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Determinaton of proximate composition and mineral contents of blue crab (*Callinectes sapidus*) and swim crab (*Portunus pelagicus*) caught off the Gulf of Antalya

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Abstract

The proximate composition and mineral contents of blue crab (*Callinectes sapidus*) and swim crab (*Portunus pelagicus*), caught off the Gulf of Antalya, were investigated. The aim of this study was to demonstrate the nutritive value. Claw and body meat of these two species were analyzed. For both species there were no significant differences in the moisture, fat and ash contents of claw and body meats but protein contents of swim crab were significantly higher ($P < 0.05$) than those found in blue crab. Na, K, Ca, Zn and Cu values for blue crab and swim crab were not significantly different. There were no significant differences between Na, K, Mg, Zn, Fe, Mn and Cu contents of claw and body meats of the two species.

1. Introduction

Marine invertebrates are being widely used as food and feed supplement around the world. Crabs, among many other invertebrates, are considered as an important shell fishery product.

Callinectes sapidus originally occurs along the eastern Nova Scotia and Uruguay. Its main distribution is on the North American coast, where it forms an important fishery resource. It was reported that this species was introduced artificially, between 1935 and 1945, to the northern Aegean Sea and that it was later displaced to the southern Aegean Sea and gradually came to the Mediterranean (Enzenross, Enzenross, & Bingel, 1997).

Portunus pelagicus, originating from the Indo-Pacific, was introduced to the Mediterranean Sea via the Suez Canal. This species is distributed at 10–60m depths on the coasts of the Eastern Mediterranean and Africa (Abdel Razek, 1988; Holtius, 1987).

Gökoðlu, Aydýn, and Çiloðlu (1998) have reported that two species, *C. sapidus* and *Portunus pelagicus*, which have commercial value, were found in the Gulf of Antalya. They also reported that the population was increasing in this region. According to Fisheries Statistics (1998) reported, 95.2% of the total catch of crab was caught in the Mediterranean region of Turkey in 1999.

Although crab is caught in a considerable amounts on the coast of the Mediterranean Sea, its consumption by Turkish people is unknown, due to lack of knowledge. Gökoðlu et al. (1998) reported that crabs were caught from the Gulf of Antalya by dip net and trotline during fishing and discarded by fisherman due to their harmful effects on nets. Therefore, crabs are going to waste in this region which has an important population of them.

The chemical composition and nutritive value of crab meat have been extensively investigated in various parts of the world (Allen, 1971; Farragut, 1965; Henry, Boyd, & Green, 1995; Kifer & Bauersfeld, 1969; Lauer, Murray, Anderson, & Guptill, 1974; Lopez, Williams, & Ward, 1980; Moustafa, Moharram, El-Sokkary, & Telb, 1987; Radhakrishnan & Natarajan, 1979; Reddy, Flick, Arganosa, & Young, 1991; Siddiquie, Akbar, & Qasým, 1987; Sidwell, Bonnet, & Zook, 1973; Sidwell, Buzzell, Foncannon, & Smith, 1977; Thompson & Farragut, 1966; Tsai, Chen, & Tsai, 1984). In the present study, two crab species (*C. sapidus* and *P. pelagicus*) were investigated to determine their proximate composition and mineral contents. The aim of this study was to demonstrate the nutritive value and thereby to encourage an increase in the consumption and utilization of these species in Turkey.

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Table 1
Proximate compositions of blue crab (*Callinectes sapidus*) and swim crab (*Portunus pelagicus*)[a]

	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Callinectes sapidus				
Claw meat	83.1±0.53	15.0±0.026 a	0.64±0.005	1.39±0.019
Body meat	81.58±0.65	14.71±0.09 a	0.79±0.019	1.89±0.08
Portunus pelagicus				
Claw meat	77.09±0.09	21.54±0.30 b	0.81±0.1	2.52±0.01
Body meat	75.28±0.53	22.64±0.95 b	1.21±0.02	2.24±0.023

[a] Data are means±standard errors. Within the column values with different letters are significantly different ($P<0.05$). Values without letters are not significantly different ($P>0.05$)

2. Materials and methods

2.1. Materials

The crabs, *C. sapidus* and *P. pelagicus*, were caught by dip net from the Gulf of Antalya, the coast of Western Mediterranean of Turkey, in July 2001. After catching they were transferred to the laboratory alive. The mean width and length of carapace were 9.62±0.15 cm and 4.85±0.24 cm for blue crab and 13.25±1.48 cm and 6.15±0.72 cm for swim crab, respectively. The mean weights of blue crab and swim crab were 73.28±10.08 g and 173.03±46.34 g, respectively.

