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Quality determination of experimental sausage production from shark meat.

Dilek Kahraman Yilmaz[1], Nermin Berik[1*]

[1]*Department of Fisheries and Processing Technology, Faculty of Marine Sciences and Technology, Canakkale Onsekiz Mart University, Canakkale, Turkey.*

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ABSTRACT

In this study, sausage from spiny dog fish (*Squalus acanthias)* was produced. The purpose of study was to determine sausage made from shark meat was consumable or not. In order to find out quality characters of shark meat, paste and products, physical and chemical analysis were carried out.

No significant differences for pH were observed among the meat, paste and product ($P>0.05$). Due to similar studies; the quantity of seperated gel and seperated fat, water holding capacity and loss of weight caused by cooking method were found low in paste of sausage while process efficiency was found high. In addition, chemical analysis of water (moisture), protein and fat amounts were not higher than the required values.

In conclusion, the quality evaluation results indicated that shark (by-catch fish species) meat can be used for sausage processing.

Introduction

The spiny dogfish shark is widely distributed all over the world and at Turkish coastal areas (Anonymous 2008). Some parts of the shark, including the muscles, cartilages and livers are used completely for human consumption and pharmaceutical industry. Vannuccini reported that shark meat, fins, skin and internal organs are often used as food (1999). The development of restructured seafood can be a way of reaching young and health-conscious consumers (Sanchez et al. 2004). Therefore, fish can be an interesting alternative source of protein and, moreover, among the various traditional meat products in the market, sausages are specially suited – given their organoleptic and technological characteristics – for experimenting meat replacement by fish (Cardoso et al. 2008a). In fish sausages, with total or partial replacement of livestock meat, there are recently used various fish products as well (Cardoso et al. 2008a; Cardoso et al. 2008b; Cardoso et al. 2009; Arslan et al. 2001).

*Corresponding author
E-mail address: nberik@yahoo.com (N. Berik)
Tel:+: +90 286 218 00 18 / 1533 fax: +90 286 218 05 43

However, there is no study reporting the sausages from *S. acanthias*.

The authors' aim was to measure the physical and chemical properties of a shark fish sausage (with complete replacement of livestock meat by shark mince) in order to assess its similarity to ordinary livestock sausages.

Material and methods

Spiny dogfish (N=15) (Figure 1, 1) were purchased from sea product factories in Çanakkale (caught from the Marmara Sea). They floated, headed and gutted, and each fish batch (Figure 1, 2) was kept frozen at -20ºC within 4 weeks. Frozen shark were thawed overnight in a refrigerator, for the experiment. The resulting fish flesh was minced once in a meat grinder (Figure 1, 3). Shark mince was mixed with fat, soybean meal, potato starch, spices, preservers and ice (Table 1). The pastes (Figure 1, 4) were filled into a sausage case in known manner in the grinder machine (Figure 1, 5). Then, sausages cooked (55°C, 20 min), smoked (75°C, 45 min) (Figure 1, 6) and pasteurized (90°C, 20 min) (Figure 1, 7) in the oven, smoked machine, and autoclave, respectively.

pH

pH was determined in fish fillets, sausage paste and cooked sausages with a pH meter (Hanna instruments HI 211) (Bloukas et al. 1997).

