



Proximate composition and sensory evaluation of salted pearl mullet (*Chalcalburnus tarichi* Pallas, 1811) produced using different methods

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Abstract

The aim of this study was to determine the proximate composition and sensory scores of the salted pearl mullet (*Chalcalburnus tarichi* Pallas, 1811) produced using different methods. It was determined that the OS11 group had the highest amounts of dry matter and protein ($82.77 \pm 0.52\%$ and $44.52 \pm 0.28\%$) ($p < 0.05$). The OS11 group had the highest value of energy (404.59 ± 1.33 kcal/100g) ($p < 0.05$). The highest taste score (6.88 ± 0.83) and the highest overall acceptance score (7.25 ± 0.73) in raw samples were obtained by the NS31 group and the NS32 group ($p < 0.05$), respectively. It was observed that the salted pearl mullet (*C. tarichi* Pallas, 1811) produced by using different methods had a high nutritional value. While the samples produced in the previous season (last year) were liked less according to the results of the raw sensory analysis, the samples of the new season, except for the samples produced by using dry salting method in bottom perforated plastic can be liked less according to the result of the cooked sensory analysis.

Keywords: salted pearl mullet; *Chalcalburnus tarichi* Pallas, 1811; salting method; proximate composition; sensory evaluation.

Practical Application: Determine the proximate composition and sensory scores of the salted pearl mullet (*Chalcalburnus tarichi* Pallas, 1811) produced using different methods.

1 Introduction

Being one of the oldest methods used to preserve fish, the salting process has still been used in many countries in the world. In the traditional salting method, people treat the fish with table salt or rock salt and ripen them. The salting process slows down the incidence of spoilage, which is a sign of the deterioration of fish. The process of salting the fish is briefly the covering of the products in the appropriate boxes and barrels using the salt (by placing one layer of fish and then one layer of salt) in order for the salt to penetrate into tissue. The main purpose here is to provide for dehydration. Thus, the water required for the microorganisms and other chemical reactions in the structure is reduced so that the activities which are effective in deterioration are stopped either completely or partially (Akcicek & Canyurt, 1994). However, the salt purity level used in this process, the treatments applied during the preparation of the fish, and the cleaning and storage conditions of the used water affect significantly the quality of the final product.

In the process of conservation with salt; protein denaturation and removing water enable fish to gain firmness, the bacterial activity reduces by causing an antiseptic and bactericidal effects on the microorganisms. Salt gives flavor to the product and protects its fats like antioxidants by drying the flesh to some extent (Food and Agriculture Organization, 1970; Akcicek & Canyurt, 1994). Since salt is also an aroma enhancer, it has the effect of enhancing the appeal of the fish.

Pearl mullet (*C. tarichi* Pallas, 1811) or Van fish (its local name), is an endemic fish species from the family Cyprinids (*Cyprinidae*)

that can survive in the salty and highly alkaline (salinity 0.19%, pH 9.8) waters of the Lake Van (Turkey). Even though its name is mullet, it is actually a member of the Cyprinids (Akyil et al., 2009). Sewage residues of the surrounding settlements of Lake Van, a lake with an enclosed basin, are also poured into the lake without any purification. For this reason, Lake Van, which shows stratification characteristics, gets increasingly polluted every day (Bilgili et al., 1995). The amount of pearl mullet fishing in the lake has started to fall since 2005 due to contamination and was 9945 tons in 2018 according to the fisheries statistics of the Turkiye Istatistik Kurumu (2019).

Pearl mullet (*C. tarichi* Pallas, 1811) is a cheap source of quality protein because it is affordable and has a high meat quality (Ozdemir et al., 1985). Since 65% of Lake Van is located near to Bitlis province, pearl mullet (*C. tarichi* Pallas, 1811) is as popular in Bitlis as in Van and its catching is being realized. Pearl mullet (*C. tarichi* Pallas, 1811), which is caught on the shores of Lake Van in Bitlis, is consumed salted or freshly. Salted pearl mullet is consumed mostly during fishing ban periods or when it is not caught because of winter conditions.

Salted pearl mullet (*C. tarichi* Pallas, 1811) is produced usually at home by pressing whole fish into an appropriate container or barrel (wooden box or plastic can) without cleaning internal organs or after cleaning internal organs based on traditional dry salting method.

The objective of this study was to determine the proximate composition and sensory scores of different types of salted pearl

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mullet (*C. tarichi* Pallas, 1811) preserved using traditional dry salting method in Bitlis, Turkey.

