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RESEARCHPAPER

Wild Fish vs. Farmed Fish: Consumer Perception in Turkey

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Abstract

Since it is not possible to meet the demand for fish meat through fisheries, it is tried to be met with the aquaculture. As a result, farmed fish production has been increased in recent years. Therefore, it is important to know how consumer trends are changed against farmed or wild fish. This study aimed to determine the factors affecting fish consumption preferences of consumers living in Turkey. 472 people in coastal and inland areas were asked questions and factors influencing the formation of consumer preferences were examined. Logistic regression was performed to find the most proper model. According to the study, the majority of consumers have little knowledge of the origin of the fish due to insufficient regulatory regulations in labeling. However, some consumers believed that the farmed fish may be more nutritionally valuable, while others thought that the farmed fish have poorer taste and texture compared to wild fish and they were also concerned about contamination from polluted waters or contaminated feed. One of the most troubling topics for consumers is the drug or antibiotic usage and their residues in the aquaculture sector. The consumers were willing to pay extra money for farmed fish if they know them antibiotic-free.

Introduction

Fish production from aquaculture accounted for 44.1% of total production (including for non-food uses) from capture fisheries and aquaculture in 2014, up to from 42.1% in 2012 and 31.1% in 2004 in the World (FAO, 2016). Of the world, at national level, 35 countries produced more farmed than wild-caught fish in 2014. These countries namely, China, India, Vietnam, Bangladesh, and Egypt have a population of 3.3 billion, or 45% of the world's total population. The other 30 countries including Greece, the Czech Republic and Hungary in Europe, and the Laos and Nepal in Asia have relatively well-developed aquaculture sectors (FAO, 2016).

Throughout for centuries, traditional fisheries have been supplying fish to the markets. However, unsustainable fishing activities accompanying inadequate legislative regulations have caused a reduction of wild fish stocks. Considering these situtation, it was thought that aquaculture would support production of fishery products to satisfy the global consumer demand as an alternative way (Cahu, Salen, & de Lorgeril, 2004). While aquaculture is the fastest-growing animal food-producing sector with an increasing production from less than 1 million tonnes per year in the early 1950s to 73.8 million tonnes in 2016 in developing countries especially in Asian countries (FAO, 2016).

On the other side, the consumer perception including acceptance or rejection of a certain food product is of a multi-factorial nature (Costell, Tárrega, & Bayarri, 2010).

Sensory properties are not the most decisive factors. Consumers may have some prejudices towards a new food product. (Pearson, 2002; Shifferstein, 2001; Von Alvensleben, 2001). One of the most contradictive subject is the perception of the consumers about farmed and wild fish when considering the way farmed fish is produced (Kole, 2003). Consumer behaviour in Turkey is mostly similar with the other consumers in other countries. It is reported that fish consumption per capita is 5.4 kg by 2016 which shows a dramatic decline comparing with the last decades (8 kg by 2000 and 6.9 kg by 2010) (BSGM, 2018). Since there are several factors including limited marketing of fish especially apart from coastal areas, unaware consumers, the superstitions about the aquaculture, insufficient information campaigns of related ministries affect consumption of fish, the most important one is. Most consumers have little knowledge on whether a seafood product is captured or farmed and concerned about the antibiotic and PCBs residues (Santos & Ramos, 2016).

However, some of the consumers think that farmed fish have value-adding possibilities because of the feeding opportunities comparing to the wild fish, while some of them do not prefer farmed fish regarding to their negative impacts such as poorer taste and texture. (Vanhonacker, Altintzoglou, Luten, & Verbeke, 2011).

In this study, we tried to reveal the underlying cause of consumer perception of wild and farmed fish in Turkey. The main aim of the study is to specify perception of the consumers and give advice to fisheries industry for production concerning consumer preferences and legislators for considering consumer concerns in labelling or such legislative regulations.

Material and Methods

Data Collection

A survey was conducted to determine the components playing the important role in consumer preferences of farmed fish consumption. Equation 1 was used to determine the number of the participants. While 384 participants were calculated from Eq. 1, a total of 472 were selected for better assessment and surveyed by online questionnaire. Survey was conducted from the people, both in the interior and coastal areas considering that the fish consumption preferences of the coastal regions and the inhabitants differed. The study was conducted on subjects consuming fish in the restaurant at a certain time periods.

