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THE ORGANOLEPTIC EXAM OF COOKED HIGH PRESSURE PROCESSED AND COOKED UNTREATED FISH FILLETS

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Abstract

Advanced food processing technologies provide us with the possibility to keep food fresh and safe for as long as possible as an alternative to refrigeration storage. One process in particular, the high pressure processing (HPP), can represent an interesting option for restaurant owners or processors of smoked fish. By using this technology, fish fillets can be kept fresh and protected from any microbial alteration that could endanger the consumer even in the case of not preparing them in the next hours after delivery. In this study, we included rainbow trout fillets as samples. The first type of samples were previously pressurized at a pressure level of 400 MPa/6 min. The second type of samples was represented by controls (untreated samples). Both of them were introduced in the sensorial exam (triangle test method) after a cooking process. The baked high pressure processed and control samples were compared with respect to texture, taste, odor and appearance. The final results revealed that the majority of the panelists found the untreated sample softer. Regarding flavour and appearance, the HPP samples and the controls were perceived as mainly similar.

Key words*: high pressure processing, organoleptic exam, trout fillets.*

INTRODUCTION

The rainbow trout (*Oncorhynchus mykiss*) is a species of salmonid which became very appreciated over the last years due to its dietary quality.

Its value as hard-fighting game fish and his remarkable benefits for human consumption make from this low-fat, sweet water fish an interesting option for fishermen to consumers. Some of the most important characteristics of rainbow trout include: excellent organoleptic properties, tender flesh, high levels of vitamins, antioxidants and omega-3 fatty acids, which convert it into an important source for a healthy food diet and respectively, a safer way of living.

The commercial value of this product has seriously grown in the late 19th century worldwide. Even though wild fish is known to have a stronger taste, being promoted as superior to farmed fish, the increased demand in the international markets, has influenced the soar of aquaculture.

See food and fish in general, beside their highly nutritional value, are very perishable (Mengden et al., 2015), having a very short shelf-life. Because fish muscles are quickly spoiled by different strains of bacteria, it can easily lead to potential microbiological risks for the consumers. For this reason, promising preservation methods that could extend shelf-life and reduce the microbial load are tested in current days (Rode et al., 2016). High pressure processing (HPP) is considered an advanced food technology which offers great advantages in this way. Even though the first attempts to use HPP date since the 19th century, the method itself became popular and beneficial in food industry in 1980 (Yagiz et al., 2007). HPP can reduce the microbial load, having a minimum effect on the flavour, nutrients, vitamins and other nutritional values of foods (Erkan et al., 2010). With this type of

processing, a better shelf-life can be obtained, but most important, the microbial risks for humans is significantly reduced (Aubourg et al., 2013). Being a non-thermal technology it is capable of inactivating spoilage and pathogenic microorganisms (Alves de Oliveira et al., 2017), modifying enzymatic activity, but preserving the freshness and the nourishing factors from foods.

The aim of this study was to evaluate the effects of an HPP pre-treatment on the sensorial quality of cooked rainbow trout fillets in comparison with untreated cooked fillets, while including the advantage of shelf-life extension. The objectives pursue comparisons regarding final product texture, flavour (odor and taste) and appearance.

MATERIALS AND METHODS

FISH SAMPLES

Fresh skinless rainbow trout fillets (weight, 60±20 g), were obtained from an aquaculture farming system (Osnabrück, Germany) and immediately transported on ice to the German Institute of Food Technologies (DIL) (Quakenbrück, Germany). The fillets were portioned in half. Each aliquot of the fillet (weight, 24,05±6,05 g) was placed in a clean, dry polyethylene bag purchased from Schulte&Co (Lohne, Germany), vacuum-sealed using Multivac Typ C200 (Wolfertschwenden, Germany) and HPP processed in 3-5 h after slaughtering and filleting.

HPP TREATMENT

Pressure treatment was carried out in a 55 L capacity high-pressure vessel HIPERBARIC (Burgos, Spain). The stainless steel vessel had 200 mm internal diameter. The instrument had a 22 m^2 surface requirement and an automatic loading/unloading system. The transmitting medium used was water. The maximum temperature of the samples during pressure treatment was 6°C. The first type of samples used in the study were placed in a cylindrical loading container and pressurized at 400 MPa at a rate of 150 MPa/min. The holding time was 6 min. The holding time refers to the time that the product was subjected to a given pressure (it does not include come up time and release time). The second type of samples used in the experiment were control samples which were not subjected to any kind of pressure treatment (untreated sample). All samples were stored in a cooling room with controlled temperature conditions of 4.0 ± 0.1°C until the sensorial exam was performed.