2 Materials and methods

2.1 Material

The samples of salted pearl mullet (*C. tarichi* Pallas, 1811), produced by using six different methods, were obtained with wooden boxes, plastic cans or in bottom-perforated plastic cans from three local producers at the end of the catching season of 2016 and 2017 (May-June). The samples stored in cold storage (2 ± 2 °C) were analyzed between August and September 2017. Six fish were used in each sampling day and thus the analyses were completed within 18 days. So, 108 fish samples were analyzed (3 producers x 6 methods x 3 samples for each method x 2 catching seasons).

2.2 Traditional producing methods of salted pearl mullet (*C. tarichi* Pallas, 1811)

The salted pearl mullet in Bitlis is produced generally using large rock salts according to the traditional dry salting method. The producers add salt with hand and eyeball estimates. Then, the product is stored at room temperature until it is consumed.

Method 1: The fish is gutted, cleaned with tap water, placed in a wooden box (one layer of salt and one layer of fish by turns), and kept at room temperature.

Method 2: The procedure applied in method 1 is performed without gutting.

Method 3: The fish is gutted, cleaned with tap water, and placed in a plastic can (one layer of salt and one layer of fish by turns). The bottom of the can isn't perforated. It is a kind of juicy brine.

Method 4: The procedure applied in method 3 is performed without gutting.

Method 5: The fish is gutted, cleaned with tap water, and placed in a plastic can (one layer of salt and one layer of fish by turns). The top is covered with salt. Holes are drilled at the bottom of the can to remove water leaking from the fish. Such salted fish is stored at room temperature.

Method 6: The procedure applied in method 5 is performed without gutting.

Table 1 shows the sample codes of salted pearl mullet (*C. tarichi* Pallas, 1811). The OS (old sample) code indicated the samples obtained at the end of the 2016 catching season and stored for averagely 15 months before the analysis. The NS (new sample) code indicated the samples obtained at the end of the 2017 catching season and stored for averagely 3 months before the analysis.

2.3 Proximate composition analysis

The moisture content was determined by drying an accurately weighed sample of minced fish in an oven at 103 ± 2 °C for 3 h (Mattissek et al., 1992). The ash content was obtained by

heating the residue at 550 °C for 3 h of Association of Analytical Chemists (AOAC) 938.08 (Association of Analytical Chemists, 2003a). The protein contents were assayed by using the method of AOAC 928.08 (Association of Analytical Chemists, 2003b). Total lipids were determined on a 1 g sample of the minced fillets using the acid hydrolysis method of Weilmeier and Regenstein (Weilmeier & Regenstein, 2004). The carbohydrate content of the fish was determined by the Merrill and Watt's method (Merrill & Watt, 1973). The estimated energy value is calculated by using the following formula ((protein X 4) + (fat X 9) + carbohydrate X 4)). All the analyses were performed in duplicate.

2.4 Sensory analysis

A panel of eight experienced judges carried out the sensory analysis on both raw and cooked samples. The sensory evaluation was conducted in individual booths under controlled conditions of light, temperature, and humidity. The sensory analysis was performed using the method of Mohan et al. (2012). The salted fish was assessed using a nine-point descriptive scale in terms of appearance, odor, taste and texture characteristics. A score of 9.0-7.0 points indicated "very good quality", a score of 6.9-5.0 points indicated "good or acceptable quality", and a score of 4.9-1.0 points indicated "bad or unacceptable quality".

2.5 Statistical analysis

The resulting analysis data were evaluated by using an IBM SPSS Statistics 21* program. Analysis results were calculated as mean \pm standard deviation. One-way analysis of variance (ANOVA) was applied. Parametric assumptions were formed for multiple comparisons. In order to determine the sources of the differences found within different groups, Tukey's test was used if there was homogeneity of variance and the Tamhane test was used if there was no homogeneity of variance. The value of $p < 0.05$ was accepted as a significant difference between the groups (Sumbuloglu & Sumbuloglu, 2002).

Table 1. Sample codes.

Sample Code	Explanation
NS11	Salted fish produced in the wooden box according to method 1 with gutting
OS11	
NS12	Salted fish produced in the wooden box according to method 2 without gutting
OS12	
NS21	Salted fish produced in plastic can according to method 3 with gutting
OS21	
NS22	Salted fish produced in plastic can according to method 4 without gutting
OS22	
NS31	Salted fish produced in bottom perforated plastic can according to method 5 with gutting
OS31	
NS32	Salted fish produced in bottom perforated plastic can according to method 6 without gutting
OS32	
NS	New sample (at the end of 2017 catching season, stored average 3 months until analyzed)
OS	Old sample (at the end of 2016 catching season, stored average 15 months until analyzed)

3 Results and discussion

3.1 Proximate composition of salted pearl mullet (*C. tarichi* Pallas, 1811)

Table 2 shows the proximate composition of the salted pearl mullet (*C. tarichi* Pallas, 1811) groups.