We assumed, n: sampling size, p=0.5 (probability of farmed fish consumption), q=0.5 (probability no consumption farmed fish). Z: 95% t table value and e: 5% sampling error. The resulting sample size is demonstrated in Equation 1 (Yamane, 1967)

$$n = \frac{p*q*Z^2}{e^2}$$

$$n = \frac{0.5*0.5*1.96^2}{0.05^2} = 384 \text{ consumers} \quad \text{(Eq. 1)}$$

Statiscal Analysis

Logistic regression was performed to obtain the most proper model to define the connection between the dichotomous characteristic of interest (dependent variable, response or outcome variable) and a set of independent (predictor or explanatory) variables. Logistic regression provides the coefficients (including standard errors and significance levels) of a formula in order to call a logit transformation of the probability of presence of the characteristic of interest.

Variables

Dependent variable: choosing consumption of the farmed fish.

Y=1; Prefer to consume farmed fish

Y=0; Prefer to not consume farmed fish

Independent variables:

X_1: Age

X_2: Gender (1: male, 2: female)

X_3: Region (1: coastal, 2: interior)

X_4: Revenue (1:<1000 TRY/month, 2: 1001-2000 TRY/month, 3: 2001-3000/month, 4: 3001-4000/month, 5: >4000 TRY/month)

X_5: Fish consumption frequency (1: Weekly more than one, 2: Every week; 3: Every 15 days, 4: Every month, 5: several times a year)

X_6: Consumption season (1: spring, 2: winter, 3: summer, 4: autumn)

X_7: Reason of consumption (1: I like its taste, 2: for being healthy, 3: Other)

X_8: Do you ask the origin (farmed of wild) of fish in the restaurant? (1: yes, 2: no)

X_9: Do you ever pay attention to the origin in processed fish? (1: yes, 2: no)

X_{10}: Do you consume more, if you are informed on the label of the farmed fish whether or not the antibiotics are used?

X_{11}: How much more will you pay for the farmed fish without drug residue?

In the study, the hypothesis that culture fish or natural origin fish is not important in the preference of the fish consuming people was formulated.

Overall Model Fit

It resulted by logistic regression that the null model ln ($L0$) where $L0$ is the likelihood of obtaining the

observations if the independent variables had no effect on the outcome and the full model −ln(*L*) where *L* is the likelihood of obtaining the observations with all independent variables incorporated in the model. Besides, the difference of these two yields a Chi-Squared statistic which is a measure of how well the independent variables affect the outcome or dependent variable. When the P-value is less than 0.05 for the overall model fit statistic, then there is evidence that at least one of the independent variables contributes to the prediction of the result. Cox & Snell R2 and Nagelkerke R2 are other benefits of fit measures known as pseudo R-squareds. Considering Cox & Snell's pseudo R-squared has a maximum value that is not 1. Nagelkerke R2 adjusts Cox & Snell's so that the range of possible values extends to 1.

Regression Coefficients

The regression coefficients are the coefficients b_0, b_1, b_2, ... b_k of the regression Equation 2:

$$\text{Logit}(p)=b0+b_1X_1+b_2X_2+ b_3X_3\ldots\ldots+b_kX_k \quad \text{(Eq. 2)}$$

If the independent variable with a regression coefficient is not significantly different from 0 (P>0.05), then it could be eleminated from the model. If P<0.05, then the variable contributes significantly to the prediction of the result variable. The logistic regression coefficients show the change (increase when bi>0, decrease when bi<0) in the predicted logged odds of having the characteristic of interest for a one-unit change in the independent variables. When the independent variables Xa and Xb are dichotomous variables then the influence of these variables on the dependent variable can simply be compared by comparing their regression coefficients ba and bb.

The Wald statistic is the regression coefficient divided by its standard error squared (Glantz & Slinker, 2001; Pampel 2000)

Odds Ratios with 95% Confidence Interval

An odds ratio (OR) is a measure of association between an exposure and an outcome. The OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure (Szumilas, 2010). Exponential of both sides of the regression is taken and the final equation is formulated by Equation 3:

$$\text{odds}=p/(p-1)=eb_0*eb_1X_1*eb_2X_2\ldots\ldots*eb_kX_k \quad \text{(Eq. 3)}$$

Hosmer & Lemeshow Test

The Hosmer-Lemeshow test is a statistical test for goodness of fit for the logistic regression model. The data are divided into approximately ten groups defined by increasing order of estimated risk. The observed and expected number of cases in each group is calculated and a Chi-squared statistic is calculated by Equation 4:

$$X^2HL= \sum_{Xg-1}^{G} \frac{(Og-Eg)}{(Eg-(1-{}^{Eg}/_{ng}}} \quad \text{(Eq. 4)}$$

with O_g, Eg and ng the observed events, expected events and number of observations for the g^{th} risk decile group, and G the number of groups. The test statistic follows a Chi-squared distribution with G−2 degrees of freedom (Hosmer, Lemeshow & Sturdivant, 2013).