Meat from body and claw portions of crabs was separated by hand and analyzed to determine the proximate composition and mineral contents. All assays were conducted on duplicate samples of the homogenates.

2.2. Proximate composition analysis

The moisture content of crabs was determined by drying the meat in an oven at 105 °C until a constant weight was obtained (AOAC, 1990). Crude protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method (6.25 × N) (AOAC, 1990). Fat was determined by the method described by the AOAC (1990), using the Soxhlet system. Ash content was determined by dry ashing in a furnace oven at 525 °C for 24 h.

2.3. Mineral analyses

For mineral determination, the samples were digested in HNO3/HClO4. The elements Na, K, Ca, Mg, Fe, Zn, Mn, Cu, were measured by atomic absorption spectrophotometry (AAS), using a Varian Spectra atomic absorption spectrophotometer, model A-400. Phosphorus (P) was measured by spectrophotometer (Shimadzu UV 160 A) after colouring the samples in Barton solution (Kaçar & Kovancý, 1982). The results were expressed as absorbance at 430 nm. Standard curves were used for the determination of the elements in question.

2.4. Statistical analysis

Data were treated by analysis of variance. Significance was established at $P<0.05$.

3. Results and discussion

Table 1 gives the proximate composition of blue crab (*C. sapidus*) and swim crab (*P. pelagicus*).

The moisture, fat and ash contents of blue crab and swim crab were not significantly ($P>0.05$) different. Protein contents of swim crab were significantly higher ($P<0.05$) than those found in blue crab. There were no significant differences ($P>0.05$) in the moisture, protein, fat and ash contents of claw and body meats.

Table 2 shows the average percent values for moisture, protein, fat and ash in various crab species reported by other authors. Our results are in agreement with published data.

The mineral contents of *C. sapidus* and *P. pelagicus* are given in Tables 3 and 4. Sodium, potassium, calcium, zinc

Table 2
Proximate composition of different crab species reported by various authors

Species	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Reference
Callinectes sapidus	81.20	16.10	1.0	1.6	Farragut (1965)
Callinectes sapidus	77.4–86.7	11.9–19.2	0.4–1.5	1.3–1.8	Wheaton and Lawson (1985)
Paralithodes camtschatica	80.1–82.8	14.6–19	0.2–1.4	1.3–2.2	Wheaton and Lawson (1985)
Neptunnis spp.	75.9–81.4[2]	12.8–18.8[2]	0.5[2] [a]	0.6–2.3[2]	Wheaton and Lawson (1985)
Cancer magister	78.5–82.3[2]	14.3–23.4[2]	0.7–2.2[2]	1.2–1.9[2]	Wheaton and Lawson (1985)
Portunus pelagicus	78.06	12.35	1.02	1.78	Siddiquie et al. (1987)
P. sanguinotantus	78.87	13.09	1.25	2.79	Siddiquie et al. (1987)
Scylla serrata	75.53	14.8	1.29	1.44	Siddiquie et al. (1987)
Callinectes sapidus	81.58–83.1	14.71–15	0.64–0.79	1.39–1.89	Present study
Portunus pelagicus	75.28–7.09	21.54–2.64	0.81–1.21	2.24–2.52	Present study

Table 3
Mineral contents of blue crab (*Callinectes sapidus*) and swim crab (*Portunus pelagicus*) (mg/100g)[a]

	Na	K	Ca	Mg	P
Callinectes sapidus					
Claw meat	266.8±8	256.3±37	149.2±45 a	35.1±7 a	135.2±12 a
Body meat	326.9±9	244.4±12	64.9±5 b	37.1±0.5 a	165.4±11 c
Portunus pelagicus					
Claw meat	353.5±8	308.9±19	150.9±6 a	55.8±2 b	120.6±47 b
Body meat	319.8±20	303.8±19	87.6±7 b	48.8±2 b	154.2±27 d