The highest dry matter content ($82.77 \pm 0.52\%$) was determined in the OS11 group. The minimum and maximum moisture contents of the samples were $17.23 \pm 0.52\%$ and $46.74 \pm 0.28\%$. When Bilgin et al. (2007) produced salted mountain trout (*Salmo trutta macrostigma* Dumeril, 1858) using both dry salting and brine methods by adding 20% salt solution, and storing them for 180 days in the refrigerator ($4\text{ }^{\circ}\text{C} \pm 1$), they found moisture amount as $57.000 \pm 1.105\%$ in dry salted samples and $63.005 \pm 0.002\%$ in brine samples on the 90th day of storage, as well as $53.068 \pm 0.252\%$ in dry salted samples and as $55.040 \pm 0.80\%$ in brine samples on the 180th day of storage. Sardine fish (*Sardine pilchardus*) stored at different rates for 10 months had an increase in dry matter (Urkut & Yurdagel, 1985). This signified that the moisture content reduced. Kolsarici & Candogan (1997) found a decrease in the moisture content of 18% and 22% salt-containing samples of anchovy (*Engraulis encrasicolus*) during 29-week storage. Turan & Erkoyuncu (1997) and Tomek & Yapar (1990) found similar results regarding the moisture content of the salted fish. Koral (2016) reported that the dry matter content of anchovy stored at room temperature and refrigerator conditions for 180 days and salted with different salting methods was between 38.55-38.02% in brine groups and 50.14-53.27% in dry salted groups. The moisture content in the samples of the salted pearl mullet (*C. tarichi* Pallas, 1811), other than the OS11 and OS12 groups, was higher than the water rate of 30.5% in dry salted fish reported by Lu et al. (1979). Inat et al. (2013) found the average moisture ratio as 21.99% in ready-to-eat salted anchovy samples. The moisture contents in *C. tarichi* were determined between 13.65-49.40% (Kucukoner & Akyuz, 1992), $42.96 \pm 7.241\%$ (Patir et al., 2006) and $44.70 \pm 0.30\%$ (Kucukoner & Kilinceker, 2009). The experimental related studies revealed that the minimum and maximum moisture contents were 62.61% and 72.68%, respectively in salted fish during the storage period (Patir et al., 2001; Tomek & Yapar, 1990; Yapar, 1989). The results of the present study (except for the OS11 and OS12 groups) are

similar to results of Kucukoner & Akyuz (1992) and Kucukoner & Kilinceker (2009), and lower than results of Yapar (1989), Tomek & Yapar (1990), Patir et al. (2001), and Kilinceker & Kucukoner (2003). This difference may be attributed to different fish species and different technological procedures.

The minimum and maximum ash contents of the samples were $17.08 \pm 0.11\%$ and $21.12 \pm 0.43\%$. The ash amount of *S. trutta macrostigma* was found as $20.949 \pm 0.050\%$ in dry salted samples and $19.043 \pm 0.026\%$ in brine samples on the 90th day of storage and as $21.470 \pm 0.009\%$ in dry salted samples and $19.791 \pm 0.086\%$ in brine samples on the 180th day of storage (Bilgin et al., 2007). It has been reported that the amount of inorganic matter in salted fish increases depending on the duration of conservation and the salt content. Inorganic matter and salt rates increased in anchovy fish stored in intensive salt curing during storage for 29 weeks and this condition affected other components (Kolsarici & Candogan, 1997). The inorganic matter amount reached from 1.45% to 20.80% (KT) and 19.00% (S) in egrez (*Vimba vimba tenella*) and stored for 118 days by applying dry salting (KT) and brine (S) (Isikli, 2000). Koral (2016) reported that the ash content of anchovy stored for 180 days at room temperature and refrigerator conditions and salted with different salting methods was between 10.44-11.39% in brine groups and 17.65-17.97% in dry salted groups. Eggez (*V. vimba tenella*) fishes were salted by dry and brine salting methods and stored for 118 days and the amount of inorganic matter increased to 20.80% in dry salted group and to 19.00% in the brine salted group (Isikli, 2000). Ash amounts of the samples were higher than 5.4% reported by Lu et al. (1979) for dry salted products and higher than $13.19 \pm 0.22\%$ reported by Kucukoner & Kilinceker (2009) for salted *C. tarichi*. But it is compatible with the average moisture content of 15.01-29.12% determined in brine fish made of pearl mullet in the study by Kucukoner (1990) as well as the average moisture content of 16.49-19.79% determined in salted pearl mullet in the study by Kilinceker & Kucukoner (2003).

