THE EFFECT OF ADDING ZEOLITE ON TROUT MEAT QUALITY

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UTICAJ DODAVANJA ZEOLITA NA KVALITET MESA PASTRMKE

Abstrakt

U radu je ispitivan uticaj zeolita tipa "Minazel" kao aditiva hrane za pastrmke primenjenog u koncentraciji od 1% i 2% na sledeće proizvodne parametre: osnovni hemijski sastav mesa, mikotoksikološku ispravnost, senzorne osobine, randman i koncentraciju pojedinih makro i mikroelemenata.

Primenjene koncentracije zeolita, kao aditiva hrane nisu uticale na hemijski sastav pastrmskog mesa, koncentraciju minerala (Ca, Cu, Zn, Pb i Mn) i njegove senzorne osobine. Izvesni stepen pozitivnog uticaja ispoljen je u pogledu randmana mesa i prosečne telesne mase pastrmki posle ezenteracije.

Ključne reči: *zeolit, kalifornijska pastrmka, meso, kvalitet, minerali*

INTRODUCTION

Meat fish, especially salmonids is a very respected nutritional food which is characterized by a favorable biologically valuable protein, low fat content and high content of vitamins and minerals.The above nutritional characteristics make it highly valuable nutritional food product that is used not only in the diet of healthy individuals, but as in the diet convalescents purposes. Meat quality is a set of several features of which the most important are: organoleptic properties (appearance, texture, color, smell and taste), chemical properties and hygienic-toxicological safety (Baltić et al. 1997). Meat quality

of trout and other fish species are influenced by numerous factors specific to each pond or a natural ecosystem (Spinelli,1979). The main differences between the meat quality of fish and domestic animals are the percentage of edible parts in pigs is 71%, 55% broiler and 52% of carp and trout 61%. The protein content in meat of pigs is about 9%, 11% of broiler chickens, carp 16% and 19% of trout. Also, fish meat is one of the richest sources of minerals, and especially phosphorus, resulting its biological value is considerably higher than the meat of warm-blooded animals. Significantly, the fish oil containing over 50% unsaturated fatty acids, and carbohydrate content in meat of fish is negligible, and represents an indispensable dietary food (Huisman,1979; Steffens, 1980; Rašeta et al.,1984, Milinković,1986; Baltić et al.,1997). Modern concepts of nutrition in intensive aquacultural production are based on the use of various additives to achieve maximum performance results. Proceeding from this,it is accessed in this paper studies the influence of zeolite type Minazel, in addition to food on the main parameters of meat quality rainbow trout.

MATERIAL AND METHODS

The study was conducted at the trout pond in Gornja Trešnjica during the period of 150 days on 24.540 fish which were divided into five groups: one control and four experimental groups of 4908 fish in each pool. Initial density of plantation was 98 fish/ m^3, or 86 fish per m^2 of water surface. Formed groups of fish were fed with dry pelleted food of domestic origin, and the pellet size and number of meals during the test was determined by previously given to food tables (Phillips, 1970).

Co-group of fish was fed with pellets without the addition of zeolite, while the experimental group of fish O-I and O-II offered feed supplemented with 1% zeolite, and the experimental groups O-III and O-IV were fed with pellets supplemented with 2% zeolite. Determination of the meat quality of fish was carried out at the end of the experiment, and applied to the determination of sensory properties (appearance, color, smell and taste), chemical composition (protein, fat, ash, water and minerals), and setting mucotoxicological safety of meat, at the end experiment. All tests were performed on samples from 20 fasted fish per treatment, after 24-hour cooling meat at 4^0C. The chemical composition of meat was analyzed using standard methods of testing (SRPS ISO). Total water content was determined by drying samples to constant weight, crude ash by incineration and annealing the sample at 500^0C to 600^0C, total protein by Kjeldahl method in the basis of nitrogen content, total fat by extraction by Soxlett in the pre-drying the sample, microminerals (Cu , Mn, Zn and Pb) by atomic absorption spectrophotometry AAS, and Ca spectrophotometrically. For evaluation of sensory properties of meat,thus acceptability of meat fish, was used method called Rang test (Baltić, 1994). Determination of residues of mycotoxins in fish meat was carried out by the method of thin-layer chromatography (Balzer et al., 1978).

