THE EFFECTS OF SEASON AND SEX IN THE FATTY ACIDS AND PROXIMATE COMPOSITIONS OF COMMON CUTTLEFISH (*SEPIA OFFICINALIS*)

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Abstract

The effects of season and sex on the fatty acids and proximate compositions of the mantle of the cuttlefish *S. officinalis* were evaluated. The results of the proximate composition showed that the level of protein contents of female of *S. officinalis* were significantly higher than those of male (P<0.05) for all seasons. In addition, lipid and moisture contents of female of cuttlefish were generally low compared to those of male cuttlefish. The fatty acid compositions of each sex and all seasons ranged from 29.38% to 32.51% saturated (SFA), 8.70-11.11% monounsaturated (MUFAs) and 48.23-54.57% polyunsaturated acids (PUFAs). The proportions of *n*-3 PUFAs (44.00-50.63%) were higher than *n*-6 PUFAs (3.38-4.25%) regardless of sex and seasons.

Keywords: Cephalopods, Nutrients

Introduction Cephalopoda, one of the most important groups of marine invertebrates, are consumed throughout the world. Annual catch of cuttlefish ranged from 11,000 to 15,000 tons throughout the world and they occupies an important place among cephalopoda [1]. Bochemical contents of marine organisms have been reported to change due to seasonal changes [2,3,4]. Studies have been conducted on the nutrient value and fatty acid composition of cuttlefish [5,6,7]. In this study, the effects of season and sex in the fatty acids and proximate compositions of the mantle tissue of the common cuttlefish (*Sepia officinalis*) were investigated.

Materials and Methods

The common cuttlefish is generally caught in the Mediterranean and Eagen sea shore in Turkey. This species was caught in Mersin Bay with net in all seasons (except summer). Mantle which is the main edible portion of cuttlefish was homogenized and chemical analyses were done on this part of fresh samples. The analyses were performed at least in triplicate. Lipid content by the Bligh and Dyer [8] method, moisture content by AOAC [9] method, total crude protein by the Kjeldahl method [10] and ash content by the AOAC [9] method. Fatty acid profiles of fat extracted from samples were determined by gas chromatography (GC) of methyl esters. Methyl esters were prepared by transmethylation using 2 M KOH in methanol and n-heptane according to the method decribed by Ichibara et al. [11] with minor modification. Statistical analysis of data was carried out with the SPSS statistical program. ANOVA (Analysis of Variance) was used to evaluate the effect of gender on the fatty acid and proximate composition and trace element levels.

Results and Discussion

Tab. 1. Seasonal changes in fatty acid composition of *S.officinalis*

Food Category (% by weight)	Identified prey items	Food Category (% by weight)	Identified prey items
Teleostei (58.67%)	*Argentina sphyraena*	Crustacea (19.25%)	*Alpheus glaber*
	Echelus myrus		Amphipoda
	Gnathophis mystax		*Ateleycyclus rotundatus*
	Macroramphosus scolopax		*Chlorolocus crassicornis*
	Trachurus trachurus		Crangonidae
	Zeus faber		*Goneplax rhomboides*
Cephalopoda (16.36%)	*Eledone* sp.		*Munida* sp.
	Octopus defilippi		*Nephrops norvegicus*
	Sepiolidae		*Pagurus* sp.
Polychaeta (3.89%)	Aphroditidae		*Parapenaeus longirostris*
			Pasiphaeidae
Plantae (0.06%)	*Posidonia oceanica*		*Platysquilloides lilljae*
			Sergestes sp.
Cannibalism (1%)	*Scyliorhinus canicula*		Squillidae

Fatty acid analyses; Table 1 shows the seasonal changes in fatty acid composition of male and female cuttlefish. The fatty acid compositions of each sex and all seasons ranged from 29.38% to 32.51% saturated (SFA), 8.70-11.11% monounsaturated (MUFAs) and 48.23-54.57% polyunsaturated acids (PUFAs). The major fatty acids found in cuttlefish were myristic acid (C14:0, 1.56-2.43%), palmitic acid (C:16, 16.38-19.24%), heptadecanoic acid (C17:0, 1.41-1.63%), stearic acid (C:18, 7.45-9.27%), oleic acid (18:1 *n*-9, 3.31-5.15%), linoleic acid (C18:2 *n*-6, 0.49-0.77), arachidonic acid (C20:4 *n*-6, 2.78-3.38%), *cis*-11-eicosapentaenoic acid (EPA, C20:5 *n*-3, 15.73-17.75%) and *cis*-4,7,10,13,16,19-docosahexaenoic acid (DHA, C22:6 *n*-3, 27.46-33.02%). These results were in agreement with those reported by Ozyurt et al. [7],Reale et al. [12],and Ozogul et al. [13]. The proportions of *n*-3 PUFAs (44.00-50.63%) were higher than *n*-6 PUFAs (3.38-4.25%) regardless of sex and seasons. This high PUFA level is similar to those reported [2,5,7,12,13]. The major polyunsaturated fatty acids of cephalopoda observed were EPA and DHA. In this study, the levels of DHA, which was recorded in autumn, spring and winter, were 31.54%, 27.46%, and 28.70% for female cuttlefish, respectively, whereas its level were observed to be 33.02%, 29.23% and 28.70% for male cuttlefish. The EPA levels in female of cuttlefish mantle were found to be 17.75%, 16.26%, 15.73% and 13.9% while its level in male of cuttlefish were 15.85%, 17.22% and 16.80% in autumn, spring and winter, respectively. It is well known that the fatty acid profile of fish muscle reflects the content of the dietary lipid sources. Nutrient levels vary between species and even within species. Diet, size, age, reproductive status of fish, environmental conditions, and especially water temperature, influence lipid content and fatty acid composition of seafood.

Proximate analyses; Table 2 shows seasonal changes in proximate composition of male and female of cuttlefish. The results of the proximate composition showed that the lowest lipid content was obtanied from female in winter (0.74%) whereas the highest level of lipid was found in males in Autumn (0.94%). The lowest total mineral substance (TMS) content was obtained in Autumn (1.07-1.08%), whereas the highest level of TMS was obtained in Spring (1.73-1.75%) in both female and male. The lowest protein content was also obtained in Autumn (16.96-17.33%). However, the protein contents did not change in both Spring (21.47-22.18%) and winter (21.64-22.01%) seasons. For all seasons, the level of protein contents of female of *S. officinalis* were significantly higher than those of male (P<0.05). In addition, lipid and moisture contents of female of cuttlefish were generally low compared to those of male cuttlefish.

Tab. 2. Seasonal changes in proximate composition of *S.officinalis*

Composite	Autumn		Spring		Winter	
	♀	♂	♀	♂	♀	♂
Protein	22.18±0.00^{b}	21.47±0.18^{a}	17.33±0.10^{a}	16.96±0.15^{a}	22.01±0.12^{b}	21.64±0.28^{a}
Lipid	0.89±0.04^{a}	0.91±0.02^{a}	0.84±0.06^{a}	0.94±0.02^{b}	0.74±0.00^{a}	0.82±0.00^{b}
Moisture	75.00±0.02^{a}	75.78±0.07^{b}	80.65±0.08^{a}	80.75±0.09^{a}	75.44±0.34^{a}	75.52±0.19^{a}
TMS	1.75±0.03^{b}	1.73±0.01^{a}	1.07±0.10^{a}	1.08±0.04^{a}	1.64±0.05^{b}	1.59±0.02^{a}

Different letters (a-b) in the same row are significantly different (P<0.05).

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