While the minimum protein amount ($24.50 \pm 0.56\%$) was determined in the OS21 group, the maximum protein amount ($44.52 \pm 0.28\%$) was observed in the OS11 group. The amount of

Table 2. Proximate Composition of the Salted Pearl Mullet.

Sample Code	DM (%)	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Energy (kcal/100 g)
NS11	$61.47 \pm 0.34^{a*}$	38.53 ± 0.34^a	17.08 ± 0.11^a	30.69 ± 0.09^{ad}	9.54 ± 0.44^{ac}	4.16 ± 0.87^a	280.24 ± 2.22^{ad}
OS11	82.77 ± 0.52^b	17.23 ± 0.52^b	21.12 ± 0.43^b	44.52 ± 0.28^b	15.40 ± 0.18^b	1.73 ± 0.64^{bc}	404.59 ± 1.33^b
NS12	59.53 ± 0.22^{ae}	40.47 ± 0.22^{cd}	17.24 ± 0.16^a	30.54 ± 0.25^a	8.09 ± 0.11^a	3.66 ± 0.03^{ab}	263.67 ± 0.75^{adg}
OS12	80.54 ± 0.64^b	19.45 ± 0.64^e	19.55 ± 0.61^{cd}	43.66 ± 0.26^b	14.72 ± 0.20^b	2.62 ± 0.21^{abc}	396.72 ± 3.16^b
NS21	54.76 ± 0.21^{cd}	45.24 ± 0.21^f	20.49 ± 0.22^{bc}	25.97 ± 0.07^{cf}	6.90 ± 0.88^{abc}	1.39 ± 1.10^c	217.76 ± 4.68^{ceg}
OS21	53.42 ± 0.86^{ch}	46.58 ± 0.08^g	20.34 ± 0.26^{bc}	24.50 ± 0.56^{dgg}	7.17 ± 0.08^{cd}	1.42 ± 0.70^c	212.06 ± 0.55^{cef}
NS22	53.26 ± 0.28^{cd}	46.74 ± 0.28^g	17.44 ± 0.31^a	27.38 ± 0.22^{cgh}	5.57 ± 0.58^{ad}	2.86 ± 0.52^{abc}	218.79 ± 4.96^{cefg}
OS22	52.64 ± 0.96^{dg}	47.36 ± 0.96^g	19.78 ± 0.10^{ce}	24.79 ± 0.05^{eg}	6.31 ± 0.86^{abde}	1.75 ± 0.78^{bc}	206.89 ± 5.54^{ceg}
NS31	60.51 ± 0.46^{eah}	39.49 ± 0.46^{ac}	17.91 ± 0.18^{af}	30.40 ± 0.50^{ahg}	8.90 ± 0.05^a	3.29 ± 0.61^{abc}	269.14 ± 2.99^{ad}
OS31	57.76 ± 0.10^{ej}	42.24 ± 0.10^h	18.67 ± 0.61^{def}	30.23 ± 0.03^{adh}	7.26 ± 0.67^{abc}	1.59 ± 0.25^c	246.02 ± 5.63^{adfg}
NS32	58.24 ± 0.38^{efg}	40.76 ± 0.38^d	18.96 ± 0.73^{def}	30.85 ± 0.36^{aef}	7.72 ± 0.42^{ac}	1.72 ± 0.43^{bc}	254.32 ± 4.69^{df}
OS32	56.43 ± 0.35^{fgh}	43.51 ± 0.31^i	19.46 ± 0.42^{ce}	29.21 ± 0.20^{ad}	6.34 ± 0.43^{ac}	1.48 ± 1.01^c	231.06 ± 1.74^{ef}

*Lower case letters indicate the difference between the lines in the same column; The difference between the mean values indicated by the same letter is insignificant ($p > 0.05$).

protein was also increased in the samples with high dry matter content. Koral (2016) reported that the protein content of anchovy stored at room temperature and refrigerator conditions for 180 days and salted with different salting methods was 12.30-12.36% in brine groups and 16.20-16.47% in dry salted groups. The protein values (except for the OS11 and OS12 groups) were much lower than the protein value of 35.5% reported by Lu et al. (1979) for salted fish in the literature. The protein contents in salted pearl mullet were determined to be between 19.23-27.13% (Kucukoner & Akyuz, 1992). The protein amount of the samples was higher than $26.10 \pm 0.24\%$ reported by Kilinceker & Kucukoner (2003) for salted *C. tarichi*. Inat et al. (2013) found the average protein amount as 21.12% in ready-to-eat salted anchovy samples.

