RESEARCH REGARDING EVALUATION OF SENSORIAL FEATURES OF EUROPEAN CATFISH MEAT PRESERVED THROUGH DIFFERENT METHODS

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Abstract

Fish meat had remarkable sensorial features and very good nutritive features conferred by its high content in proteins, lipids with a high un-saturation degree, as well as by contended mineral substances. But the main problem for capitalization of this food type is maintaining of its initial quality, due to the reduced preservation degree.

The aim of the current research is, on one hand, to observe the influence of different preservation methods on sensorial features of meat gathered from Silurus glanis breed, associated with prolongation possibilities of practical shelf life time, and on the other hand to establish the optimal storage period for preserved meat, through sensorial analysis.

The applied preservation methods were: refrigeration, freezing, salting and smoking. Optimal storage period for the preserved products was enlightened by sensorial analysis which is based on an analytical appreciation method for quality through scoring.

Based on the obtained results, fish meat stored under refrigerated form was conform from sensorial point of view till day 6, the one preserved by freezing kept its minimal quality properties till month 10, while European catfish filets subjected to smoking and salting obtained a practical storage period of 35 days, respectively 42 days.

Key words: European catfish, preservation methods, sensorial analysis

INTRODUCTION

Sensorial analysis is one of the most important evaluation method for freshness state and quality level for fish and fish products. Application of sensorial evaluation in a clear and precise way is an indispensable modality for collecting of some valuable information regarding quality of a food product, which till now couldn't be obtained only by utilisation of human senses [1].

Although the nowadays techniques offer the possibility of some alternative methods for evaluation of fish meat freshness state, sensorial analysis remain, for the moment, the most efficient, economical and rapid technique, specific to domain [2], [3].

One of the fish breeds which leave a strong fingerprint in consumers' olfactory memory is European catfish (*Silurus glanis*). This one is appreciated on consumption market due to skin devoid of scales, white meat, without bones, with a low fat content [4]. Because also at this breed the main problem consists in maintaining the initial quality, application of some preservation methods, could represent a viable alternative for prolongation of practical storage period. Having in view those aspects, in the current study, we aimed to establish the shelf life time for European catfish filets processed through the most common preservation methods which are specific for fishery industry, based on the results offered by sensorial analysis.

MATERIAL AND METHOD

Biological material was represented by 24 individuals from *Silurus glanis* breed, with a corporal mean mass of around 2000 g/individual. Fishes were alive transported at Aquaculture Laboratory from U.A.S.V.M. Iaşi, were processed as filets and were divided in 6 batches for each applied preservation method, one batch for each storage interval.

Refrigeration was realised in chilled air flow, storage temperature being around 2-4°C. Freezing was applied just after fishes' slaughtering, temperature in storage unit being around values of -16°C ÷ -18°C. To apply preservation through salting, was utilised dry salting method, at cold (6% NaCl in product), temperature in storage unit being between 3-5°C. Smoking was applied in three consecutive days, for 3-4 hours/day, at a reduced temperature in smoking chamber (between 30-40°C), using a so called „cold smoking". The obtained product was stored at a temperature of 3-4°C.

Sensorial evaluation was realised by a six member team, persons whom are familiar with fish products. Sensorial analysis of samples (20g/piece) was made using analytical appreciation method through points, utilising a hedonic scale with 9-1 quality points [5]. In according with the utilised appreciation system, for each analysed sensorial characteristic is given a score between 9 and 1, where 9 indicates the optimal parameters for the studied attribute, in according with product standard and following a descendant trend, obtaining of minimum score 1, show absolute unacceptable parameters, for each type of analysed sensation.

Calculus utilised for qualitative evaluation through sensorial features is based on the following formula:

$$Pmp = Pm \times f_i \times f_t$$

where:
Pmp is the weighted mean score; Pm is the mean score, which represent the arithmetic mean of results' evaluation through scoring for a sensorial features by a group of tasters; f_i is the importance factor which indicate the participation rate of each sensorial feature to product quality; f_t is transformation factor which is utilised for passing from 9-1 scoring scale to 20 points scale, for establishing the product global quality (in current case the value of transformation factor is 2.22).

