RESEARCH REGARDING THE WARM SMOKING INFLUENCE OVER CHEMICAL COMPOSITION OF TROUT MEAT

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Abstract

Smoking, as a traditional method for trout preservation, is one of the oldest methods utilised to increase the storage time and to improve the taste of fish meat. To realize the current study were smoked at warm a number of 60 individuals from three different breeds, 20 individuals for each breed), determine the efficiency at smoking, dry matter, ash, content in proteins and content in lipids for all three batches of smoked trout (L1, L2 and L3). By weighting of the smoked carcasses, gathered from the all three experimental batches, were obtained efficiency for smoking between 51.58% and 57.19%. Regarding the chemical composition the obtained values were between 37.14 and 40.29% for dry matter. Content in proteins recorded the best values (29.42%) at individuals from L2 batch, content in lipids was between 7.18% and 9.21%, and content in ash was in interval 1.52-1.58%.

Key words: warm smoking, trout, meat, chemical composition

INTRODUCTION

Smoking, as a traditional preservation method for trout, is one of the oldest methods used to increase the storage period and to improve the taste of fish meat, existing proves that this preservation method was used since ancient times (Krasemann, 2004, Pagu et al., 2013). In this context smoking represent the technological operation of fish exposure to smoke action aiming to assure preservation, flavouring and formation of specific colour (Doe, 1998). This is one of the most used capitalization methods for trout and allows not only long time preservation but also an easier manipulation and transportation (Pagu et al., 2013).

Smoked fish is widely spread nowadays due to its taste and flavour and also due to the prolonged shelf-life, obtained as a consequence of combined effects of dehydration, anti-microbial and anti-oxidant of the smoke components (carboxylic acids, formaldehyde and phenols) (Ionescu, et.al., 2006).

Romanian national tradition has a large variety of products which could be considered local, being consumed with great pleasure, and among them a special place is reserved to smoked trout (Pagu et al., 2012).

Warm smoking is practiced usually for small trout, which are partially roasted during technological process.

During warm smoking, in fish muscular tissue took place a series of physical and chemical processes, which affect, mainly, water percent and protein component of meat (Krasemann, 2004).

Water content, in the case of trout subjected to smoking, id decreasing being influenced by the smoking method, fish breed and waist and could be between 45% and 72% (Alçiçek, and Atar, 2010 Pagu, et al., 2013).

This decreasing is not only a weight decreasing but represents, at the same time, an increasing of nutritive value, because proteins form meat are concentrated during smoking process (Usturoi et al, 2009).

MATERIAL AND METHODS

Biological material was represented by 60 individuals of rainbow, brown and brook trout, with different ages, reared into a intensive system at a trout fish farm from Suceava county. To fulfil our aims, from studied biological material were established three experimental batches L1, L2 and L3, each having a number of 20 individuals of trout from each breed.

During our research, trout in the analysed batches were reared in same environmental and feeding conditions.

Smoked trout was obtained by impregnation with natural smoke, made by burning of wood with tough texture (beech) and wet sawdust. Warm smoking is a often utilised method for small sized trout.

After gathering, sorting and slaughtering, trout was subjected to many processes to be able to be smoked, as follows:

Evisceration is the operation by which was removed the visceral mass and internal organs, and have the role to increase the trout preservation period. Washing took place just immediately after removal of blood and mucus.

Drying is realised to create necessary conditions for submission of smoke constituents of fish surface and for coagulation of proteins in the superficial layer of fish meat, for limiting the evaporation of water from rainbow trout meat (Văcaru and Usturoi, 1994).

Roasting was carried out at temperatures between +80 ÷ +100°C. After roasting fish, could be consummated, without any other future gastronomic preparation.

Smoking was realised at temperatures of smoking mixture lower than +80°C. Chilling of fish took place, in a first stage, up to a temperature of +15 ÷ +18°C, and its storage was realised at a temperature between 0 ÷ +2°C (Usturoi et al, 2009).

Technological losses at warm smoking of rainbow trout vary 25-30 % from initial mass (Krasemann, S., 2004).

To calculate smoking efficiency is utilised the following formula:

$$R.A.\ (\%) = \frac{\text{Weight of carcass after smoking}}{\text{Weight before slaughtering}} \times 100$$

To determine the chemical composition of smoked trout meat were gathered samples from side musculature of fishes' bodies.