While the OS11 group had the highest fat amount ($15.40 \pm 0.18\%$), the NS22 group had the least fat amount ($5.57 \pm 0.58\%$). The amount of fat in the samples with high dry matter content also increased. Fat amount of *S. trutta macrostigma* was found as $2.155 \pm 0.010\%$ in dry salted samples and $2.468 \pm 0.268\%$ in brine samples on the 90th day of storage, and as $1.332 \pm 0.119\%$ in dry salted samples and $1.039 \pm 0.030\%$ in brine samples on the 180th day of storage. The difference between dry salting and brine was insignificant ($p > 0.05$) for all-day storage in terms of total lipid content (Bilgin et al., 2007). Kolsarici & Candogan (1997), Yapar (1989), and Isikli (2000) reported decreased fat content during the storage of salted fish products. Koral (2016) reported that the fat content of anchovy stored at room temperature and refrigerator conditions for 180 days and salted with different salting methods was between 13.25-13.64% in brine groups and 16.12-17.62% in dry salted groups. The fat values (except for the OS11 group and the OS12 group) were much lower than the fat value of 11.59% by Kucukoner & Kilinceker (2009) for salted *C. tarichi*. Inat et al. (2013) found the average fat amount as 17.24% in ready-to-eat salted anchovy samples.

The carbohydrate contents of the samples were determined between 1.39 ± 1.10 - $4.16 \pm 0.87\%$ (Table 2). As shown in Figure 1, minimum and maximum energy content was 212.06 ± 0.55 kcal/100 g in the OS21 group and 404.59 ± 1.33 kcal/100 g in the OS11 group, respectively (Figure 1).

The energy value of the OS11 group was the highest because of its high protein and high-fat content. It is known that variations in the chemical composition of fish are closely related to nutrition, living area, fish size, catching season, seasonal and sexual variations as well as other environmental and processing conditions (Schormuller, 1968; Ludorff & Meyer, 1973).

The dry matter, moisture, ash, protein, fat, carbohydrate, and energy contents of the salted pearl mullets (*C. tarichi* Pallas, 1811) were significantly different (Table 2) ($p < 0.05$).

3.2 Sensory scores of the raw salted pearl mullet (*C. tarichi* Pallas, 1811)

Table 3 shows the sensory scores of the raw salted pearl mullet (*C. tarichi* Pallas, 1811) and Figure 2 shows the overall acceptance scores of the raw salted pearl mullet (*C. tarichi* Pallas, 1811). The general view score of the raw samples was at least 5.00 ± 1.41 in the OS11 group. The NS32 group had the highest scores according to the general view, texture, odor and overall acceptance scores. On the other hand, the highest taste score (6.88 ± 0.83) was observed in the NS31 group. The OS21 group had the lowest scores according to texture, odor, taste, and overall acceptance scores. The general view, texture, taste, and overall acceptance scores of the raw salted pearl mullets (*C. tarichi* Pallas, 1811) were significantly different ($p < 0.05$), but the differences between odor scores of the samples were insignificant ($p > 0.05$) (Table 3).

The NS32 group had an overall acceptance score over 7 and so it was accepted as "very good quality" by judges. But the other groups were accepted as "good or acceptable quality" since they had an overall acceptance score between 5.0 and 6.9 (Figure 2).

Sensory score of frozen (-18°C) pearl mullet (*C. tarichi*, Pallas 1811) was found as 6.0 ± 1.0 in whole samples and 6.6 ± 1.14 in cleaned samples on the 90th day of storage and as 6.0 ± 0.71 in whole samples and 6.8 ± 0.84 in cleaned samples on the 120th day of storage. The difference between the whole samples and the cleaned ones was insignificant ($p > 0.05$). Sensory scores revealed that all samples had a "very good" quality till the 30th day and the "medium" quality on the 60th and the 120th days (Ekici et al., 2011). Turan & Erkoyuncu (1997) determined the sensorial

