Effect of Stinging Nettle Extracts on Duration of Shelf-Life of Common carp (*Cyprinus carpio*) filets

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Abstract

The research was conducted to evaluate antimicrobial and antioxidant activities of standardized water extract of stinging nettle (*Urtica dioica*) on the shelf-life of the Common carp (*Cyprinus carpio*) fillets during 5 days of refrigerated storage. Filets was treated with salt (1.5%) and five types of solutions were prepared: control (no extract), 10% nettle extract in cold and worm extraction, and 20% nettle extract prepared in hot and cold extraction. All of samples were prepared at the first day of experiment and the evaluation by the sensory panel are done in zero point, first day, two hours after treatment, than 24, 72 and 120 hours after treatment. Total of samples were used is 20. We compared the appearance of the flesh, particularly at the cut surface along the backbone, the texture of the raw fish, under manual pressure, the odor of the raw fish, the odor of the cooked fish, the flavor of the cooked fish and the texture of the cooked fish. In parallel with the sensory evaluation, microbiological tests were also performed.

Keywords: carp, fish meat, nettle, plant extracts

1. Introduction

Traditional Common carp (*Cyprinus carpio*) meal preparation in Serbia implies purchasing live carp and preparing for the same day, which is one of the most important reasons for the low consumption of this type of food, around 6kg per capita. The second problem is the relatively high price of carp in our market 5-7 Euro per kilogram of fish, [1] whit big percent of waist. For this reason, in the last few years there has been changed the consumption of trade with freshwater fish in supermarkets, sliced meat is stored on ice, similarly as seafood. In this case, there is another kind of problem, and this is a fast microbiological change in meat, their storage time is short, about 48 hours, with changes in texture already in first 24 hours, [2]. That is why there was a need to create a preparation that would extend that deadline. Similar preparations already exist on the market, but include either chemical compounds, which are often unacceptable for the local market, or change its texture, mostly due to aggressive ph. The second type of preparation includes herbal preparations which contain some of the aromatic plants, and their use is limited to consumers where such treatment and change in the scent and taste of fish is acceptable, usually associated with the preparation of some other fish species but not the carp as well [3]. The combination of thyme EO at 0.4% with nisin at 1000 IU/g was effective in controlling L. monocytogenes in minced fish meat. The sensory properties of the treatment were acceptable to the panelists.

Ucak was a similar experiment in 2011 [4]. His trial was carried out with Atlantic mackerel burgers, and the treatment with rosemary extracts. The results of the study showed that addition of rosemary extract in fish burger resulted in longer shelflife compared to the control. Rosemary extract, in combination with vacuum pack, was

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effective in controlling the growth of bacteria and biochemical indices.

He et all. [5] conducted the trial with antioxidant activity of green tea and its catechins in a fish meat model system, but also with suprats prepared from muscle of meckeler, and they exhibited excellent antioxidant properties as evidenced.

Akarpat, made the trial in 2007 [6], with hot-water extracts from myrtle, rosemary, nettle and lemon balm leaves on lipid oxidation and color of beef patties during frozen storage.

With common carp it was also made some trials, but with bitter orange peel extract, the results showed that the extract could reduce the chemical degradation and lipid oxidation in the filets compared to the control, as reflected with lower TVBN, FFA, PV and TBA values. They maintain common carp fillet shelflife until 16 days without any significant loss of texture, odor, color or overall acceptability, while control samples had a shelf-life of only 4 days [7].

On the other hand, there are unofficial literary data that suggest that in the 19th and early 20th centuries they used stinging nettle as a treatment to maintain the carp of carp in some local communities in the south and southwest of Serbia.

The same nettle (*Urtica dionica*) has been proven to have antimicrobial effects that have been investigated in our geological area, and in the work of Đurović et al [8]., The following active substances are listed according to Soxlet extraction: Kaempferol 285 MS / MS, Rutin 300 MS / MS, Quercetin 151 MS /MS, Galic acid 125MS/ MS; Vanilic acid108 MS / MS; p-Coumaric acid 119 MS / MS, Kaempferol 3-O-glucoside 285 MS / MS, Naringenin 151 MS / MS; Syringic acid 182 MS/MS; Cinnamic acid 103 MS/MS; Protocatechuic acid 109 MS /MS, [8]. And Total phenolic content of leaves of nettle according to Ghaima [9] 48.3 mg GAE / gdw.

