

## CONSUMERS' OPINION ABOUT EFFECTS OF REARING CONDITIONS AND STRESS ON FISH MEAT QUALITY

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### MIŠLJENJE POTROŠAČA O UTICAJU USLOVA GAJENJA I STRESA NA KVALITET RIBLJEG MESA

#### *Apstrakt*

Dobrobit farmskih životinja predstavlja veoma aktuelnu temu u svetu, čemu je doprinelo inteziviranje proizvodnje i uočavanje povezanosti između uslova gajenja i pojave zdravstvenih, reproduktivnih i drugih problema. „Dobrobit” i “stres” su povezani i međusobno uslovljeni kod svih životinja, pa i riba. Iako su ribe veoma specifične već samim tim što žive u vodenoj sredini, dokazana je podudarnost sa kopnenim kičmenjacima po pitanju fiziologije stresa i njegovih posledica po zdravlje, produktivnost i kvalitet mesa. Najznačajniju ulogu u tome ima kvalitet životne sredine i hrane. Takođe, dokazano je da ribe mogu da osećaju bol, strah i patnju koje, pre svega uzrokuju postupci pri uzgoju, transportu i klanju.

U cilju dobijanja podataka o informisnosti javnosti u Srbiji o osnovnim činjenicama vezanim za uslove gajenja, stres i dobrobit riba anketirano je 235 punoletnih, slučajno izabranih lica. U radu je prikazan deo rezultata koji se odnose na povezanost uslova gajenja i kvalitet mesa riba. Statistička analiza odgovora izvršena je uz pomoć hi-kvadrat testa.

Približno 91% ispitanika znalo je da kvalitet mesa ribe zavisi od kvaliteta vode u kojoj riba živi, odnosno od kvaliteta hrane koju koristi (90%). Gotovo polovina je smatrala da zna i način na koji voda i hrana deluju na kvalitet mesa riba. O uticaju stresa, kao i načina na koji je riba usmrćena potpunu informaciju imao je najmanji deo anketiranih (22,98%, odnosno 25,96%), dok su nešto većem procentu anketiranih te činjenice bile poznate, ali ne i način delovanja. Veliki broj anketiranih izjasnio se da zna da ribe mogu da osećaju bol (72,77%), strah (70,21%) i patnju (44,68%), a ove emocije je 66,33% povezal o sa postupcima u toku uzgoja, transporta i klanja.

Na poznavanje efekta kvaliteta vode, hrane i stresa na kvalitet mesa ribe značajno je uticalo obrazovanje ispitanika ( $p < 0,001$ ) tj. veće znanje su pokazali ispitanici sa višim

nivoom obrazovanja. Na poznavanje efekta kvaliteta hrane na sličan način je uticala i visina primanja ( $p=0,001$ ), a na saznanje da na kvalitet mesa ribe utiče stres starosti ispitanika ( $p = 0,007$ ), naročito onih između 30 i 49 godina. Shvatanje bola kod riba bilo je značajno povezano sa visinom primanja ( $p<0,037$ ) i veličinom domaćinstva ( $p=0,038$ ). Odgovori muškaraca i žena značajno su se razlikovali samo na pitanje da li znaju da riba može da oseća strah ( $p = 0,04$ ), prvenstveno zato što žene manje veruju u to. Preko 70% anketiranih iz gradova i 50% anketiranih iz seoskih naselja smatralo je da riba može da oseća bol. Procenat onih koji nisu čuli za to najveći je u selima (37,04%), pa u četiri najveća grada u Srbiji - Beogradu, Novom Sadu, Nišu i Kragujevcu (25,00%). Većina anketiranih iz svih tipova naselja smatralo je da su neki postupci u toku uzgoja, transporta i klanja uzrok bola, straha i patnje riba.

Na osnovu rezultata ovog istraživanja može se zaključiti da, uprkos znatnom broju ispitanika koji se izjasnio pozitivno u pogledu poznavanja efekata uslova života, ishrane i stresa na kvalitet ribljeg mesa, neophodno je bolje informisanje javnosti na ovu temu. Time bi se doprinelo poboljšanju kvaliteta ribljeg mesa, a svakako i dobiti farmerski gajenih riba.