Based on the obtained results for sensorial evaluation, was calculated the total mean score (Pmt), by summing the values of weighted mean score for all sensorial features. The obtained values were processed using the scoring scale for qualitative evaluation (tab. 1).

Table 1 Scoring scale for qualitative evaluation (0-20 points)

Total maximum score	Obtained qualification
18.1 – 20	Very good
15.1 – 18	Good
11.1 – 15	Satisfactory
7.1 – 11	Unsatisfactory
0 – 7	Altered

RESULTS AND DISCUSSIONS

In case of catfish meat preserved by refrigeration, evaluated sensorial attributes, during those 15 storage days were colour, smell, texture, consistency and brightness. If at the beginning of storage period the obtained score for each analysed sensorial feature is maximal, together with time passing was observed an inversely proportional relation between score given by evaluation team and storage period. Sensorial attributes with the most intense degradation dynamic, during storage, were smell and colour, while at the opposite pole were placed consistency, respectively muscular fibres cohesion, which seems to be less affected during those 15 days.

After calculation of total score presented in *table 2*, could be affirmed that European catfish filets preserved by refrigeration are considered as being *very good* in the application day for refrigeration and *good* from qualitative point of view in day 3 of storage. Day 6 of storage represent the last interval in which sample could be consumed having in view that score of 13.6, obtained for this storage interval, indicates a *satisfactory* from qualitative point of view. In the next storage intervals, refrigerated catfish meat recorded a continuous depreciation this thing being shown by the obtained score, which starting with day 12 is associated with qualification *altered product*. Similar results are also enlightened in literature [6], [7], [8], [9]. The obtained values were statistically processed. So, between total scores which illustrate the freshness state of refrigerated European catfish meat, for each storage interval, are obtained statistical differences *very significant*, which show the fact that dynamics of sensorial features related to existed duration between storage intervals was very pronounced.

Table 2 Sensorial evaluation of European catfish meat preserved and stored under refrigerated form

Specification	Sensorial attributes	n	Storage interval (days)					
			0	3	6	9	12	15
Mean score	brightness	6	9.00	8.50	7.33	4.67	2.33	1.17
	colour	6	9.00	8.33	5.50	3.83	1.67	1.00
	smell	6	9.00	7.33	4.83	3.33	1.00	1.00
	texture	6	9.00	8.17	6.83	5.33	2.83	1.00
	consistency	6	9.00	8.50	7.50	6.67	4.33	2.67
Total mean score	$\bar{X}$	6	20.00[a]	17.88[b]	13.63[c]	9.85[d]	4.65[e]	2.68[f]
	$s_{\bar{x}}$	6	0.00	0.70	0.44	0.39	0.47	0.16
	v%	6	0.00	3.93	3.24	3.95	10.06	5.97
	min	6	20.00	17.10	12.90	9.10	4.20	2.40
	max	6	20.00	18.90	14.00	10.20	5.30	2.90

Values of total mean score without common exponent present differences with statistical signification (p<0.001)

The second preservation method applied to European catfish filets is freezing. The evaluated sensorial characteristics, during those 12 storage months were: juiciness, colour, smell, texture and consistency. Taken together, was observed that during storage period, those five analysed sensation types keep a descendant trend similar by obtained scoring (*tab. 3*). However, if at previous preservation method, consistency sensorial attribute was the less affected one, this time we observe that in interval month 2 – month 5, this one known a significant depreciation, which could be associated with forming of extra-cellular ice crystals, with direct implication on muscular tissue morphology.

Must be remarked that none of analysed sensorial features didn't reach a qualitative minimal level, intensity of degradation processes going up to a level of 2/3 from initial quality.

