Impact of underlying psychometric attitudes on fish consumption: an exploratory research in Modern Metropolitan Lima, Peru

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Abstract: Even though Peruvian fishing industry is a key component of its economy, fish consumption is under the appropriate dietary intake levels. Given the current status, it is relevant to identify the factors that propitiate higher fish consumption levels. Thus, this research assessed the effects of underlying psychometric attitudes, such as fish consumption experience and taste preferences among others, over the probability of eating fish at the recommended level of twice a week in Modern Metropolitan Lima, Peru. A latent-variable-based instrument on validated 5 points Likert scales was applied to a stratified random sample of 159 Modern Metropolitan Lima fish consumers. An ordered logistic regression was used to analyze the marginal probabilities of Peruvian individuals that consume fish twice a week or less. The results showed that underlying psychometric variables as taste preferences and past experience contributed significantly to the probability of eating fish at a recommended level. Contrarily, it was found that perceived health benefits of eating fish, and demographic control variables did not have any impact on fish consumption frequency. Outcomes may have insightful implications on promotion, marketing and sales of fish in Peru, particularly to the "positive" fish consumers, who consume fish more frequently in Modern Metropolitan Lima.

Key words: consumer behavior; fish consumption; ordered logistic regression; Peru

JEL classification: C25, Q18, Q22

1 Introduction

Peru's fishing industry has historically been a key component of the country's economy (Evans and Tveteras, 2011). The total contribution of the marine fisheries sector to the Peruvian economy was estimated to be $32 billion USD for 2009- this being a conservative estimate- (Christensen et al, 2014). Furthermore, Peruvian marine fisheries generate economic and social benefits through processing, distribution and consumption (Christensen et al, 2014) positioning Peru as the second ranking fishing country in the world after China in terms of capture volumes (Sánchez Durand and Gallo Seminario, 2009). The Peruvian domestic market of fish is largely composed by fresh fish because of the coastal connectivity, covering around 30% of the national market (Del Carpio and Vila, 2010), and being the fresh sector representative of more than 50% of consumption compared to the processed one (Fréon et al, 2014).

Even though Lima is a coastal city, its fish consumption is low, as this phenomenon happens in other coastal cultures (Can et al, 2015). Actual Peruvian fish consumption generally not even comes close to the recommendations to eat fish twice a week (Birch, Lawley and Hamblin, 2012; Verbeke, Vermeir and Brunso, 2007). The annual per capita edible fish consumption in Peru was estimated to be 11.2 kg (up to 22.5 kg in whole fish equivalents) in 2011 (Avadí and Fréon, 2015) which is just above the average per capita European fish consumption of 20.5 kg (Verbeke and Vackier, 2005). The low frequency of fish consumption in Peru could be due to different barriers, for instance, supply related, as the lack of cold chain (FAO, 2007), logistical operations and optimal sanitary conditions (Freón et al, 2014). Additionally, demand related barriers such as lack of habit and difficulty of preparation

(Mitterer-Daltoé et al, 2013), beliefs of expensiveness (Verbeke and Vackier, 2005), and unpleasant physical properties (Olsen, 2004) may deter frequent fish consumption.

Different factors beyond sensorial characteristics have become fairly influencing in consumer's dietary and food choices (Carrillo et al, 2010) and their analysis have been directed to explain the consumer behavior towards fish (Mitterer-Daltoé et al, 2013; Verbeke and Vackier, 2005). Several authors have found that taste preferences and positive attitudes are related with higher levels of fish consumption (Drewnowski and Darmon, 2005; Olsen, 2003; Lennernäs et al, 1997). Furthermore, past-experience in consumption has been found directly related with fish consumption frequency or the intention to eat it (Mitterer-Daltoe et al, 2013; Verbeke and Vackier, 2005). Given the current low frequency of fish consumption and the importance of fish in the dietary habits, it is critical to identify the factors that propitiate adequate fish consumption levels. Thus, the primary objective of this research is to reveal if underlying psychometric variables as for instance taste and past experience of fish consumption among others, affect the probability of eating fish at the recommended level of twice a week in Modern Metropolitan Lima, Peru.

2 Materials and Methods

Metropolitan Lima was chosen as the study site of this research as is the fifth most populated city in Latin America and their individuals contribute around US$ 3,503 of per capita GDP (Del Carpio and Vila, 2010). Accordingly, the survey was taken in supermarkets and fish markets between August and October 2015 in the area of Modern Metropolitan Lima as it presents predominately A and B socio-economic levels (Ipsos Apoyo, 2011). A stratified sampling procedure was undertaken considering fish markets and fish shoppers. At the consumer's level, a systematic random sampling was applied. The sample consisted of 159 consumers who currently consume fish at any frequency. The associated error of the sample was 7.8%, considering p=q=0.5, a confidence interval of 95% and unknown fish consumers population size.