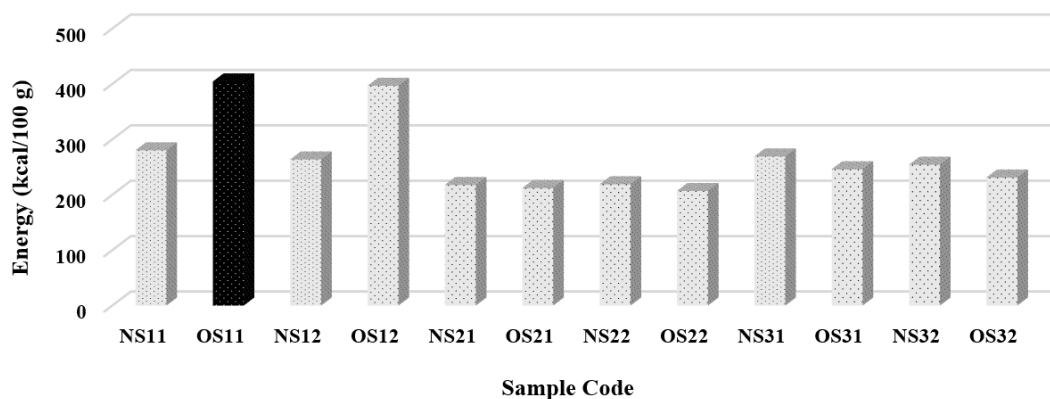
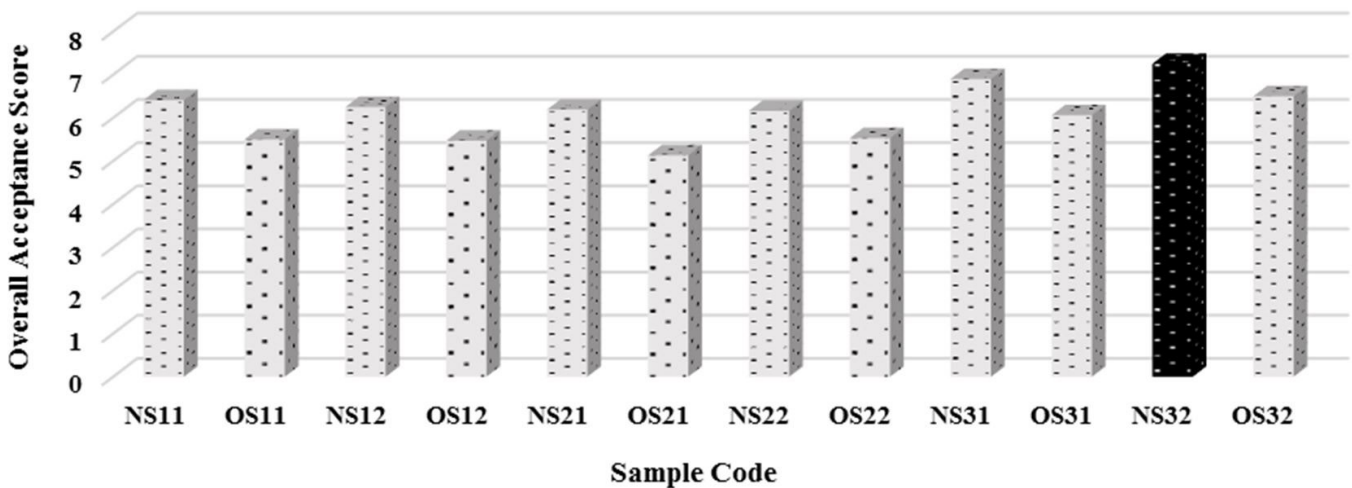


Figure 1. Energy Value of the Salted Pearl Mullet.

Table 3. Sensory Scores of the Raw Salted Pearl Mullet.