*Gljučme reči: stres, riba, kvalitet mesa, potrošači, Srbija*

*Keywords: stress, fish, meat quality, consumers, Serbia*

## INTRODUCTION

Welfare of fish has become an important issue in the world almost simultaneously with the development of intensive farming systems. Farmed fish are exposed to numerous stressors, they respond in the same way as other vertebrates, and can feel physical pain and unpleasant emotions (Ashley and Sneddon, 2008; Braithwaite and Boulcott, 2008; Lembo and Zupa, 2010; Wendelaar, 1997). These facts are generally reasons for all farmed animal welfare protection (Anon., 2009).

Food quality and safety for a long time represent a generally accepted concept of human and animal health protection. Violation of welfare principles may affect the safety of fish meat and products (Poli, 2009; Poli et al., 2005). Relation between animal welfare and food safety is mostly considered from an ethical aspects of food production, with requirements for humaneness use of procedures during fish harvesting (Cooke, 2001), as well as stunning and slaughter methods (EFSA, 2009), since these procedures contribute to manifestation of stress reaction and consequently unwanted processes in meat. Food safety can also be endangered by harmful substances, microorganisms and parasites that can get into live fish. Therefore, measures used to improve welfare and to reduce stress in fish, as well as provision of adequate quality of water and feed, stocking density, use of health protection measures, and careful handling with these animals have a positive effect on fish meat quality and safety (Relić et al., 2010).

In the last decade in Serbia great efforts has been directed to improvement of fish production and quality of fish meat (Marković et al., 2011, 2012). These efforts could be significantly supported if effects of rearing conditions and stress on the quality of fish meat are well known to the consumers. In this paper the results of preliminary research related to Serbian consumers' awareness about this topic is presented.

## MATERIALS AND METHODS

This research was conducted in spring 2013 on a preliminary sample of 235 adult persons from the territory of the Republic of Serbia. The questionnaire consisted of four groups of questions, and in this paper questions from the first and the third group were analyzed. The first group consisted of questions related to gender and age, personal net monthly income, education, number of household's members, the presence of juveniles in the household, and character of the place of residence. In the second group were questions about frequency of fish consumption and about habits of Serbian consumers. The third group was represented by questions about terms related to rearing conditions and stress in fish i.e. understanding of effects of water (Question 1), feed (Question 2), stress (Question 3), and killing method (Question 4) on fish meat quality. In addition, consumers' opinion about existence of pain (Question 5), fear (Question 6), and suffer in fish (Question 7) and, finally, awareness that some handling procedures during rearing, transport and slaughter could cause pain, fear and suffer in fish (Question 8) were also analyzed.

Data analysis was performed by using Stat Soft 6.1., and Microsoft Excel 2007 softwares. Distributions of responses are presented graphically. For statistical analysis of the uniformity of answers through different categories and independence of the responses with respect to their demographic and other characteristics the chi-square test ( $\chi^2$ ) was used.