The structured questionnaire was administered with the support of students from the Universidad del Pacífico in Lima, Peru. The instrument presented three different sets of Likert scale items ranged from 1 (strongly disagree) to 5 (strongly agree). The papers from which the scales belong are presented at the first column in table 1. Additionally, frequency of fish consumption was measured on the scale "less than weekly", "weekly" and "twice or more times a week" based on the recommendation of fish consumption of Birch, Lawley and Hamblin (2012). Consumer characteristics such as age, sex and socio-economic level were also considered as the literature has found significant differences with respect to fish consumption frequencies (Can et al, 2015; Lennernäs et al, 1997). Lastly, consumers where asked to qualify their perception as positively or negatively towards fish.

The Likert scales were originally written in English and then translated to Spanish. In addition, two bilingual professionals, one in the linguistic field, and the other, expert on fish issues, cooperated for the back translation. Psychometric analysis such as construct validity, via Principal Components Analysis (PCA), and reliability of scales, via Cronbach's alpha, was assessed using SPSS 22.0. The factor scores were obtained using a non-refined method, averaging the items' score by factors (DiStefano et al, 2009). This approach was chosen because using regression based scores (e.g. Anderson-Rubin scores) "is inappropriate and can lead to faulty analysis and recommendations" (Zuccaro, 2007, pp. 511). An ordered logistical regression was used to assess the marginal probabilities of individuals to consume less than the usual and at the recommended level of fish consumption (twice a week). This model was chosen because the dependent variable has three ordered outcomes and it presented a non-calculable continuous latent variable that was measured through a categorical ordered variable. Thus, there were no assumptions about the distribution

of the independent variables (Borooah, 2001). The logistical link function was chosen in order to facilitate the interpretation of the coefficients as log-odds. To assess the goodness-of-fit of the model, the variables were introduced by steps and the variations of the Log-Likelihood were checked for significant changes using the χ^2 statistic. Additionally, the test of proportionality of odds across response categories was tested. Finally, the Variance-Inflation-Factor (VIF) was checked using the variables included in the model. The ordered logistical regression model was executed using STATA 13.

3 Results and Discussion

The constructs validity was assessed through a Principal Component Analysis with a Varimax rotation. The results showed that the test criteria reached fulfilling levels. The Kayser-Meyer-Olkin statistic was over 0.8 assuring an adequate sampling adequacy. The Bartlett's sphericity test was highly significant, which means that the correlation matrix of the items was different from the identity. Furthermore, the trace of the anti-image correlation matrix showed values greater than 0.7, which implied a good sampling adequacy of each item. Three components presented eigenvalues greater than 1, reason why they were retained. After the Varimax orthogonal rotation, the three components presented well differentiated loading for each factor and were greater than 0.6. All of the factors presented Cronbach's alphas greater than 0.7 indicating an adequate level of reliability. Moreover, all item-rest correlation were positive inside each construct. The following table (Table 1) summarized the previous analysis.

Table 1. Varimax rotated component matrix and reliability of scales

Origin of the items	Items in the instrument	Components		
		Past experience	Taste	Health
Verbeke and Vackier (2005)	I know many fish species to prepare	**0.90**	0.07	0.07
	I have reasonable knowledge about fish	**0.90**	0.07	0.15
	I am very informed about fish	**0.85**	0.15	0.15
	Fish preparations are familiar to me	**0.79**	0.32	0.11
Carrillo et al. (2011); Sveinsdóttir et al. (2009)	I have a positive attitude towards fish taste	0.15	**0.72**	0.03
	I'm very pleased with a meal that has fish	0.23	**0.71**	0.04
	I appreciate eating fish	-0.04	**0.68**	0.13
	I enjoy eating fish	0.22	**0.74**	0.21
Carrillo et al. (2011); Verbeke, Vermeir & Brunso (2007)	Eating fish reduces the risk of having cancer	0.03	0.08	**0.65**
	Eating fish stimulates bone development	0.17	0.06	**0.66**
	Eating fish contributes to cerebral development	0.05	0.05	**0.73**
	By eating fish, I extend my life expectancy	0.31	0	**0.73**
	Fish is good for my nails, teeth, skin, hair, etc.	-0.02	0.29	**0.67**
	Eigenvalues (Varimax rotated)	3.23	2.27	2.5
	% of variance explained	21.80%	16.70%	18.70%
	Cronbach's α	**0.91**	**0.72**	**0.74**