THE TRIANGLE TEST WITH THERMALLY PROCESSED HPP TREATED AND CONTROL SAMPLES

The triangle test is one of the commonest tests used in sensory evaluation. This type of sensory method for quality control requires trained assesors (Kilcast David, 2010). The test is useful whenever a test sample has to be compared with a control or reference sample that does not or should not change.

In accordance with the objective of our study, a number of 30 trained panelists participated in the test (ISO 4120, 2004). All samples were baked in aluminium foil at 170°C for 10 min and each panelist was presented with 3 coded samples, 2 high-pressure processed samples at a pressure level of 400 MPa/6 min and one control sample (0 MPa). The high-pressure processed sample (400 MPa/6 min) was chosen in account of the good microbiological inactivation and superior physicochemical aspect. The high-pressure processed samples were labelled as sample number 273, respectively 856 and the control sample with 138 (Table 2). The panelists are asked to identify the odd sample. Additionally, the panelists were asked to describe the difference referring to texture, taste, odor, appearance or others. If the panelists were unsure of their decision, they could write down their best guess and specify in the 'Remarks' section that their choice was based on an assumption (ISO 4120, 2004). For the assessment of results the correct answers given were counted and compared to the values of the significance level (P) (ISO 4120, 2004; Meilgaard et al., 1991) (Table 1).

Table 1. The number of assessors in a triangle test required to give correct judgments, at three different significance levels

Number of assessors	Significance level		
	5%	1%	0,1%
7	5	6	7
8	6	7	8
9	6	7	8
10	7	8	9
11	7	8	10
12	8	9	10
13	8	9	11
14	9	10	11
15	9	10	12
16	9	11	12
17	10	11	13
18	10	12	13
19	11	12	14
20	11	13	14
21	12	13	15
22	12	14	15
23	12	14	16
24	13	15	16
25	12	15	17
26	14	15	17
27	14	16	18
28	15	16	18
29	15	17	19
30	15	17	19

Sources: ISO 4120, 2004; Meilgaard et al., 1991

RESULTS AND DISCUSSIONS

The results revealed that 20 out of 30 panelists who participated at the sensorial exam identified correctly the odd sample (untreated and baked fillet) coded with the number 138 (Table 2). The answers were statistically significant ($P \geq 0.001$) expressing a level of confidence equal to 99.9%. A graphical description of the cooked untreated sample, based on the answers given by the panelists who identified the odd sample (cooked untreated sample), is shown in Figure 1. A number of 27 panelists observed differences in texture. The majority of the answers described the untreated cooked sample as softer than the high-pressure processed samples. For this quality indicator, the answers were statistically significant ($P \geq 0.05$). After HPP, the texture of fish meat is known to change towards firmness (Chouhan et al., 2015; Gómez-Estaca et al., 2007) and therefore, this property might persist even after thermal processing. The answers describing the appearance of the cooked untreated sample vs the appearance of the cooked high-pressure processed samples were not statistically significant ($P>0.05$). HPP fish meat usually becomes more opaque because the lightness increases (Chouhan et al., 2015; Gómez-Estaca et al., 2007; Gudbjornsdottir et al., 2010) (Figure 2), but in this case, it appears that after cooking there is no significant difference between untreated and high-pressure processed fish meat. The differences in flavour consisting in taste and odor were minimal. Twelve panelists noticed a difference in smell, from which 8 considered the untreated sample to have less intensive odor than the other two samples (Figure 1). The answers describing a less intensive odor andless intensive taste for the cooked untreated sample were both situated at the limit of the statistical significance ($P = 0.05$). This differences between the untreated cooked samples and the high-pressure

processed samples should not be considered at this point because the number of the answers were insufficient, but further studies should pay close attention to this parameter.

Less favour in the cooked untreated sample could automatically indicate more flavour of the cooked high-pressure processed samples and more flavour in products is always desirable. Few remarks were made concerning the shape and uniformity of the samples. This was due to the difficulty of cutting homogenously the trout fillets.