Gathered samples were subjected to chemical analysis, in according with laboratory methodological norms, respecting all the recommendations imposed by them and in according with the nowadays standards.

Proteins were identified by Kjeldahl method, which consists in heating of nitrogen from organic combinations and its' transforming in ammonium sulphate, with the help of concentrate sulphuric acid in the presence of a catalyser. By adding a strong alkaline, ammonium is released, and by distillation could be caught into a certain quantity of acid with a well-known normality. Excess of acid it is titrates with an alkaline solution of same normality and, through difference is established the quantity of total nitrogen (SR ISO 937:2007).

Determination of lipids content was realised using Soxhlet method, which consists in fat extraction from the analysed sample using petrol ether.

Were made envelopes from filter paper, which were previous dried in oven at +105°C temperature, for one hour, after that were chilled in desiccators and weighted. After that in each envelope was placed a quantity 3-5 g of meat. The envelopes with samples were placed in oven for drying, for 2 hours, and after chilling in desiccators were weighted again (SR ISO 1443:2008).

Ash was determined by calcinations at 550±20ºC in calcinations oven (SR ISO 936:2009).

Determination of dry matter was realised through the method of drying in oven, which is the most used indirect method and suppose the drying of sample in oven at +100 - +105°C, till reaching a constant weight (SR ISO 1442:2010).

The software used for statistical analysis was SPSS. We calculated the average, standard deviation, coefficient of variation and statistical significance of differences between samples, using Anova Single Factor

RESULTS AND DISCUSSION

Fish exposure to smoke action, represent a special stage, determined by the characteristics of raw material. Trout is subjected to some inter-relations with environment, which are decisive regarding its meat quality (Pagu, I.B., et al., 2013).

Determination of smoking efficiency was realised for each batch, after a previous chilling of trout smoked carcasses (table 1).

Table 1

Smoking efficiency at trout breeds

Specification	Batch	n	Live weight (g) $\bar{X} \pm s_{\bar{X}}$	Smoking efficiency (%) $\bar{X} \pm s_{\bar{X}}$	V%	Min.(%)	Max.(%)
Rainbow trout	L1	20	277,15±6,75	51,58±0,35	2,38	49,87	53,17
Brook trout	L2	20	249,90±2,43	54,22±0,34	1,93	53,25	56,55
Brown trout	L3	20	359,90±12,14	57,19±0,26	1,37	59,30	61,61
Significance of differences between batches' means	L1 vs. L2 = ***; pt. 1:38 GL L1 vs. L3 = ***; pt. 1:38 GL L2 vs. L3 = ***; pt. 1:38 GL						

Analysing the data presented in table 1 are observed some differences in evolution of mean values for smoking efficiency, function of trout breed. So, the mean values of corporal mass were 277.15±6.75 g for L1 batch, 249.90±2.43 g at trout individuals from L2 batch respectively 359.90±12.14 g for L3 batch.

As regarding the smoking efficiency for the studied trout individuals, this one have a mean value of 51.58±0.35% for rainbow trout, 54.22±0.34% at brook trout individuals from L2 batch, and respectively 57.19±0.26% as was recorded in the case of brown trout from L3 batch.

Statistically analysing the obtained mean values for smoking efficiency at all three batches we observed very significant statistical differences.

In our research, regarding the dry matter content from analysed samples, we obtained values between 37.14 % - 40.29%. The highest values were obtained at brook trout individuals (table 2). The obtained values for variation coefficient didn't pass over the limit of 10%, which enlightened a high homogeneity inside the three batches of studied smoked trout.

Statistical differences recorded between L1 and L2 batches were significant and the ones recorded between batches L1 and L3, respectively L2 and L3 were very significant.

Table 2

Dry matter content of smoked trout meat

Specification	Batch	n	D.M. (%) $\bar{X} \pm s_{\bar{X}}$	V%	Min.(%)	Max.(%)
Rainbow trout	L1	20	38.74±0.46	5.35	36.34	42.69
Brook trout	L2	20	40.29±0.54	4.04	37.22	42.98
Brown trout	L3	20	37.14±0.30	4.76	34.56	40.55
Significance of differences between batches' means	L1 vs. L2 = *; pt. 1:38 GL L1 vs. L3 = ***; pt. 1:38 GL L2 vs. L3 = ***; pt. 1:38 GL					

In according with the data from table 3 the content of smoked trout meat in proteins is between 27.93±0.2% and 29.42±0.29%, with the highest value (31.85%), recorded at individuals of smoked brook trout.