Results and Discussion

Socio-demographic profile of the respondents was shown in Table 1. While 64.4% of respondents are male, 35.6% of the respondents were female. The age interval of the respondents was between 18 and 66 (Figure 1). 72% of the respondents were living in coastal areas and 28% of them were living interior areas. Previous studies reported that the revenue is an important factor on fish consumption (Solgaard & Yang, 2011; Altintzoglou, Sveinsdottir, Einarsdottir, Schelvis, & Luten, 2012; Aydın & Karadurmuş, 2012). Average revenue interval of the respondents was 2001-3000 TRY whereas, they contain the majority with 39.8%.

Fish consumption preferences of the respondents were also given in Table 2. It was determined that 70.3% respondents do not prefer to consume the farmed fish. It is obviously not meant that they never consume it. On the other side, 29.7% of respondents indicated that they prefer the farmed fish. Cardoso, Lourenço, Costa, Gonçalves, & Leonor Nunes (2016) reported that elder people are more skeptical about farmed fish consumption.

Consumers stated that they eat more fish during autumn and winter season. Majority of the respondents (55.9%) declared that they consume the fish for being healthy. Besides, consumers were asked whether they ask about the origin of fish while eating at a fish restaurant. 55.9% of respondents answered that "*I always ask about the origin"*. 44.1% of the consumers stated that they did not ask. Looking the processed fish products, 49.2 of the consumers do care about the origin of fish, whether farmed or wild. However, 50.8% declared that they did not even care about the origin. Altintzoglou, Vanhonacker, Verbeke, & Luten, (2011) stated that consumers in Belgium and Norway were more conscious of the origin of the fish as they consumed fish because it was healthy.

One of the most concerned topics for consumers is the drug or antibiotic usage and their residues in the aquaculture sector. In this questionnaire, consumers were asked "*If you are guaranteed that there is no drug residue in the fish, will you be willing to pay more for it".* 35.6% of the respondents answered that they would not

Table 1. Socio-demographic profile of the respondents

Gender	**N**	**%**
Male	304	64.4
Female	168	35.6
Region	**N**	**%**
Coastal	340	72.0
Interior	132	28.0
Revenue (TRY)	**N**	**%**
<1000	112	23.7
1001-2000	92	19.5
2001-3000	188	39.8
3001-4000	52	11.0
>4000	28	5.9

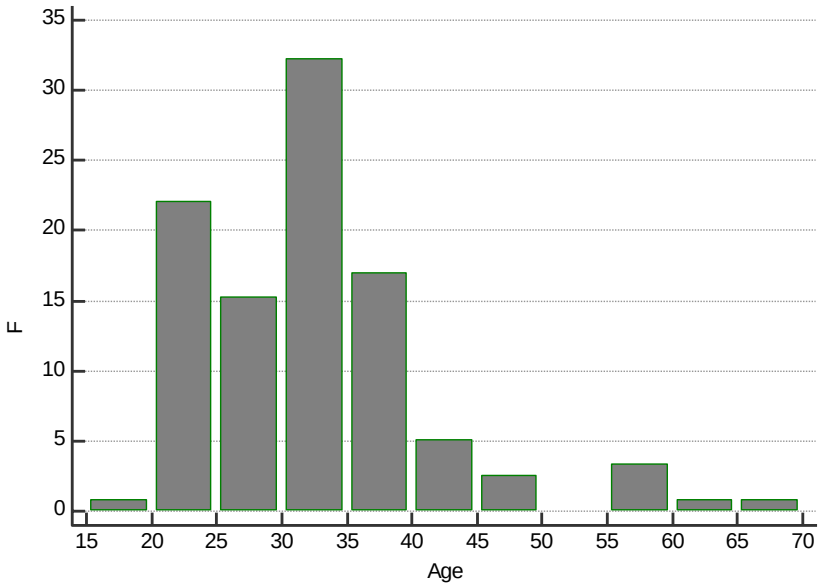

Figure 1. Age groups.

pay the extra price. While 24.6% of them were willing to pay 10% more, 22.0% of them declared that they might be able to pay 20% more.