The results of the experiment are grouped into appropriate series and statistically analyzed on a computer using the usual mathematical - statistical procedures that include variance analysis and evaluation of the significance of the results obtained (the difference) using the test called Tukey honest significant difference test.

RESULTS AND DISCUSSION

The data listed in Table 1 indicate closer to the chemical composition of meat of fish examined. Based on the chemical composition shown it can be concluded that the average water content of the meat was very constant and ranged from 76,71% to 76,91% in the experimental group of fish whose food is treated with zeolite and the Co-group which was not used zeolite as a feed supplement to 76,74%.

A similar trend of relative uniformity between the groups was found regarding the concentrations of protein in meat, whose average content ranged from 19,00% (0-I group) to 19,26% (0-IV group). The average body fat content of trout was also uniform and ranged from 2,58% (0-IV group) to 2,70% (0-I group). The average ash content in the tested meat samples, was also constant and varied from 1,8% (0-II group) to 1,43% (0-III group).

The results of the basic chemical composition of meat of fish in this experiment are consistent with the findings of most other authors. According to their research, the water content in meat of trout ranges from 74,18% to 79%, then the protein content of 19,20% to 21,31%, fat content of 0,50% to 4,00% and ash content of 0,40% to 1,80% (Francetić, 1967; Peters, 1980; Vukašinović et al., 1989; Rašeta et al., 1994; Veljković et al.,1995; Hristić et al., 1996; Baltić et al., 1997).

Table 1. The average chemical composition of meat of trout at the end of the experiment, (%)

PARAMETER %	GROUP				
	Co	**0-I** (1% zeolite)	**0-II** (1% zeolite)	**0-III** (2% zeolite)	**0-IV** (2% zeolite)
Total protein	19,20	19,00	19,10	19,26	19,18
Total Fat	2,67	2,70	2,63	2,60	2,58
Ash	1,39	1,39	1,38	1,43	1,41
Water	76,74	76,91	76,89	76,71	76,83
Dry matter	23,26	23,09	23,11	23,29	23,17

Analyzing the chemical indicators of meat quality studied fish, it can be concluded that, despite the existence of minimal differences in the numerical values set forth by the difference from the standpoint of statistical analysis were not significant ($p>0,05$). Different dietary treatments did not affect the zeolite water content, protein, fat and ash in meat trout, which is consistent with research by Veljović et.al., (1998). By mycotoxicological analysis of meat there was not found the residues presence of mycotoxins of the meat sample.

Table 2. Average values of mineral content in meat trout, (mg/kg)

PARAMETER mg/kg	GROUP				
	Co	0-I (1% zeolite)	0-II (1% zeolite)	0-III (2% zeolite)	0-IV (2% zeolite)
Copper,Cu	21,20	23,00	22,50	20,90	2180
Manganese,Mn	56,20	63,50	59,0	54,6	61,0
Zinc,Zn	112,0	108,5	121,0	116,0	110,0
Lead,Pb	0,025	0,010	0,045	0,021	0,039
Calcium,Ca	28,0	19,5	32,0	24,0	26,5

Mean values of certain minerals in the meat of the trout examined are shown in Table 2. Based on these data, we can see considerable uniformity in terms of calcium content in meat and microminerals of rainbow trout. Cu content ranged from 20,90 (O-III) to 23,0 mg/kg (O-I), the concentration of Mn ranged from 54,60 (O-III) to 61,0 m /kg (O-IV), then Zn from 110,0 (O-IV) to 121,0 mg / kg (O-II), then Pb from 0.010 (O-I) to 0,045 mg/kg (O-II) and at the end Ca from 19,5 (O-I) to 32,0 mg / kg (O-II).

The results obtained in terms of copper, manganese, zinc, lead and calcium in the meat of the trout were in the normal reference framework for this type of fish (Brown et al., 1977; Vukašinović et al., 1989; NRC, 1991; Baltić et al.,1997; Vukićević,1998). Statistical analysis revealed no significant differences, both between treated groups and between control groups and other groups of fish ($p>0,05$).