Sample Code	General View Score	Texture Score	Odor Score	Taste Score	Overall Acceptance Score
NS11	6.13 ± 1.45 ^{ab*}	7.25 ± 1.28 ^{ac}	6.38 ± 1.41 ^a	5.88 ± 1.64 ^{ab}	6.41 ± 1.15 ^{ab}
OS11	5.00 ± 1.41 ^b	6.50 ± 1.93 ^{abc}	5.88 ± 1.89 ^a	4.63 ± 1.77 ^{ac}	5.50 ± 1.43 ^{ab}
NS12	6.75 ± 1.58 ^{abc}	6.88 ± 1.46 ^{ac}	6.25 ± 1.58 ^a	5.25 ± 1.58 ^{ab}	6.25 ± 1.22 ^{ab}
OS12	6.50 ± 1.07 ^{abc}	5.38 ± 1.19 ^{abc}	5.75 ± 1.75 ^a	4.26 ± 1.91 ^a	5.47 ± 1.26 ^{ab}
NS21	7.12 ± 0.83 ^{ac}	5.75 ± 1.89 ^{abc}	6.38 ± 1.06 ^a	5.50 ± 0.76 ^{ab}	6.19 ± 0.46 ^{ab}
OS21	6.38 ± 1.69 ^{abc}	4.75 ± 1.04 ^b	5.13 ± 1.46 ^a	4.25 ± 1.04 ^a	5.13 ± 0.76 ^a
NS22	7.25 ± 0.89 ^{ac}	6.00 ± 0.76 ^{abc}	5.75 ± 1.16 ^a	5.63 ± 0.92 ^{ab}	6.16 ± 0.60 ^{ab}
OS22	6.88 ± 1.13 ^{abc}	5.25 ± 1.39 ^{ab}	5.25 ± 1.39 ^a	4.88 ± 1.13 ^{ab}	5.53 ± 0.90 ^{ab}
NS31	7.63 ± 0.74 ^{ac}	7.13 ± 1.25 ^{ac}	5.88 ± 1.36 ^a	6.88 ± 0.83 ^b	6.90 ± 0.61 ^b
OS31	7.13 ± 1.36 ^{ac}	6.75 ± 0.70 ^{abc}	5.50 ± 1.60 ^a	4.88 ± 1.36 ^{ab}	6.06 ± 0.88 ^{ab}
NS32	8.25 ± 0.70 ^c	7.38 ± 1.06 ^c	6.88 ± 1.25 ^a	6.50 ± 0.93 ^{bc}	7.25 ± 0.73 ^b
OS32	7.00 ± 1.07 ^{abc}	7.00 ± 1.07 ^{ac}	6.50 ± 1.20 ^a	5.50 ± 1.31 ^{ab}	6.50 ± 0.68 ^{ab}

*Lower case letters indicate the difference between the lines in the same column; The difference between the mean values indicated by the same letter is insignificant ($p > 0.05$).

**Figure 2.** Overall Acceptance Score of the Raw Salted Pearl Mullet.

quality of rainbow trout (*Oncorhynchus mykiss* W. 1758) and salmon (*Salmo salar* L. 1758) salted with dry salting methods (25% salt, w/w) and brine salting method (26.4% salt solution). According to test results, both rainbow trout and salmon salted with both salting methods had very good quality in terms of consumability during the trial (six months). When Erdem et al. (2005) evaluated sensory evaluation of the horse mackerel (*Trachurus mediterraneus*, Steindachner, 1868) produced by adding 10% salt solution and stored in the refrigerator (4 °C ± 1), they indicated that the sensorial value of 4.75 at the beginning of the study decreased to 1.75 at the end of the 60th day and exceeded the consumption limit.

3.3 Sensory scores of the cooked salted pearl mullet (*C. tarichi* Pallas, 1811)

Table 4 shows the sensory scores of the cooked salted pearl mullet (*C. tarichi* Pallas, 1811) and Figure 3 shows the overall acceptance scores of the cooked salted pearl mullet (*C. tarichi* Pallas, 1811).

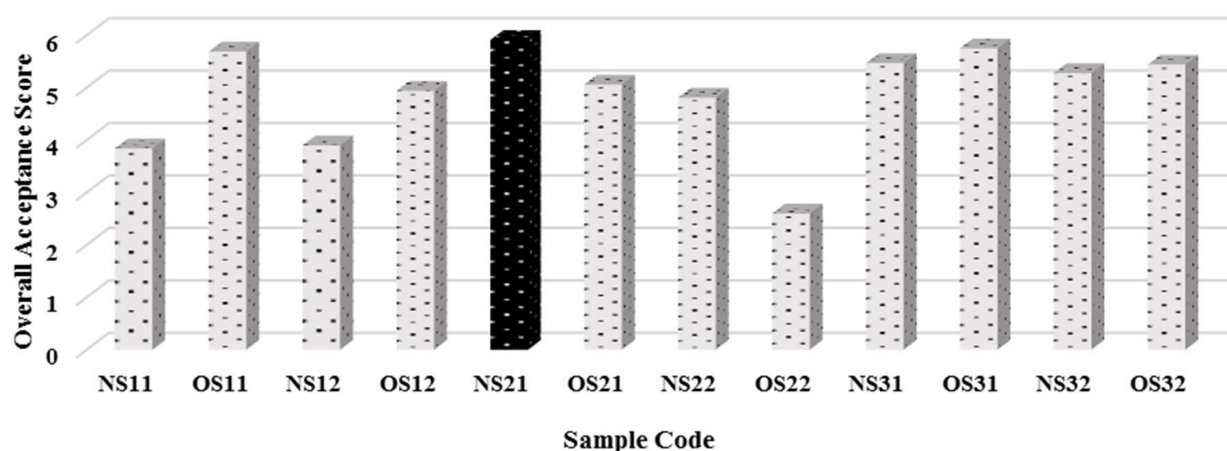
The highest mean score for the general view of the cooked samples was 6.88 ± 1.13 in the OS31 group. The NS21 group had the highest scores of texture and overall acceptance. On the other hand, the highest odor score (6.25 ± 1.75) and the highest taste score (5.38 ± 1.51) were observed in the OS11 group. The OS22 group had the lowest scores in terms of the general view, texture, taste and overall acceptance scores. The general view, texture, taste, and overall acceptance scores of the cooked salted pearl mullets (*C. tarichi* Pallas, 1811) were significantly different ($p < 0.05$), but the differences between odor scores of the samples were insignificant ($p > 0.05$) (Table 4).