According to Table 3, P = 0.00012 < 0.01. The H_0 hypothesis is rejected. Age is an important variable in the preference of consumers of farmed fish. As the age of the people observed to be increased, the preference for the farmed fish observed to be decreased. Odds Ratio (OR) was found as 0.890. This value was close to 1. It is understood that the age of the consumers does not actually affect the consumption as an independent variable. It observed that the regions and revenue of the respondents were not influenced by the farmed fish consumption (p>0.05). There was a significant relationship between consumers' preferences for farmed fish consumption and purchasing preferences for drug-free fish. Since the coefficient of the variable is positive, the likelihood of consumer preference increases if there are no drug residues in aquaculture. The OR value is 2.949 in the model. Large OR values of 1 show that the factor is important on the condition that the coefficient is significant (p<0.05).

Respondents who consume the fish at least once a week were found to be statistically significant in preference for farmed fish (p<0.05). This effect was negative (-1,641). In other words, it is seen that those who consume fish once a week primarily prefer the wild fish (OR value<1). It is statistically significant that the consumers ask the origin of the fish at the fish restaurant. This effect was negative. Since the OR value is low, the effect is low. It is seen that the answers (*i like its taste*, *for being healthy, and other*) given by the consumers to the question of why they consume fish are a significant factor in preferring farmed fish. This effect was also negative. The effects of "*More consumption if it's antibiotic free*" and "*Extra payment for drug-free fish*" were not significant (p>0.05). As can be seen from Table 3, consumers were found to have a tendency to consume farmed fish if its antibiotic-free (p <0.05, OR = 2.949).

Table 2. Fish consumption preferences of the respondents

Consumption frequency	**N**	**%**
Weekly more than one,:	56	11.9
Every week;	168	35.6
Every 15 days,	124	26.3
Every month,	76	16.1
Several times a year	48	10.2
Consumption season	**N**	**%**
Spring	28	5.9
Winter	224	47.5
Summmer	48	10.2
Autumn	172	36.4
Consumption reason	**N**	**%**
I like its taste	180	38,1
For being healthy	264	55,9
Other	28	6.0%
Do you ask the origin in the restaurant	**N**	**%**
Yes	264	55.9
No	208	44.1
Pay attention to the origin in processed fish	**N**	**%**
Yes	232	49.2
No	240	50.8
More consumption if it's antibiotic free?	**N**	**%**
Yes	272	57.6
No	200	42.4
Extra payment for drug residue-free fish	**N**	**%**
I can not pay more	168	35.6
10%	116	24.6
20%	104	22.0
30%	32	6.8
40%	52	11.0

As can be seen from the respondents, more than half do not consume fish once a week. In fact, this is one of the factors that affect the Turkey's per person consumption of seafood products. (Dağtekin and Ak, 2007). Increasing of consumption mostly in winter can be explained by the decreasing in fish prices with anchovy fishing and the perception that fish obtained by catching is healthier.

Conclusions

Sustainability of marine feed sources which are the main component of the farmed fish feed like marine proteins and lipids are also a concern for some consumers. Developing alternative feed sources considering the marine sources decline should be the main subject of the growing aquaculture industry. One of the most common belief is possible adverse environmental effects of aquacultural production including both direct and indirect organic pollution and interaction of wild fish with escapee individuals. There are several factors affecting consumer preferences. Since marine sources decline, the aquaculture industry has to develop alternative feed sources and break taboos of agricultural production to satisfy consumer demands globally in the near future. As the production of fish from fishing in Turkey decline dramatically over years for ins., 503 thousand tonnes by 2000 to 335 thousand tonnes by 2016, there was a dramatic increase in aquacultural production from 2000 (79 thousand tonnes) to 2016 (253 thousand tonnes) (BSGM, 2018). The total production from fishing and aquaculture remains almost constant comparing the years 2000 (582 thousand tonnes) and 2016 (588 thousand tonnes) (BSGM, 2018). The gap between captured fish by the years was observed to be met by aquaculture. As the aquacultural production increases in response to marine sources decline, consumption of fish per capita declines over years and this is due to the main perception of consumers about aquacultural production in Turkey.