Ghaima, with associates [9], investigated antibacterial and antioxidant activities of ethyl acetate extract of nettle and dandelion, but organic solvents, namely ethyl acetate in our research, were unacceptable in the research.

2. Materials and methods

Plant material preparation

For the needs of the experiment, Urtica sp. was collected on the slopes of Fruška Gora during the month of March, and the above-ground part of the plant was used, precisely leaves and thin support branches. Thereafter, drying of the preparations at a temperature of 105^{o}C to a constant weight has been achieved. Moisture was calculated from the mass difference after and before drying [8]. Later it was milled to a powder structure and stored at a constant temperature of 4^{o}C in a closed dark glass bottle.

From the mentioned plant material, two types of extraction were performed parallel to the day before the experiment was started. The first aqueous extract was made at a concentration of 20% by dissolving in cold deionised water, with a constant physical mixing for 20 minutes. Then, by filtration of the same through the filter paper, the thickness was 0.2 mm and the pore size is 12-15, the diameter was 240 mm. From prime water extract, with dilution with deionized water we made second extract with concentration of 10%. The other concentrated water extract was made in a water bath at a temperature of 90^{o}C plant material was soaked, and after 10 minutes at room temperature, the filtration was carried out through the aforementioned filter paper. In this way, four aqueous extracts were obtained, while deionized water was taken for control treatment.

Sample preparation

Fresh carp is taken from the "Sutjeska" fish pond through the classic market channels, so we did not circumvent any of the possible points of contamination during transport. Four carps from the same place, the same age and average weight of 2.5 kg were taken, with a deviation of±0.1 kg. The fish were sacrificed by cervical translocation without anesthesia. Finally, samples- equal pieces of meat with ribbon in it, with average wait 70g±5g. Filets was treated with salt (1.5%).

Treatment preparation

The experiment is performed in 5 treatments, a warm extraction at a concentration of 10% and 20%; a cold extraction at a concentration of 10% and 20%, and control treatment. The treatment was done uniformly on the surface from all sides equally, first day of trial, storage were obtained at refrigerator at individual plastic vacuum boxes.

The thermal processing of fish was in alufolie at a temperature of 100^{o}C for 20 min with rotation for 10 minutes.

Microbiological evaluation

Samples for microbiological analysis were taken on the day after the section, and 5th day at the end of the treatment. Row fish muscle was analyzed. The total number of aerobic mesophilic bacteria was determined by the Plate Count Agar (HiMedia, Mumbai, India) method. The seeds were incubated at a temperature of 30 [deg.] C. for 72 h after which counted colonies were counted.

Sensory evaluation

Sensory evaluation was carried out with the aid of 8-member trained panel (average age of 31, 4 male and 4 female panelist). Treated fish samples were observed before and after cooking, sensory color, odor and overall acceptability attributes, and flavor at the first 4 days of experiment using a 9-point hedonic scale (1¼ unacceptable , 9¼ very acceptable) [3].

The thermal processing of the fish was in alufolia at a temperature of 100^{o}C for 20 min with rotation on10 minutes and served to panelist on paper plates. Each sample was under code. Sensory evaluation was performed on day 0 and at 2-day intervals until the end of 6 days of refrigerated storage at 4^{o}C.

3. Results and discussion

Sensory results of sliced common carp meat showed that the limits of acceptance of samples were 4 days respectively and 5th day of storage acceptance is on the minimal level (Table 1). According to the statistical analysis, there were no significant differences in acceptability of color of all groups during the storage, but there were two types of discoloration to observe. First is the aggressive color of nettle in the treatment with the cold water extract, especially in the stronger concentration. The second deviation from the color of the control group is the deviation in the direction of more intense red color in treated samples with a hot water extract from nettle, in both of concentrations, but only in later sessions, that could be correlated with the oxidative processes which did not be observed analytically in this research. [9].

The odor was observed in two directions of development. The first variation of the taste is directly dependent on the treatment of the coprocessing preparations, and according to the sensory panel evaluation the acceptability at lower concentrations was 10% in both cases positive, whereas at higher concentrations, 20% in both modes of extraction was poorly evaluated, even in one repetition (1 observant) as unacceptable. The second variation is dependent on the microbiological changes i is in direct correlation with it, Table 2.

Taste and Smell were not in direct correlation, and they moved independently of each other, and the acceptability of tastes, in all the groups where the tasting was moving in smaller ranges than is the case with the scent of treated meat that was less acceptable to those who had the same change taste.

