications for research and practice. *The Journal of Marketing,* **54** (4), 3-19.

Hair Jr, J. F., Black, W. C., Babin, B. J., Anderson, R. E. and Tatham, R. L. (2010). SEM: An introduction. *Multivariate data analysis: A global perspective* 629-686.

Harrison, R.W., Stringer, T. and Prinyawiwatkul, W. (2002). An analysis of consumer preferences for value-added seafood products derived from crawfish. *Agricultural and Resource Economics Review,* **31**, 157–170.

Long, J. S. and Freese, J. (2006). *Regression models for categorical dependent variables using Stata.* Stata press.

Manalo, A. B. (1990). Assessing the importance of apple attributes: an agricultural application of conjoint analysis. *Northeastern journal of agricultural and resource economics,* **19** (2), 118-124.

Wang, M. H., Thomas, K. R., Chan, F. and Cheing, G. (2003). A conjoint analysis of factors influencing American and Taiwanese college students' preferences for people with disabilities. *Rehabilitation Psychology,* **48** (3), 195-201.

Wehmeyer, K. and Müller-Lankenau, C. (2005). Mobile couponing–measuring consumers' acceptance and preferences with a limit conjoint approach. Proceedings of the 18th Bled eConference", Bled, Slovenia.