A very important indicator of the quality of meat fish, other than the chemical composition and its sensory properties were investigated in this experiment by method Rang test or meat acceptability by consumers. The fish meat samples in all experimental groups assessed the acceptability, and the results are shown in Table 3.

Table 3. "Rang testa" results acceptability of meat trout at the end of experiment

GROUP		GROUP				
		Co	0-I (1% zeolite)	0-II (1% zeolite)	0-III (2% zeolite)	0-IV (2% zeolite)
TOTAL		**109**	**109**	**107**	**105**	**106**
DIFFERENCE	**Ko**	-	-	2	4	3
	0-I	-	-	2	4	3
	0-II	-	-	-	2	1
	0-II	-	-	-	-	1
	0-IV	-	-	-	-	-

From the results (Table 3) we can see a great match acceptability sensory properties of fish meat between two groups. According to Veljovic et al. (1998), the addition of zeolite to trout food at a concentration of 0,5% had no effect on sensory properties and chemical composition of meat trout. Slightly higher values of Rank test, made in Co-group and 0-I group could be attributed to slightly higher fat content in meat of fish of these groups, as some researchers reported a higher fat content in the body of fish,

conditions, and better sensory properties acceptability of meat fish, or better values of Rank test (Spinelli, 1979; Nose,1979; Hebber et al., 1979; Plavša et al. ,2000). Based on the results of Rank test, obtained in this research, can be concluded that the application of zeolite as a food additive had no effect on the sensory properties of meat of fish examined.

Table 4. The average body weight of trout (g) with the dressing percentage (%)

PARAMETER	GROUP				
	Co	0-I	0-II	0-III	0-IV
Body weight of uncleaned fish, g	239,51	260,15	266,24	246,94	250,86
Body weight of the cleaned fish, g	208,00	226,20	231,99	214,59	218,10
Weight womb,%	13,15	13,05	12,86	13,10	13,06
Dressing percentage (%)	86,84	86,95	87,13	86,90	86,94

Data on average body weight of trout before and after the actual ezenteracion dressing percentage, are shown in Table 4. Based on the established results can be seen that the highest body mass of cleaned fish had 0-II group (231,99 g), which is understandable, considering that this group had the highest average body weight before ezenteracion (266,24 g). The lowest final body weight had the fish Co-group (239,51 g), in line with the lowest yield and body weight after ezenteracion (208,00 g). Analysis of data (Table 4) showed that fish 0-II group, made the best dressing percentage of 87,13%, followed by 0-I group with dressing percentage of 86,95%, then 0-IV group with 86,94 %, 0-III group with 86,90% and at the end the Co-group which has achieved the lowest dressing percentage of 86,84%.

Based on test results yield, as a very important factor of meat quality trout conclusions can be drawn that the fish whose food containing zeolite scored better yield compared to the fish co-group. Considering that the applied zeolite content in food of 1% results in achieving the best value meat yield of fish, the same concentration of zeolite is shown in this study as the most optimal dose for improving yield of meat trout.

CONCLUSION

Analyzed the quality of meat for consumption of trout in this experiment indicated that the applied zeolite concentration (1% or 2%) as a food additive, did not affect the basic chemical composition and content of the studied minerals in meat of fish. The numerical values of moisture, protein, fat, ash and minerals in meat of fish of all experimental groups were very equal in the absence of significant differences ($p>0,05$). The recorded values of measured parameters of the chemical and mineral composition of meat trout ranged in normal physiological limits for these indicators. Mycotoxicological analysis examined samples of fish meat, was not found the presence residues of mycotoxins. Zeolite as a food additive, used in different concentrations did not affect the sensory properties of meat trout.

Addition of the tested food additives contribute to the achievement of greater body mass of 231,99 g of fish 0-II groups which were given the zeolite pellets at a concen-

tration of 1%, compared to fish fed the Co-group without zeolite, with an average body weight of fish was 208,00 g. The average yield of treated and cold carcasses ready to roast was the best at fish 0-II group (with the addition of 1% zeolite in feed) 87,13%, and the worst in fish co-group (without addition of zeolite in feed) 86,84%.

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