KMO: 0.827; Bartlett's test χ^2d.f.(78):822,6 (<0.001); Values in the trace of the anti-image correlation matrix >0.7

Own elaboration, 2015

Past experience is a substantive predictor of later behavior because past behavior was a reasoned action (Vermeir and Verbeke, 2008). Foxall, et. al. (1998) proved that taste is a main reason for purchasing fish. Finally, healthiness is also one of the key factors in consumer perceptions (Niva, 2007). These three latent variables were included in the ordered logistic regression model which presents the following structure:

$$Y^* = \sum_{k=1}^{k} \beta_k X_{ki} + \varepsilon_i = Z_i + \varepsilon_i \quad \textbf{(1)}$$

Where Y^* represents the continuous latent dependent variable, β_k the log-odds coefficients for each variable, X_{ki} represents the included variables in the model, and ε_i the random disturbance term with a standard logistic distribution with mean 0 and variance 3.29. The value of the observed Y categorical variable depends on the latent Y^* variable, which must surpass certain thresholds α_i:

$$Y = 1\ if\ Y^* \leq\ \alpha_1 \rightarrow P(Y=1) = \frac{1}{1-\exp(Z_i - \alpha_1)}$$
$$Y = 2\ if\ \alpha_1\ \leq\ Y^* \leq\ \alpha_2 \rightarrow \frac{1}{1-\exp(Z_i - \alpha_2)} - \frac{1}{1-\exp(Z_i - \alpha_1)} \quad \textbf{(2)}$$
$$Y = 3\ if\ Y^* \geq\ \alpha_2 \rightarrow P(Y=3) = 1 - \frac{1}{1-\exp(Z_i - \alpha_2)}$$

The frequency of fish consumption was used as a dependent categorical variable. The three latent variables were included to measure the individual impact of health attributes, taste preferences and past experience at eating fish. Then, two dummy variables which indicated if the usual place of consumption was at home or eating out, and also, if the individual has a positive or negative perception towards fish were also included in the model. It was expected, for instance, that income level, measured through the district, among other variables, would had an effect on fish consumption (Can et al, 2015). Thus, age, sex and high socioeconomic level were used as control variables. Table 2 showed the summary statistics of the variables included in the ordered logistic regression model. Later, table 3 showed the regression model results. The goodness-of-fit of the model was assessed through the Likelihood-Ratio χ^2 test which was highly significant (<0.001). The assumption of proportionality of odds across response categories was not significant (sig: 0.61) which ensures that the coefficients hold the same across categories and revealed that the model was correctly justified.

Table 2. Statistics of the variables in the model

Variable	Min	Max	Mean (SD)
Frequency of fish consumption	1	3	2.0 (0.76)
1- Less than weekly (28%)			
2- Once a week (43%)			
3- Twice or more (29%)			
Independent variables			
Health	1	5	3.6 (0.67)
Taste	1.5	5	4.2 (0.66)
Past experience	1	5	3.2 (1.01)
Main consumption in house	0	1	0.6 (0.49)
Positive ideas towards fish	0	1	0.7 (0.44)
Control variables			
Age	19	84	43.8 (15.2)
Female	0	1	0.8 (0.37)
High socioeconomic level	0	1	0.5 (0.50)

Own elaboration, 2015

Table 3. Ordered logistic regression model

Fish consumption frequency (dependent)			
	B	(SE)	Sig.
Health	0.09	(0.28)	0.743
Taste	**0.56**	(0.31)	**0.071**$^{+}$
Past experience	**0.50**	(0.19)	**0.009****
Main consumption at home	**1.19**	(0.36)	**0.001****
Positive ideas towards fish	**0.89**	(0.41)	**0.032***
Age	0.02	(0.01)	0.124
Female	-0.29	(0.45)	0.523
High socioeconomic level	-0.26	(0.35)	0.463
Ancillary parameters			
α_1	4.80	(1.38)	
α_2	7.18	(1.46)	

LL: -127.14; LR $\chi^2(8)$: 46.14 (Sig. <0.001.)
Approx. LR test of proportionality of odds across response categories: $\chi^2(8)$: 6.36 (Sig. 0.61)
Mean VIF: 1.18; $^{+}$p<0.1, *p<0.05 ,**p<0.01

