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Some Physicochemical Characteristics of Fish Products Sampled from Bulgarian Retail Markets

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HIGHLIGHTS

- The highest level of water content and water activity was found in frozen fish products.
- The lowest pH value was found in the marinated fish products.
- Frozen fish products had the lowest salt and ash contents.
- Frozen Bulgarian fish products are probably more susceptible to spoilage than the other ones.

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Acronyms and abbreviations
a_w=Water activity

ABSTRACT

Background: The quality and safety of fish products is determined by chemical, physical, and microbiological parameters, important for satisfying consumers' requirements. Also, the freshness of fish is essential for evaluation of its quality. On the Bulgarian retail market, fish is commonly offered chilled, frozen, or processed. The purpose of this study was to determine some physicochemical characteristics of fish products sampled from Bulgarian retail markets.

Methods: During June to July 2017, this survey was performed on 45 samples from smoked, semi-dried, marinated, and frozen fish products sold in Bulgarian markets. The samples were collected from specialized stores for fish products, and transported to the laboratory for analysis. Water content, water activity (a_w), pH, salt content, and ash content were determined according to the standard protocols.

Results: The highest average water content was established in frozen products, followed by almost equal values in marinated, smoked, and semi-dried fish products. The average a_w value was also the highest in frozen products (0.975), it was almost the same in marinated and smoked (0.892); and the least in semi-dried fish products (0.905). Semi-dried (3.36%), marinated (3.19%), and smoked (3.03%) fish products had considerably higher average salt content than frozen ones (0.1%). The average pH value of marinated fish products (5.26) was lower than frozen (6.88), smoked (6.76), and also semi-dried (6.68) ones. Average ash content was substantially higher in smoked (7.16%), semi-dried (6.57%), and marinated (5.97%) fish products compared with frozen products (1.18%).

Conclusion: It is concluded that the frozen fish products sold in Bulgarian markets are probably more susceptible to spoilage than marinated, smoked, and semi-dried ones.

Introduction

The consumption of fish and fish products is beneficial for human health. Fish provides proteins, long-chain omega-3 polyunsaturated fatty acids, vitamins, and minerals (Borresen, 2008; Oguzhan and Angis, 2013).

The quality and safety of fish products is determined by chemical, physical, and microbiological parameters, important for satisfying consumers' requirements. Also, the freshness of fish is essential for evaluation of its quality

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(Ababouch, 2006; Agustini et al., 2009; Alasalvar et al., 2011; Hall, 2012). On the Bulgarian retail market, fish is commonly offered chilled, frozen, or processed (smoked, semi-dried, marinated, and canned). The investigations on physicochemical parameters of fish products on the national market are few. Hence, the purpose of this study was to determine some physicochemical characteristics of fish products sampled from Bulgarian retail markets.

Materials and methods

During June to July 2017, this survey was performed on 45 samples from smoked, semi-dried, marinated, and frozen fish products sold in Bulgarian markets. Smoked fish comprised mackerel (*Scomber scombrus*; n=6), herring (*Clupea harengus membras*; n=6), and salmon fillet (*Salmo salar*; n=7). Semi-dried ones included mackerel (*Scomber scombrus*; n=6). Marinated fish samples were sprats (*Sprattus sprattus*; n=6) and Atlantic saury fillet (*Scomberesox saurus*; n=2). Frozen fish comprised Alaska pollock fillet (*Theragra chalcogramma*; n=8) and pink salmon fillet (*Oncorhynchus gorbuscha*; n=4). The samples were collected from specialized stores for fish products, and transported to the laboratory for analysis.

Water content, water activity (a_w), pH, salt content, and ash content were determined according to the standard protocols described by AOAC (1990).

Results

The average water content in smoked, marinated, frozen, and semi-dried fish products were 60.34, 60.47, 80.75, and 41.80%, respectively; the average a_w values for the mentioned samples were 0.892, 0.892, 0.975, and 0.905, respectively. The mean pH values for smoked, marinated, frozen, and semi-dried products were determined as 6.76, 5.26, 6.88, and 6.68, respectively. The average salt and ash contents of the samples are shown in Figures 1 and 2. The details of physicochemical characteristics of fish products are presented in Table 1.