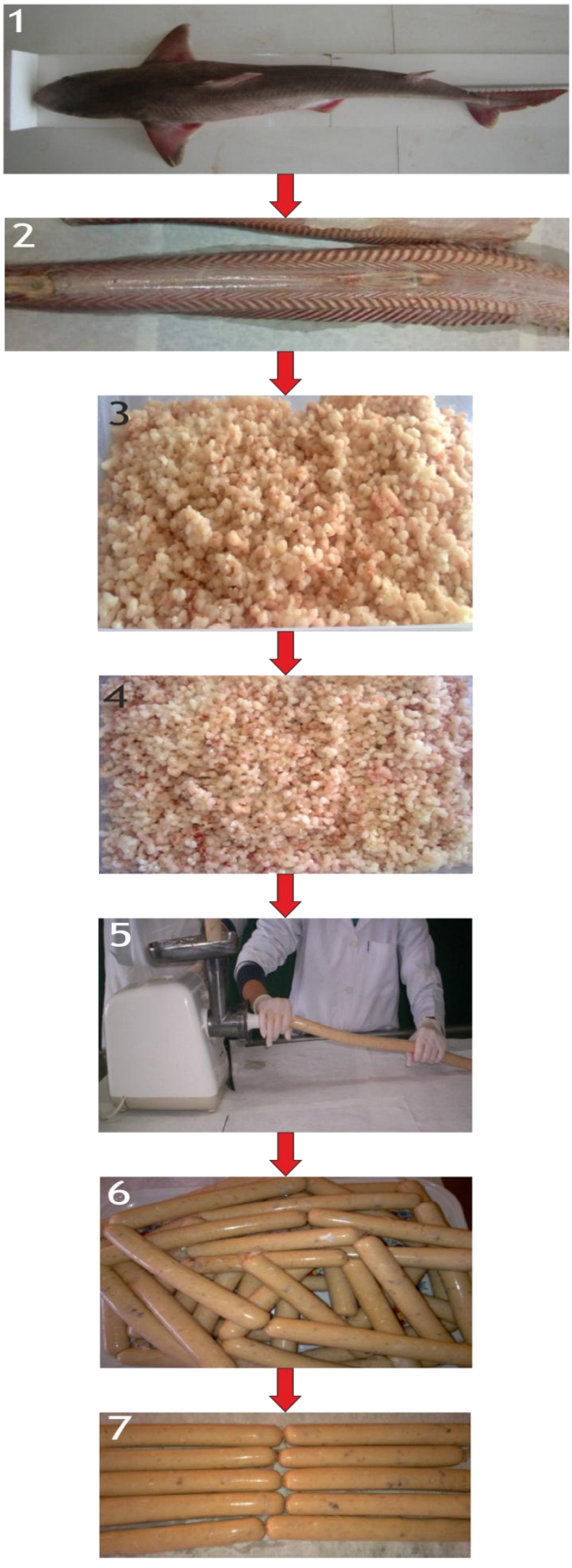

Figure 1. Fish sausage processing.

Table 1. Formulation of dogfish sausage.

Ingredients	Percentage (%)
Dogfish mince	67.57
Ice	15.00
Fat (1/2 sunflower oil+1/2 beef fat)	10.00
Soybean meal	2.40
Starch	2.40
Salt	1.75
White pepper	0.30
Sugar	0.13
Black pepper	0.13
Allspice	0.07
Red pepper	0.07
Coriander	0.07
Ginger	0.03
Cinnamon	0.03
Sodium nitrite	0.02
Ascorbic acid	0.02
Sodium nitrate	0.01

Physical analysis

Physical analysis include water-holding capacity, cook loss, processing yield and jelly and fat separation were determined by standart methods (Purma 2006; Bloukas et al. 1992; Hughes et al. 1997; Bloukas et al. 1997).

Proximate composition

Proximate analyses of the fish fillets, sausage paste and cooked sausages were performed using standard methods (AOAC 1998). Dry matter was analyzed by drying at 105°C in an oven to a constant weight, crude fat by ether extraction, crude protein by the Kjeldahl method, and crude ash by incineration at 525°C in a muffle furnace for 12 h.

Statistical analysis

Statistical significance was determined by one-way analysis of variance (ANOVA) followed by a TUKEY multi comparison test with SPSS 17.0 package software. Statistical significance was established at $P<0.05$.

Results

The pH of the fish fillet, paste and sausage are shown in Table 2. There was no difference in pH among the samples ($P>0.05$). Thus hygienic conditions were effective in delaying pH changes (Arslan 2002). Influence of shark meat on water-holding capacity, cook loss, processing yield and jelly and fat separation of sausages are shown in Table 3. Also proximate compositions are shown in Table 4.