Table 2. Answers obtained after conducting the triangle test

Number of assessors	Triangle 1- sample codes			Total number of correct answers
1	273	138	856	✓
2	273	138	856	✓
3	273	138	856	✓
4	273	138	856	✓
5	273	138	856	x
6	273	138	856	✓
7	273	138	856	✓
8	273	138	856	x
9	273	138	856	x
10	273	138	856	✓
11	273	138	856	x
12	273	138	856	✓
13	273	138	856	✓
14	273	138	856	✓
15	273	138	856	x
16	273	138	856	✓
17	273	138	856	
18	273	138	856	✓
19	273	138	856	✓
20	273	138	856	x
21	273	138	856	x
22	273	138	856	x
23	273	138	856	✓
24	273	138	856	✓
25	273	138	856	x
26	273	138	856	✓
27	273	138	856	x
28	273	138	856	✓
29	273	138	856	✓
30	273	138	856	✓
				20

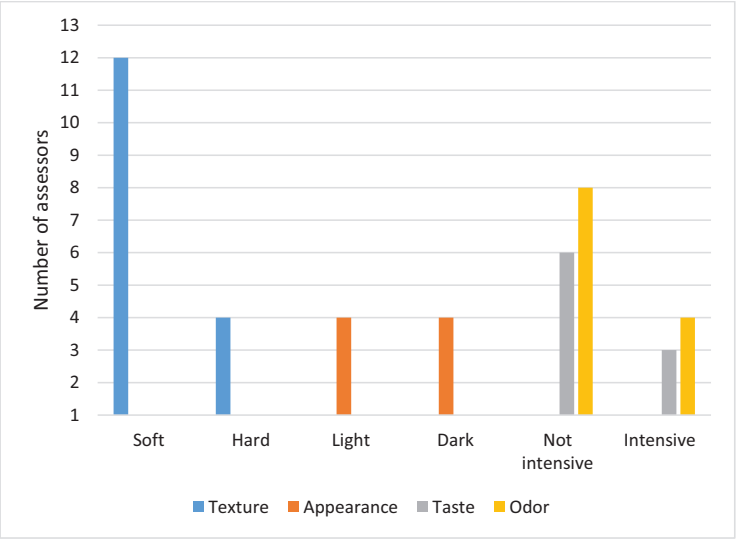
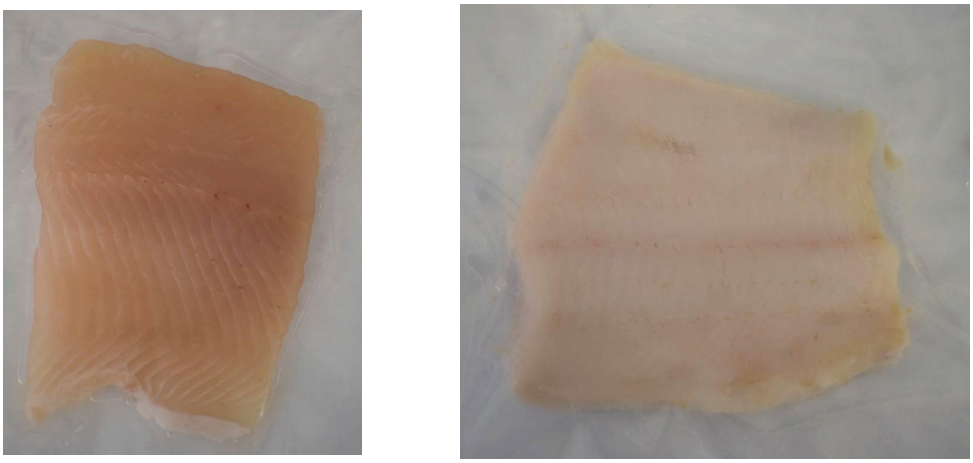


Figure 1. Description of texture, appearance, taste and odor of cooked untreated sample (code 138)



A B

Figure 2. Untreated sample before cooking (A) and sample processed at 400 MPa/6 min before cooking (B)

CONCLUSIONS

The large majority of the panelists enrolled in the organoleptic exam differentiated the untreated cooked sample from the high-pressure processed samples, mainly on texture criteria. The untreated cooked sample was softer than the cooked high-pressure processed samples. The panelists did not express their appreciation in any way for softer or firmer products. However, a more compact structure similar to the structure of the high-pressure processed samples might be considered a plus in gastronomy, for processors and consumers. No significant differences were detected concerning appearance and flavour.

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