The NS11, NS12, OS12, NS22, and OS22 groups were accepted as “bad or unacceptable quality” since their overall acceptance scores varied between 4.9 and 1.0. The other groups (OS11, NS21, OS21, NS31, NS32, OS31, OS32) were accepted as “good or acceptable quality” since they had an overall acceptance score between 6.9 and 5.0 (Figure 3).

Table 4. Sensory Scores of the Cooked Salted Pearl Mullet.

Sample Code	General View Score	Texture Score	Odor Score	Taste Score	Overall Acceptance Score
NS11	3.63 ± 1.30 ^{acd*}	3.38 ± 1.77 ^{ac}	5.13 ± 1.73 ^a	3.25 ± 1.67 ^{ab}	3.84 ± 1.42 ^{ac}
OS11	5.63 ± 1.69 ^{ab}	5.50 ± 1.77 ^{ab}	6.25 ± 1.75 ^a	5.38 ± 1.51 ^a	5.69 ± 1.56 ^{ab}
NS12	3.75 ± 0.89 ^{ace}	3.38 ± 1.19 ^{ac}	4.50 ± 1.70 ^a	4.00 ± 1.07 ^{ab}	3.90 ± 0.96 ^{ac}
OS12	5.13 ± 1.25 ^{ab}	5.25 ± 1.83 ^{ab}	4.75 ± 1.67 ^a	4.63 ± 1.06 ^{ab}	4.94 ± 1.32 ^{ab}
NS21	6.13 ± 1.46 ^{bf}	6.63 ± 0.92 ^b	5.50 ± 1.31 ^a	5.37 ± 1.41 ^a	5.91 ± 0.93 ^b
OS21	5.38 ± 1.30 ^{bc}	5.38 ± 1.77 ^{ab}	5.25 ± 1.49 ^a	4.25 ± 1.39 ^{ab}	5.06 ± 1.16 ^{ab}
NS22	5.00 ± 1.60 ^{bc}	5.63 ± 0.92 ^{ab}	4.13 ± 1.25 ^a	4.50 ± 1.20 ^{ab}	4.81 ± 0.92 ^{ab}
OS22	1.38 ± 0.52 ^d	1.75 ± 0.89 ^c	4.63 ± 1.77 ^a	2.63 ± 1.92 ^b	2.60 ± 1.03 ^c
NS31	6.00 ± 1.51 ^{be}	5.50 ± 0.76 ^{ab}	5.38 ± 1.30 ^a	5.00 ± 1.41 ^{ab}	5.47 ± 0.93 ^{ab}
OS31	6.88 ± 1.13 ^b	6.13 ± 1.25 ^b	5.50 ± 1.41 ^a	4.50 ± 1.60 ^{ab}	5.75 ± 1.11 ^{ab}
NS32	5.63 ± 1.41 ^{bc}	5.00 ± 1.20 ^{ab}	5.63 ± 1.85 ^a	4.88 ± 1.13 ^{ab}	5.28 ± 1.17 ^{ab}
OS32	4.50 ± 1.60 ^{acf}	6.38 ± 1.19 ^b	5.75 ± 1.39 ^a	5.13 ± 1.46 ^a	5.44 ± 1.13 ^{ab}

*Lower case letters indicate the difference between the lines in the same column; The difference between the mean values indicated by the same letter is insignificant ($p > 0.05$).

**Figure 3.** Overall Acceptance Score of the Cooked Salted Pearl Mullet.

4 Conclusion

It was observed that the salted pearl mullet (*C. tarichi* Pallas, 1811) produced by using different methods had a high nutritional value and the OS11 group and the OS12 group had the highest nutritional value. The samples produced in the previous season (last year) were liked less and the NS32 was the most liked group according to the results of the raw sensory analysis. The samples of the new season, except for the samples produced by using dry salting method in bottom perforated plastic can be liked less than other sample groups and the NS21 group was the most liked group according to the results of the cooked sensory analysis.

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