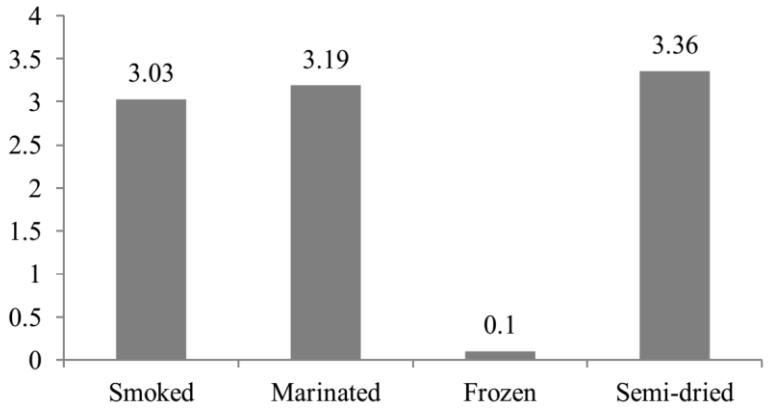

Figure 1: Average salt content (%) of different Bulgarian fish product samples

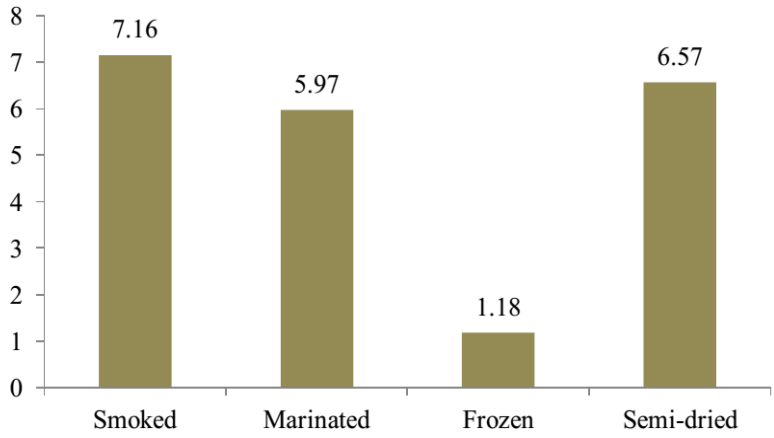

Figure 2: Average ash content (%) of different Bulgarian fish product samples

Table 1: Physicochemical characteristics of Bulgarian fish products samples

Fish products		Physicochemical characteristics (mean±SD)				
		Water content (%)	a_w	Salt (%)	pH	Ash content (%)
Smoked						
	Mackerel	46.19±4.86	0.913±0.013	2.33±0.62	7.18±0.68	5.27±0.72
	Herring	67.75±2.02	0.880±0.004	4.61±0.19	7.19±0.08	11.03±0.74
	Salmon fillets	67.10±1.80	0.883±0.008	2.16±0.54	5.91±0.18	5.20±0.98
Marinated						
	Sprat	62.93±3.58	0.905±0.018	2.31±0.07	5.62±0.12	5.37±0.55
	Atlantic saury fillets	58.01±4.90	0.880±0.001	4.08±0.84	4.90±0.09	6.58±0.84
Frozen						
	Alaska pollock fillets	84.32±5.04	0.974±0.006	0.12±0.14	7.29±0.32	1.17±0.29
	Pink salmon fillets	77.19±2.18	0.977±0.001	0.09±0.06	6.48±0.08	1.19±0.11
Semi-dried						
	Mackerel	41.80±3.34	0.905±0.005	3.36±0.47	6.68±0.52	6.57±1.32

Discussion

In the present survey, the highest water content was established in frozen products, followed by marinated, smoked, and semi-dried fish products. The water in foods could be either bound or free (Syamaladevi et al., 2016). Free water determines the shelf life as it has an influence on enzymatic, chemical, and microbiological processes while bound water has no such effect (Agustini et al., 2009). Our results were in line with assumptions of Oguzhan and Angis (2013), that thermal processing decreased water content of fish products. Cardinal et al. (2004) reported average water content of 62.9% in smoked salmon, while Salán et al. (2006) found 68.01% water content in frozen salmon fillet. According to Adegunwa et al. (2013), the water content of smoked herring varied from 50.68 to 77.75%, corresponding with our data.

Similar to water content, a_w was in the highest level in frozen products (0.975), almost the same in marinated and smoked (0.892), and the least in semi-dried fish products (0.905). Agustini et al. (2009) reported a_w values between 0.57 and 0.87 in dried fish products sold in Indonesia. The a_w value is among the most important parameters during food preservation. It influences physical and chemical properties, the replication of microorganisms in foods and therefore, their shelf life. Most microbial enzymes are inhibited at a_w less than 0.85, and bacteria do not grow when a_w is less than 0.91 (Syamaladevi et al., 2016).

The absorption and distribution of salt within fish products in the view of Martinez et al. (2011) depend on the salt curing method, fish species, fillet thickness, fillet to salt ratio, muscle structure, and rigor mortis. On the other hand, Bugueno et al. (2003) affirmed that salt curing prolongs shelf life of fish. In the present survey, salt concentrations of semi-dried (3.36%), marinated (3.19%), and smoked (3.03%) fish products had substantially higher salt content than frozen (0.1%) fish product samples. Similarly, Cardinal et al. (2004) reported average salt content of 3.1% in smoked salmon of European markets.

Marinating is among the oldest techniques for preservation of fish. Shelf life and safety of fish are due to added salt and organic acids, which reduce pH. It is proved that the pH value of 4.5 is sufficient to guarantee fish safety (Duyar and Eke, 2009). As expected, we found that the pH value of marinated fish products (5.26) was lower than that of frozen (6.88), smoked (6.76), and semi-dried ones (6.68). Anese and Gormley (1996) reported that the pH value of minced meat of cod and salmon was 6.8 and 6.6, respectively. Adegunwa et al. (2013) found that pH value in smoked herring was in range of 5.92-6.57 which was lower than the results of the present study.

In the current investigation, ash content was considerably higher in smoked (7.16%), semi-dried (6.57%), and marinated (5.97%) fish products compared with frozen (1.18%) fish products which were in accordance with the findings of Oguzhan and Angis (2013) and Salán et al. (2006). However, Adegunwa et al. (2013) established 10 times lower ash content in the smoked herring distributed in Nigeria. It has been announced that ash contents of seafood and fish products indicate that they are appropriate source of mineral substances like calcium, zinc, iron, as well as magnesium (Salindeho et al., 2014).

Conclusion

It is concluded that the frozen fish products sold in Bulgarian markets are probably more susceptible to spoilage than marinated, smoked, and semi-dried ones.

Conflicts of interest

There is no conflict of interest in this study.

Acknowledgments

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