Global appreciation of European catfish meat quality, preserved by freezing, is shown in *table 3*, where could be observed that in the first 2 months analysed product was catalogued as being *very good*, and in month 12, frozen filets to receive the qualification of *unsatisfactory product*, but not *altered product*, which prove, once more, the efficiency of this preservation method. In the light of those values, European catfish meat could be considered *satisfactory* from qualitative point of view for ten months from application start of preservation method. Literature offers only a limited number of information regarding effect of freezing on sensorial qualities of European catfish meat. But, was observed that fact that in case of other breeds with meat chemical composition similar with European catfish, degradation dynamics recorded during storage had many common points with the results obtained in the current research [10], [11], [12].

Table 3 Sensorial evaluation of European catfish meat preserved and stored under frozen form

Specification	Sensorial attributes	n	Storage interval (months)					
			1	2	5	7	10	12
Mean score	juiciness	6	9	8.83	7.33	6.33	4.50	3.33
	colour	6	8.83	8.67	7.67	6.67	5.50	3.50
	smell	6	8.83	8.17	7.33	6.17	5.17	3.67
	texture	6	9	8.33	7.67	6.50	5.00	3.17
	Consistency	6	9	8.67	6.50	6.33	4.67	3.50
Total mean score	$\bar{X}$	6	19.80[a]	18.60[a]	16.40[b]	14.18[c]	11.50[d]	7.65[e]
	$s_{\bar{x}}$	6	0.32	0.57	0.63	63	0.54	0.44
	v%	6	1.60	3.06	3.84	4.45	4.80	5.77
	min	6	19.30	17.80	15.80	13.30	10.70	7.30
	max	6	20.00	19.50	17.50	14.90	12.20	8.40

Values of total mean score without common exponent present differences with statistical signification (p<0.001)

Interpretation of obtained statistical differences between samples preserved by freezing show the fact that between first two storage intervals weren't very significant differences, this thing being enlightened also by the fact that both batches were considered to be *very good* from qualitative point of view, between all other batches being *very significant* statistical differences.

The third applied preservation method for European catfish meat was salting. The analysed sensorial features for samples preserved in this manner were: general aspect, colour, smell, consistency and taste. In the light of data presented in *table 4* could be observed a strong correlation between sensorial analysis and storage interval. So, if at the beginning of storage period, the scoring mean for each analysed sensorial type was close to maximal value which is identify with 9 points, in the last storage interval, sensorial attributes recorded minimal values for quality, enlightened especially smell and taste, which, in the light of obtained score were specific to an altered product.

After summing the obtained score for each sensorial characteristic and its transposing on scoring scale for global qualitative evaluation of product, was observed that samples preserved by salting was conform from qualitative point of view till fifth storage interval, which is identify with the 42 day from the moment of preservation method starting (*tab. 4*). Having in view that the value for this interval represent a minimal quantitative level, based on which the product could be considered as *satisfactory,* was observed a high qualitative depreciation between days 42-50 moment in which product was classified by evaluation team as altered.

Table 4 Sensorial evaluation of European catfish meat preserved and stored under salted form

Specification	Sensorial attributes	n	Storage interval (days)					
			2	12	22	32	42	50
Mean score	aspect	6	8.67	8.33	7.33	6.83	5.5	3.5
	colour	6	8.83	8	7.17	6.67	5.5	3.67
	smell	6	8.83	8.17	6.83	6.17	5.33	2.33
	consistency	6	8.5	7.83	7.17	6.67	5.5	3.5
	taste	6	9	7.83	6.5	5.67	4.33	1.83
Total mean score	$\bar{X}$	6	19.55[a]	17.78[b]	15.28[c]	13.85[c]	11.33[d]	4.90[e]
	$s_{\bar{x}}$	6	0.47	0.37	0.50	0.65	0.52	0.64
	v%	6	2.39	2.09	3.27	4.67	4.56	10.83
	min	6	19.30	17.10	14.90	13.10	10.70	4.90
	max	6	20.00	18.20	16.20	14.70	12.00	6.40

Values of total mean score without common exponent present differences with statistical signification (p<0.001)

From statistical point of view, the obtained results present *very significant* differences, with exception of values for samples evaluated after 22, respectively 32 storage days, which show the fact the product preserved by salting presented a more pronounced stability from qualitative point of view in the last third of first month from beginning of preservation method.

