CONSUMERS' VALUATION OF A LOCAL CARROT LANDRACE WITH ATYPICAL COLOR

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Abstract

Most carrots sold in the market are orange, although original carrots were purple and yellow. Local landraces have been largely replaced by orange carrots. Then, consumers are familiar with the typically considered orange carrot's color and are reluctant to others. Nowadays, consumers are increasingly interested in traditional local foods not only because of their freshness, taste and higher quality, but also for their environmental and social sustainability. In this context, local carrots of atypical colors could be reintroduced in the market if consumers will be willing to pay for them. The aim of this paper is to measure consumers' valuation of a local carrot landrace from the Spanish region of Aragon atypically colored in purple. A choice experiment was designed and conducted with 202 consumers in Aragon during 2016-2017. The sample was stratified by age, gender, education and province of residence. Before the choice experiment, participants could inspect and taste commercial orange carrots and locally produced purple carrots to indicate their hedonic preferences. Results showed that consumers' willingness to pay for the purple carrots was negative while for the local landrace was positive. However, a group of consumers positively value the atypical colour (32%).

Keywords: Aragon, choice experiment, purple, willingness to pay, Spain

1. Introduction

Although a great diversity of fruits and vegetable exist, a few are actually commercialized and consumed. It is the case of carrot. In spite of the great diversity in the color of carrots (orange, yellow, white, and purple), the market in Europe is mainly reduced to orange carrots. Purple varieties were known in Europe until the beginning of the 20th century. In the 60s, orange varieties predominated in the Western world while in the East purple, yellow, and white carrots were also found [Banga (1963)]. Then, European consumers are familiar with the typically considered orange carrot's color and are reluctant to others, even if original carrots were of different colors. Despite the fact that atypical colors produce culinary opportunities, commercial success may be limited until consumers integrate them in their everyday habits [Schifferstein et al. (2019)]. Nowadays, there is an increasing consumers' interest in local foods due to their freshness, taste, higher quality, environmental friendliness and social sustainability. Besides, purple carrots have attracted the attention as rich sources of anthocyanins with significant antioxidant capacities and good nutritional value [Algarra et al. (2014)]. Local carrots of atypical colors could be reintroduced in the market if consumers would be willing to pay for them. The aim of this paper is to measure consumers' valuation of a local carrot landrace from the Spanish region of Aragon atypically colored in purple.

2. Materials and methods

A choice experiment was used for its ability to value multiple attributes simultaneously, its consistency with the random utility theory, and the similarity of the choice tasks asked to participants with their real purchase decisions.

2.1. Choice experiment design

The first step was to choose the product, in our case, a packaged of half kilo of carrots. The second, to select the attributes and levels: price, color, origin, and production system. The price levels (€/package) were set, based on the market prices at: 0.5, 0.8, 1.1 and 1.4. The other three attributes had two options: orange or purple for the color attribute; local or not local landrace for the origin; organic or conventional for the production system. The choice sets were generated following the Street and Burgess (2007) approach. The design to estimate the main effects and some two-way factor interactions with four attributes and 4, 2, 2 and 2 levels and two options was made of 24 choice sets. They were randomly split into three blocks and

each respondent had to make eight choices. Each choice set included three alternatives: two designed and a non-buy option.

2.2. Data collection and survey

Data were obtained from an experiment with consumers in Aragon in 2016-2017. Population consisted of people living in Aragon older than 18 years. Recruitment was performed via consumer associations, universities, technological centers, and town hall centers. A total of 18 sessions of around 12 participants were carried out. Participants in the experiment received information on the main purpose of the experiment and signed an informed consent of participation. First, participants should inspect the orange and purple carrots, whole and cut, and indicate their global liking using a hedonic scale. Second, they could taste both carrots and rate their taste and global liking. Third, they carried out the choice experiment tasks. Finally, they reported their carrots purchase and consumption habits, the socio-demographics, and personal characteristics.

2.3. Model specification and estimation

The utility function is derived from the Lancaster theory [Lancaster (1966)] as a function of the products attributes and unobservable components assumed stochastic (random utility theory). In the empirical application and for the selected attributes and levels, the utility function specified for individual *n*, alternative *j* at choice situation *t*, is as follows:

$$U_{njt} = ASC + \beta_1 PRICE_{njt} + \beta_2 PURPLE_{njt} + \beta_3 LOCAL_{njt} + \beta_4 ORGANIC_{njt} + \varepsilon_{njt} \quad (1)$$

where, *n* is the number of respondents, *j* represents the alternatives in the choice sets (A, B and the non-buying option) and *t* the number of sets. The betas are parameters to be estimated. ASC represents the specific alternative coded as a dummy variable with value 1 for the non-buying option and 0 otherwise. The price variable (PRICE) was defined by the price levels in the design. The attributes of color (PURPLE), origin (LOCAL) and production system (ORGANIC) were dummy variables. Instead of assuming homogenous preferences, heterogeneity is allowed and a Random Parameters Logit model (RPL) with correlated errors was estimated using the NLOGIT 5.0.

3. Results and discussion

The final sample (202 participants) was representative of the population in terms of gender, age, education level and province of residence.

Equation 1 was estimated assuming that price is a fixed coefficient and that the coefficients for the attribute-levels variables are random following a normal distribution. From these parameters of the RPL with correlated errors model, the marginal consumers' willingness to pay (WTP) for each of the attributes were estimated (**Table 1**).

ASC and PRICE coefficients were negative and statistically significant as expected. Then, the utility for consumers was higher for the designed options than for the non-buy option and the utility of the price was negative.

Table 1. *Estimates for the random parameters logit with correlated errors model*

	Parameters in utility function		Standard deviation of parameters distribution		WTP (€/package)	
Attributes	Mean Estimation	Z-ratio	Coefficient	Z-ratio	Mean Estimation	Z-ratio
ASC	-3.986***	-20.06	---	---		
PRICE	-1.991***	-13.73	---	---		
PURPLE	-0.685***	-5.26	1.519***	10.88	-0.34***	-5.19
LOCAL	0.678***	6.17	0.818***	6.25	0.34***	6.09
ORGANIC	0.479***	3.90	0.642***	4.34	0.24***	3.88

Number of observations: 1616
Log likelihood: -1137.39; McFadden Pseudo R-square: 0.359
WTP = willingness to pay
*** = significance at 1%

The negative and statistically significant value of the parameter estimate for PURPLE variable indicated that the utility for the purple carrots was lower than for the orange ones. On contrary, the positive and statistically significant value of the parameter estimate for LOCAL and ORGANIC indicated that the utility

for the carrots produced from the local landrace and the organic production system was higher than the utility derived by the non-local landrace and the conventional system, respectively.

Consumers were willing to pay an extra price per package of +0.34 € in case of carrots from the local landrace and of +0.24 € in case of carrots organically produced. On the contrary, the WTP of –0.34 € for the color represented the discount for consumers to purchase purple carrots, indicating that they prefer the orange ones. Since the estimated coefficients for the standard deviation were positive and statistically significant at 1% level, consumers' preferences for these attributes were heterogeneous. It should be noted that, regarding the COLOR attribute, 32% of participants had positive WTP for the purple carrot representing the segment of consumers accepting these carrots. Further analysis is required to profile this segment of consumers using the hedonic liking scales and the socio-demographic characteristics.

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