Table 3

Protein content of smoked trout meat

Specification	Batch	n	Proteins (%) $\bar{X} \pm s_{\bar{X}}$	V%	Min.(%)	Max.(%)
Rainbow trout	L1	20	28.56±0.26	4.09	27.12	30.41
Brook trout	L2	20	29.42±0.29	4.36	27.81	31.85
Brown trout	L3	20	27.93±0.2	3.15	26.12	30.14
Significance of differences between batches' means			L1 vs. L2 = *; pt. 1:38 GL L1 vs. L3 = n.s; pt. 1:38 GL L2 vs. L3 = ***; pt. 1:38 GL			

The studied character is very homogenous, this thing being enlightened by the low values of variation coefficient which not passed over the value of 10%.

Significant and very statistical differences were enlightened at individuals from batches L1 and L2 respectively between the individuals from L2 and L3 batches, and between L1 and L3 batches recorded differences were insignificant.

The effectuated analysis on smoked trout meat to determine lipids percent enlightened mean values for this character of 8.98±0.17% for L1 batch, 9.21±0.22% for L2 batch, minimum value (7.18±0.24%) being recorded at L3 batch (table 4).

Were recorded very significant statistical differences between individuals from L1 and L3 batches, respectively between the individuals from L2 and L3 batches, and between L1 and L2 batches differences are insignificant.

Table 4

Lipids content of smoked trout meat

Specification	Batch	n	Lipids (%) $\bar{X} \pm s_{\bar{X}}$	V%	Min.(%)	Max.(%)
Rainbow trout	L1	20	8.98±0.17	8.55	7.84	10.46
Brook trout	L2	20	9.21±0.22	10.58	7.39	10.44
Brown trout	L3	20	7.18±0.24	15.1	5.86	9.75
Significance of differences between batches' means			L1 vs. L2 = n.s.; pt. 1:38 GL L1 vs. L3 = ***; pt. 1:38 GL L2 vs. L3 =***; pt. 1:38 GL			

In the current case ash content of smoked trout recorded quite low values for all the three studied batches, the lowest value (1.52±0.02%) for this character was determined at L1 batch, and the maximal one (1.58±0.01%) was recorded for L2 batch.

The studied character was homogenous, aspect proved by low values of variation coefficient which didn't get over the limit of 10%.

Statistical interpretation of the obtained values didn't show the existence of some significant statistical differences between L1 and L3 batches. Significant statistical differences were recorded between L1 and L2 batches respectively L2 and L3 batches (table 5).

Table 5

Ash content of smoked trout meat

Specification	Batch	n	Ash (%) $\bar{x} \pm s_{\bar{x}}$	V%	Min.(%)	Max.(%)
Rainbow trout	L1	20	1.52±0.02	6.88	1.33	1.75
Brook trout	L2	20	1.58±0.01	4.06	1.41	1.66
Brown trout	L3	20	1.52±0.02	6.1	1.38	1.65
Significance of differences between batches' means		L1 vs. L2 = *.; pt. 1:38 GL L1 vs. L3 = n.s; pt. 1:38 GL L2 vs. L3 =*; pt. 1:38 GL				

In according with the data cited in literature the ash content in smoked trout varies between 1.3 and 2.4% (Besharati, Naereh, 2004).

The obtained values as result as determination of chemical composition of smoked trout meat for all the three experimental batches are in according with the value mentioned in literature for this breeds (Alçiçek, Z. and Atar, H.H, 2010, Besharati, Naereh, 2004, Pagu, et al., 2012, 2013, Pelâez, S.R.R., 2006).

CONCLUSIONS

Smoking efficiency recorded ascendant values function of age, the lowest values being recorded at trout individuals from L1 batch, and the highest ones at individuals from L3 batch.

Water content, in the case of smoked trout, is influenced by the smoking method, breed and fish waist.

Quality of smoked trout meat is characterized by the content in dry matter, proteins and lipids, starting from these premise from quality angle is recommended, for smoking, 2nd summer rainbow trout which have a better quality, fact proved by the highest content in dry matter and proteins

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