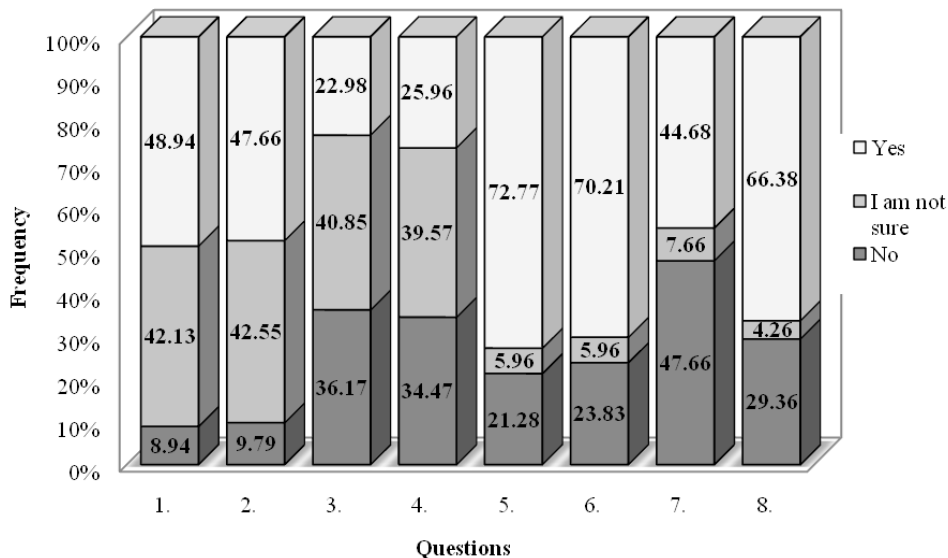
## RESULTS AND DISCUSSION

Analysis of answers to the first group of questions showed that in the sample of 235 persons, men (110) and women (125) were equally represented ( $\chi^2=0.96$ ,  $P=0.328$ ). Respondents were not equally distributed by age contingents ( $\chi^2=25.66$ ,  $P<0.001$ ). Most of the interviewed persons (71) were in the age group of 40 to 49 years. From contingents of age up to 40 a large number of people were surveyed (101) compared to contingents over 49 (63). Number of respondents with primary and secondary school (106) was not significantly different ( $\chi^2=2.25$ ,  $P=0.134$ ) from the number of better educated respondents (129). About the same number of people ( $\chi^2=1.23$ ,  $P=0.267$ ) participated in the survey with incomes below the (109) and above 40,000 RSD (126). In this survey, people from households with different number of members were represented in a different way ( $\chi^2=36.13$ ,  $P<0.001$ ). Similar to the situation in Serbia in respect to the average number of household members (Đorđević, 2008), respondents were mostly from households with three (67) and four (65) members. A significantly higher number of respondents (153) came from household without underage persons ( $\chi^2=21.45$ ,  $P<0.001$ ), as well as from the four largest cities, 160, ( $\chi^2=130.53$ ,  $P<0.001$ ).

Further analysis showed the structure of the answers to three groups of two questions is the same (Fig. 1). Distribution of the respondents to the questions consents that they know that quality of fish meat is affected by quality of the water (Question 1) and fish feed (question 2), than by stress (Question 3) and method of killing (Question 4), as well as that fish can feel pain (Question 5) and fear (Question 6).

Approximately 91% of respondents knew that quality of fish meat depends on the **quality of water** as their environment and on the quality of their feed (90%). A slightly higher percentage of respondents knew how water quality affects the quality of fish meat (48.94%), in comparison to the percentage of persons aware of that fact, but did not know

how it happens (42.13%). Similarly, slightly higher was incidence of respondents that knew the mode of action of **feed quality** on the quality of fish meat (47.66%) compared to those who knew about this influence, but did not know the mode of action (42.55%).



**Figure1.** Frequency of answers to the questions related to rearing conditions and stress in fish

Respondents were mostly aware that the quality of fish meat is associated with **stress** (40.85%) and the way the fish are killed (39.57%), but not the way of their actions. The smallest percent had complete information on the effect of stress (22.98%) and **killing method** on fish meat quality (25.96%). It is interesting that respondents knew that fish can feel **pain** (72.77%), **fear** (70.21%), and **suffer** (44.68%). Larger part of the respondents (66.33%) thought that some of the practices during rearing, transport and slaughter are the cause of these three emotions in fish.

The structure of the question on knowledge of the effect of **water** quality on the quality of fish meat depended on respondents level of education ( $\chi^2 \chi^2 = 22.59, P < 0.001$ ). Half of the respondents (50.00%) that have completed primary or secondary school this fact was known, but without awareness about the mode of action. Persons with higher qualifications usually stated (61.24%) to know the relationship between the quality of fish and the quality of the water and how they are conditioned.

Knowledge of the respondents about **impact** of fish feed on the quality of fish meat depended on the level of education ( $\chi^2 \chi^2 = 21.41, P < 0.001$ ) and their personal income ( $\chi^2 \chi^2 = 13.40, P = 0.001$ ). Similar to previous question about water quality effect, half of the respondents (50.00%) who completed primary or secondary school knew that food quality affects the quality of fish meat, but did not know in which way. More educated people mostly (59.69%) were aware of this relationship and their mutual dependence. Among respondents with lower incomes the highest percentage (47.71%) answered that they were aware the quality of fish meat is affected by the quality of fish feed, but did not know how. More than half of respondents (57.14%) with income over

40,000 RSD knew that the quality of fish meat depends on the fish diet, and they were familiar with the manner of that effect.