The last evaluated product from sensorial point of view was European catfish meat preserved by smoking. Like at fish preserved by salting, the evaluated sensorial characteristics were: general aspect, colour, smell, consistency and taste. Samples' quality was established through sensorial analysis during 40 days with a regularity of around once at 5 days. Also in this case was observed a natural relation of inversely proportionality between the obtained score and storage interval. Overall, the sensorial characteristics recorded an descendant trend uniformly from qualitative point of view, with exception of samples' consistency, which if till storage day 35 was the most stable attribute, at the end of evaluation period recorded a high denaturing, mainly due to high dehydration of samples. In according with the interpretation offered by scoring scale for global appreciation of fish

preserved by smoking, this one could be considered as being *very good* at the beginning of storage period, *good* in day 15 and *satisfactory* for the next 3 storage intervals. Total weighted mean score in storage day 35, which sum 11.4 points is at the inferior limit of scoring scale for qualitative evaluation, for classification *satisfactory*, which shown the fact that the product might still be consumed, but couldn't be commercialized. Those 6.1 points obtained by the samples afferent to last storage interval suggested the fact that analysed samples are inadequate from qualitative point of view, respectively altered (*tab. 5*).

Table 5 Sensorial evaluation of European catfish meat preserved and stored under form of cold smoked product

Specification	Sensorial attributes	n	Storage interval (days)					
			5	15	25	30	35	40
Mean score	aspect	6	8.67	7.50	6.67	5.83	4.83	3.33
	colour	6	8.83	7.83	6.33	5.67	4.67	3.17
	smell	6	9	7.67	6.83	5.83	4.83	2.83
	consistency	6	8.67	8.33	7.33	6.83	6.33	2.33
	taste	6	9	7.83	6.33	5.50	4.83	2.67
Total mean score	$\overline{X}$	6	19.73[a]	17.42[b]	14.92[c]	13.12[d]	11.35[e]	6.13[f]
	$s_{\overline{x}}$	6	0.28	0.52	0.48	0.60	0.47	0.16
	v%	6	1.42	2.98	3.18	4.56	4.16	2.66
	min	6	19.30	16.40	14.20	12.40	10.70	5.80
	max	6	20.00	17.80	15.50	13.80	12.00	6.20

Values of total mean score without common exponent present differences with statistical signification (p<0.001)

Statistical interpretation of qualitative differences existed between samples preserved as smoked product, shown the fact that between batches for each storing period exist *very significant* differences. These results enlightened the fact that qualitative modifications in fish meat preserved by smoking are very intense, relating to time period existed between storage intervals. Literature offers information regarding capitalization of European catfish as smoked product, [13], [14], but mainly the accent is on sensorial, physical-chemical and microbiological features of final product and less on degradation dynamics recorded during storage period. However, similar studies were carried out on other fish breeds, the obtained results enlightened similarities in evolution of products preserved by smoking and stored in refrigeration conditions [15], [16], [17].

CONCLUSIONS

In conclusion could be affirmed that European catfish (*Silurus glanis*) filets evaluated through sensorial analysis kept their qualitative features on a different period of tine, function of applied preservation method. Fish preserving by refrigeration at a temperature of 3-4°C is the method which highly kept the initial sensorial features of fish meat. Fish have a short preservation period of about six days from the beginning of preservation method application. Applying of freezing at temperatures around value of -18°C suppose a moderate depreciation of muscular fibre and a lose of tissue water content, at defrosting, but the minimal qualitative demands for product are increasing till month 10 of storage. Fish preservation by dry salting assures a modification of product sensorial features, which became semi-canned, acceptability period being of around 40 days from preservation starting. For fish preserved by smoking, smoke components, respectively phenols, acids and aromatic aldehydes offer the largest sensorial modification for product but with a practical storage period of up to 35 days from beginning of preservation method application.

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