Own elaboration, 2015

The reasons for particular food choices are complex and diverse in general, being food consumption influenced by many interrelating factors as for instance, food quality aspects (e.g. taste), characteristics of the individual (e.g., attitudes, perceptions, socio-economic characteristics, etc.), etc. (Batzios et al, 2005). Olsen (2004) stated that intention to purchase a fish product is mostly driven by health. Nonetheless, in our study we found that the health benefits did not significantly influence to a higher frequency on fish consumption in Modern Metropolitan consumers (p>0.10). Related to sensorial aspects, research by Lennernäs et al (1997) had highlighted the role of taste, while Drewnowski and Darmon (2005) considered the effects of taste on food choices (O´Neill, Hess and Campbell, 2014). We found that a higher positive attitude and perception on taste preferences of fish had a positive effect over eating fish at higher frequencies (p<0.10). Mitterer-Daltoé et. al (2013) determined that habit, as a variable measure of the past experience construct, was an important discriminating variable and a good explanatory factor in the consumption of fish. In our model, outcomes indicated that past experience variable (p<0.05) was significant and positively influential on the frequency of eating fish. Namely, when a person has experience over fish (past experience), the chances of increasing the frequency of consumption were higher. In addition,

the possibility of eating fish at the recommended level increased when people had positive ideas related to fish, such as highly nutritious, availability, convenience, etc. which may account for substantial differences in fish consumption behavior (Pieniak et al, 2008). Regarding the usual place of consumption, people that were used to eat fish at home had higher probabilities of getting an adequate (higher) level of fish consumption. Finally, we found that the control variables (age, sex and socio-economic level) did not present a significant relationship with higher or lower fish consumption frequency ($p>0.10$).

To clearly illustrate the results presented above, we used the ancillary parameters and the significantly different from zero parameters, to determine the probability of consumers to be classified into the category 1 (less than weekly), 2 (once a week) or 3 (twice or more). Thus, we depicted two arbitrary, but illustrative, types of consumers: First, consumer 1, who presented the highest ratings in taste preferences and past experience, usually consumed fish in-house and had a positive attitude and perception towards it. Second, consumer 2, who presented the lowest score on taste preferences and past experience. Moreover, the latter usually consume fish at restaurants and had a negative perception towards fish. Using equation (1) and (2) we found Z_i values, which showed the probability of belonging to each ordered category. Therefore, consumer 1, who had a "positive" attitude towards fish, had an approximate 7% of eating fish less than weekly, 38% chances of eating fish weekly, and an associated 55% probability of eating fish more than weekly. On the other hand, consumer 2, who had an overall "negative" attitude towards fish, had a 97% probability of eating fish less than weekly, 3% odds of eating weekly and, due to rounding, almost 0% chances of eating fish more than weekly. Thus, "positive" attitude fish consumer should be the target fish consumer in Modern Metropolitan Lima, as the probability of eating more than the recommended level is considerably higher than the "negative" attitude fish consumer.

Certainly, fish consumption traditions, ideas as tastefulness or convenience among others, and habits as past experience account for a higher frequency of fish intake (Pieniak et al, 2008). In this research, underlying variables as taste, past experience, fish consumption at home and having positive ideas towards fish showed a positive influence on the fish consumption frequency in Modern Metropolitan Lima. Particular emphasis should be on communicating benefits of consuming fish more than twice per week to the Modern Metropolitan Lima target population, mainly to the "positive" fish consumers, who consume fish more than the recommended level, to make information meaningful, useful and efficient. Trends and opportunities, such as the the actual Peruvian gastronomy boom, should be exploited to promote adequate levels of fish intake: renowned national chefs promoting fish consumption, radio and television campaings about fish ease of preparation and/or tastefullness, and billboards presenting families eating at home fish-based dishes. These promotion activities should be alligned with the objective of promoting positive attitudes toward fish consumption. Further research may include the addition of other fish consumption factors, as for instance situational determinants among others. Furthermore, the study sample size should be expanded, not only to other districts within Metropolitan Lima but also to farther coastal areas, which may provide further insight of the Coastal Peruvian fish consumption as a whole.

4 Conclusion

Even though Peruvian fishing industry is a key component of its economy, fish consumption is very low. An ordered logistic regression was used to analyze the marginal probabilities of Peruvian individuals that consume fish twice a week or less. Underlying psychometric variables as taste, past experience, fish consumption at home and having positive ideas towards fish influence positively on the fish consumption frequency in Modern Metropolitan Lima. On the other hand, it was found that the perceived health benefits of eating fish, and also, the demographic control variables did not have any impact on fish consumption frequency. These results may have important implications on production decisions, sales

and marketing for the promotion of fish in Lima, especially to the "positive" fish consumers, who consume the recommended twice per week level of fish consumption.

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