Awareness that stress affects the quality of fish meat very significantly depended on the age of the respondents ( $\chi^2=21.25$ ,  $P=0.007$ ), their education ( $\chi^2=26.14$ ,  $P<0.001$ ), and monthly income ( $\chi^2=16.75$ ,  $P<0.001$ ). Among respondents younger than 29 the most numerous were those who did not know or were not sure that stress affects the quality of fish meat (63.64%), while in other age groups most of respondents (40.74 - 47.22%) knew this fact but did not know the mode of action. Only 6.82% of the youngest knew the fact of existence of stress and how it affects the quality of fish meat. Among respondents aware of the effect of stress 66.67% were between 30 and 49 years, and only 5.56% of younger.

52.83% of people with lower level of education did not know or were not sure about stress influence on fish meat, and 12.26% declared to know about stress and the mode of action. More educated respondents mostly were aware (45.74%) that the quality of meat depends on the stress, but did not know in which way. That was followed by persons who knew about stress effects and the manner of its action (31.78%). Knowledge of stress was positively correlated with the level of education.

Almost half of the respondents with income up to 40,000 RSD (48.62%) did not know that stress affects the quality of fish meat. Most of the respondents with incomes over 40,000 RSD (43.65%) were aware that the quality of fish meat is affected by stress, but did not know how, and 30.95% knew also the way of action. This means that the respondents with higher incomes were more informed about stress in fish.

Respondents which were classified into two groups according to income differed significantly by the knowledge that fish can feel pain. Although in both groups a higher percentage believed that fish can feel pain, among those who did not believe the answers were significantly associated with the level of income ( $\chi^2=6.60$ ,  $P < 0.037$ ).

Independently of the household size, the largest part of respondents believed that fish can feel pain. However, the ratio of these values and the participation of those who have not heard that fish can feel pain suggest that knowledge about pain in fish was related to household size ( $\chi^2=16.30$ ,  $P = 0.038$ ).

Male and female responses were significantly different ( $\chi^2=6.34$ ,  $P=0.04$ ), only concerning the question of knowledge that fish can feel fear, especially because women believed in it less. One of the reasons could be small number of women who go for fishing, where they could have the opportunity to see manifestation of fear in fish.

Answers to the questions in the survey were independent of presence of children in the household.

Respondents from different types of settlements gave different answers on their awareness about fish fear ( $\chi^2=10.51$ ,  $P = 0.033$ ) and about influence of some practices during rearing, transport and slaughter on pain, fear and suffering in fish ( $\chi^2=12.93$ ,  $P = 0.012$ ). Over 70% of the citizens and 50% of respondents from rural areas believed that fish can feel pain. The percentage of those who have not heard about that was the greatest in rural areas (37.04%), and then in the four largest cities (25.00%). Opinion about fish feeling fear depended on the settlement of surveyed. However, respondents from all types of settlements, 59.68% in rural and 68.13% in Belgrade, Novi Sad, Niš and Kragujevac, believe that some of the practices during rearing, transport and slaughter cause pain, fear and suffering of fish.

Considering all data, this preliminary study is comparable with similar research carried out in the world (Honkanen and Olsen, 2009; Solgaard and Yang, 2011), at the

first place in respect to the result that respondents' answers mainly depended on their knowledge about particular topic.

## CONCLUSIONS

Results of this preliminary study showed that public in Serbia generally consider that life conditions, diet, stress, and procedures during rearing, transport and slaughter affect the quality of fish meat. With regard to the emotions of fish, people mostly recognize the feeling of pain and fear in fish.

Despite the considerable number of respondents that answered positively regarding the main factors affecting the quality of fish meat, better informing of public on this topic is necessary. This would also contribute to improving quality of fish meat, and certainly the welfare of farmed fish.

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