Change in structure and other texture properties were minimal, and apart from the minimal appearance of mucus in groups of 10% C, 10% H and control, no major oscillations and changes were observed. Similar results with natural antioxidant were reported [3, 5, 8].

Microbial analysis results are given in Table 2, and Figure 1, we can notice effect of hi concentrated cold water nettle extract, but still effect is not statistically.

The final conclusion is that the effect of nettle and her preparations has been noted but insufficient in intensity, further leading to the conclusion that in the case of further research it would be necessary to further investigate the process of preparation of the preparation, possibly determine the sterilization method of the yeast, and more precisely determine the quantities applied to fish meat.

Stinging nettle still have a weaker taste and more approximate flavor than other herbal materials described in the literature and should give her a chance in a more detailed research.

Table 1. Sensor evaluation of the fish after thermal treatment (average level of acceptance)

	No.of Session/Group	1 session	3 session	5 session
Colour				
(X±Sx)	Control	7	6	6
	10%C	4	5	5
	20%C	3	4	4
	10% H	6	6	5
	20%H	6	6	6
Odour				
(X±Sx)	Control	9	7	1
	10%C	6	6	3
	20%C	4	4	3
	10% H	5	3	1
	20%H	4	3	1
Taste				
(X±Sx)	Control	9	7	-
	10%C	9	8	-
	20%C	8	9	-
	10% H	6	5	-
	20%H	5	5	-
Texture				
(X±Sx)	Control	8	8	6
	10%C	8	8	7
	20%C	8	8	8
	10% H	8	8	7
	20%H	8	8	8
General acceptance				
(X±Sx)	Control	9	8	2
	10%C	9	9	4
	20%C	8	8	6
	10% H	9	7	2
	20%H	8	8	4

Table 2. Microbiological results

Sample	Total number of aerobic mesophilic bacteria (log cfu/g) (aver.±st. dev)
Session 1	
Start sample	4.17±0.037
Session 2	
Control	6.62±0.015
20% C	6.04±0.061
20 %H	6.15±0.034
10 %C	6.14±0.061
10 %H	6.25±0.034
Session 3	
Control	8.85±0.015
20% C	8.04±0.061
20 %H	8.25±0.034
10 %C	8.34±0.061
10 %H	8.76±0.034

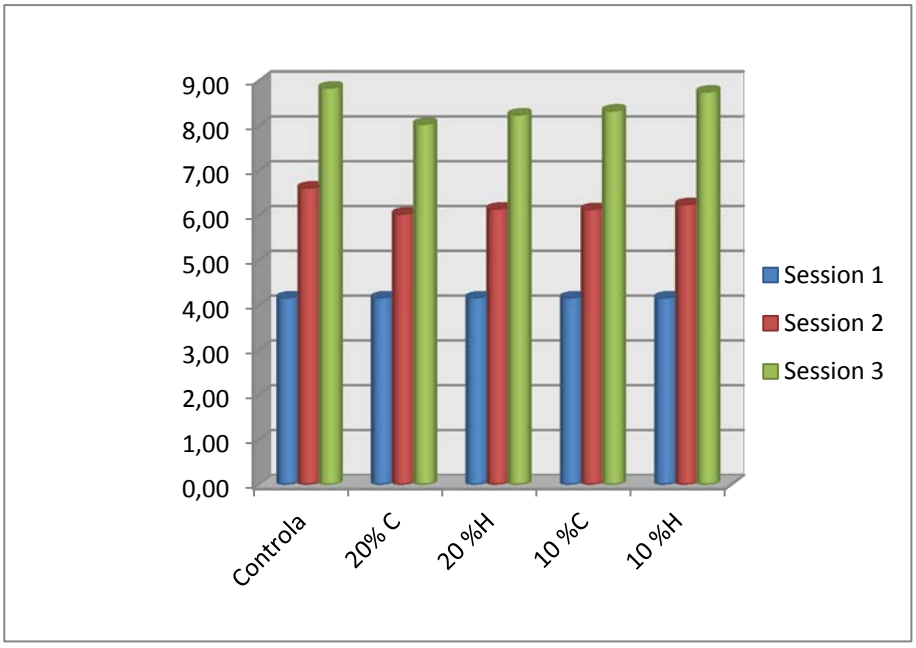

Figure 1. Microbiological results

4. Conclusions

The results of the study showed that addition of nettle extract on common carp resulted in longer shelflife compared to the control. Panellist preferred cold water extract fish, better than hotwater one, because of the specific odor. There is the effect in controlling the growth of bacteria and biochemical indices.

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