Processing steps were significantly increased ($P<0.05$) protein, fat and ash, and decreased water contents.

Table 2. Mean pH values of the fish fillet, paste and sausage.

	Fish fillet	Paste	Sausage
pH	6.44±0.02[a]	6.55±0.02[a]	6.70±0.01[a]

Values are means ±SEM (n=3). Different letters in same line indicate significant differences within groups ($P<0.05$).

Discussion

Sharks contain high urea in their body and pH could be higher than 7 (Şengör et al. 2007; Schormüller 1968). An acceptability limit of 6.80-7.00, has been proposed for fresh fish products (Ludorff and Meyer 1973). pH was 6.44 for fish filet and 6.70 for sausage samples in present study. Similarly, Şengör et al. (2007) reported that the pH for spiny dogfish filet was between 5 to 6. The pH was also found to be between 6.67 to 7.2 in silver carp sausages (Hu et al. 2007a; Hu et al. 2008) and rainbow trout sausages (Dinçer 2008).

Table 3. Influence of shark meat on some quality characters (%) of sausage

	Sausage
Jelly and fat separation	2.33±0.02
Water-holding capacity	91.05±0.05
Processing yield	94.00±0.03
Cook loss	2.5±0.01

Purma (2006) reported that the jelly and fat separation, water-holding capacity and processing yield were found to be 9.7%, 83.1% and 90.8%, respectively, for the beef sausage. Dinçer (2008) also declared that cook loss was found to be 4.47% for the rainbow trout sausage. In this study results showed that the jelly and fat separation (2.33%, Table 3) and cook loss (2.5% Table 3) were lower than the other studies. This might be due to the fact that in such studies type of sausage case and/or step of processing difference plays an important role.

Water, fat, protein and ash were significantly increased after processing in present study (Table 4). Water and fat were 47.44% and 16.37%, respectively, for dogfish sausages. Similarly, the water and fat were found to be between 48.83% to 77.42% and 4% to 23% in carp bream and common carp sausages (Gülyavuz 1991), hybrid Clarias catfish sausages (Chuapoehuk et al. 2001; Raksakulthai et al. 2004), geelbeck croaker sausages (Rahman et al. 2007), silver carp sausages (Hu et al. 2007b), rainbow trout sausages (Dinçer, 2008) and cod frankfurter sausages (Cardoso et al., 2009).

Dogfish sausage protein and ash were found to be 30.21% and 5.38%, respectively, in present study (Table 4). Protein and ash were higher in present study compared to other fish sausage studies (protein was 9.98%-19.60%, ash was 1-3.36%) (Gülyavuz 1991; Chuapoehuk et al. 2001; Raksakulthai et al. 2004; Rahman et al. 2007; Hu et al. 2007b; Dinçer 2008; Cardoso et al. 2009). This can be illustrated with the use of high level of dogfish meat (67.57%) in sausages (Table 1).

Conclusion

There is an ever-increasing consumer demand for food products. Especially, consumer preference for alternative healthier products is promoting the research and development of different meat systems. There is growing consumer interest for alternative sources of protein. Finally, shark sausages without livestock meat presented promising pH, water-holding capacity, cook loss, processing yield, jelly and fat separation and proximate parameters.

Aknowledgment

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Table 4. Proximate compositions (%) of shark fillets, paste and sausage

	Water	Protein	Fat	Ash
Filet	71.00±0.33[a]	21.08±0.35[c]	4.74±0.17[c]	2.64±0.16[c]
Paste	51.19±0.27[b]	28.03±0.07[b]	15.72±0.34[b]	4.23±0.08[b]
Sausage	47.44±0.13[c]	30.21±0.11[a]	16.37±0.11[a]	5.38±0.16[a]

Values are means ± SEM (n=3). Different letters in same column indicate significant differences within groups ($P<0.05$).

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