The Mediterranean and the Black Sea which Turkey have shoreline, have seen its catch decline from 2.0 million tonnes in 1982 to 1.2 million tonnes in 2013 (FAO, 2016). As it is reported in FAO (2016), all hake (*Merluccius merluccius*) and most red mullet (*Mullus barbatus*) stocks seem to be overfished and small pelagic stocks are on average within sustainable levels of fishing. Stocks in the region are also exposed to threats including the impacts of invasive species from the Red Sea and the impacts of eutrophication and environmental changes in the Black Sea. Also it is

Table 3. Variables in the equation for selected parameters

	B	S.E.	Wald	df	Sig.	Odds ratio (OR)	95.0% C.I.for (OR)	
							Lower	Upper
Age	-.116	.030	14.743	1	.000	.890	.839	.945
Gender(1)	.408	.338	1.464	1	.226	1.505	.776	2.916
Region(1)	-.486	.317	2.350	1	.125	.615	.331	1.145
Revenue			10.566	4	.032			
Revenue (1)	-.033	.707	.002	1	.962	.967	.242	3.867
Revenue	-.861	.705	1.493	1	.222	.423	.106	1.682
Revenue (3)	.119	.634	.036	1	.851	1.127	.326	3.901
Revenue (4)	1.045	.703	2.211	1	.137	2.843	.717	11.275
Fish consumption			11.218	4	.024			
Fish consumption (1)	-1.641	.640	6.569	1	.010	.194	.055	.680
Fish consumption (2)	-.089	.500	.032	1	.859	.915	.344	2.436
Fish consumption (3)	-.517	.495	1.092	1	.296	.596	.226	1.572
Fish consumption (4)	-.927	.548	2.859	1	.091	.396	.135	1.159
Consumption season			3.433	3	.330			
Consumption season (1)	-1.140	.616	3.423	1	.064	.320	.096	1.070
Consumption season (2)	-.213	.333	.410	1	.522	.808	.421	1.552
Consumption season (3)	-.079	.475	.028	1	.868	.924	.364	2.345
Consumption reason			13.351	2	.001			
Consumption reason	-2.107	.587	12.907	1	.000	.122	.038	.384
Consumption reason	-1.899	.553	11.808	1	.001	.150	.051	.442
Do you ask the origin (1)	-2.306	.353	42.786	1	.000	.100	.050	.199
Pay attention to the origin (1)	-.179	.324	.306	1	.580	.836	.443	1.578
More consumption if it's antibiotic free (1)	1.081	.310	12.201	1	.000	2.949	1.607	5.410
Extra payment for drug-free fish			6.298	4	.178			
Extra payment for drug-free fish (1)	-.443	.459	.932	1	.334	.642	.261	1.578
Extra payment for drug-free fish (2)	-1.139	.497	5.259	1	.022	.320	.121	.847
Extra payment for drug-free fish (3)	-.676	.488	1.922	1	.166	.509	.196	1.323
Extra payment for drug-free fish (4)	-.738	.617	1.433	1	.231	.478	.143	1.601
Constant	6.393	1.391	21.111	1	.000	597.471		

reported that, the stocks of turbot and anchovy are overfished in the Black Sea. The Mediterranean and Black Sea had 59% of assessed stocks fished at biologically unsustainable levels besides, the General Fisheries Commission for the Mediterranean (GFCM) estimates that about 85% of fish stocks in this area are fished at unsustainable levels (FAO, 2016).

According to all these facts, aquaculture seems to be a promising alternative way for global fishery product demands in the future since human being cannot omit fish and fishery products from their diets regarding to health issues. It is well known that fish (lean and fatty fish, shell fish) is an excellent source of a large variety of nutrients including high-quality protein, long chain poly-unsaturated omega-3 fatty acids vitamins (especially vitamins A and D in fatty fish, and B vitamins), and minerals and trace elements (especially iodine and selenium).

It has been observed that consumers have problems in accepting the farmed fish as a healthy and reliable food in consumption. Therefore, the implementation of the labeling system, which includes the characteristics of the feeds used in the aquaculture with the geographical marking method, will have a positive effect on the consumption preferences of the traceability and product verification system.

The revenue level can be an important factor in consumption preference with the increase in the price in fish consumption, especially in periods when fish is not caught. The low-price elasticity of farmed fish is also important. However, when the study results are evaluated, it is understood that food safety is an important factor in the preferences of consumers. This is confirmed by the fact that consumers tend to pay more for the drug-free products. Therefore, consumer satisfactory studies should be carried out to increase fish consumption and value.

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