[a] Data are means±standard errors. Within the column values with different letters are significantly different ($P<0.05$). Values without letters are not significantly different ($P>0.05$)

Table 4
Mineral contents (mg/100 g) of blue crab (*Callinectes sapidus*) and swim crab (*Portunus pelagicus*)[a]

	Zn	Fe	Mn	Cu
Callinectes sapidus				
Claw meat	6.99±0.9	1.04 ±0.13[a]	0.39±0.07[a]	2.53±0.16
Body meat	4.7±0.03	1.13±0.07[a]	0.37±0.04[a]	3.13±0.06
Portunus pelagicus				
Claw meat	4.68±0.1	0.45±0.02[b]	0.06±0.02[b]	2.08±0.05
Body meat	3.72±0.4	0.68±0.03[b]	0.16±0.03[b]	1.49±0.09

[a] Data are means±standard errors. Within the column values with different letters are significantly different ($P<0.05$). Values without letters are not significantly different ($P>0.05$)

and copper values for blue crab and swim crab were not significantly different ($P>0.05$). Magnesium contents of swim crab (*P. pelagicus*) were significantly higher ($P<0.05$) than those found in blue crab (*C. sapidus*). Phosphorus, manganese and iron values of blue crab were significantly higher ($P<0.05$) than those found in swim crab. There were no significant differences ($P>0.05$) in sodium, potassium, magnesium, zinc, iron, manganese and copper contents of claw and body meats. Calcium values of claw meats were significantly higher ($P<0.05$) than those found in body meats. Body meats contained significantly higher ($P<0.05$) amounts of phosphorus than did claw meats.

4. Conclusion

Blue crab (*C. sapidus*) and swim crab (*P. pelagicus*) are caught abundantly in the Gulf of Antalya. Although most (~95%) of the total catch are caught on the coast of the Mediterranean Sea, they are not consumed by Turkish people, due to lack of knowledge. This study shows that crabs caught from the Gulf of Antalya had high protein (14.7–15.0% for *C. sapidus* and 21.5–22.6% for *P.pelagicus*) and low fat contents (0.64–0.79% for *C. sapidus* and 0.81–1.21% for *P. pelagicus*). It was also found that they were rich in terms of mineral content, especially Na, K, Ca and P. The results show that crabs are ideal dietetic foods. For this reason, the consumption of crabs would help to prevent nutrition deficiencies in the future.

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References

Abdel Razek, F. A. (1988). Some biological studies on the Egyptian Crab *Portunus pelagicus* (Linnaeus 1766). *Acta Adriat.*, *29*(1/2), 133–143 Yugoslavija.

Allen, W. V. (1971). Amino acid and fatty acid composition of the tissues of the Dungeness crab (*Cancer magister*). *J. Fish. Res. Board Can.*, *28*, 1191–1195.

Fisheries Statistics (1998). State Institute of Statistics Prime Ministry Republic of Turkey. No 2302.

AOAC. (1990). *Official methods of analyses of association of analytical chemist*. (15th Ed.). Washington DC: AOAC.

Enzenross, R., Enzenross, L., & Bingel, F. (1997). Occurrence of blue crab,*Callinectes sapidus* (Rathbun,1896) (Crustaceae, Brachyura) on the Turkish Mediterranean an Adjent Aegean Coast and its size distribution in the Bay of Iskenderun. *Tr. J. of Zoology*, *21*, 113–122.

Farragut, R. N. (1965). Proximate composition of Chesapeake Bay blue crab (*Callinectes sapidus*). *Journal of Food Science*, *30*, 538–544.

Gökoğlu, M., Aydýn, H., & Çiloğlu, E. (1998). Antalya Körfezi'nde ekonomik öneme sahip yengeçlerin avcýlýðý üzerine bir arastýrma. In *Doğu Anadolu Bölgesi III. su ürünleri sempozyumu* pp. (10–12). Haziran, Erzurum.

Henry, L. K., Boyd, L. C., & Green, D. P. (1995). Cryoprotectants improve physical and chemical properties of frozen blue crab meat (*Callinectes sapidus*). *Journal of Science and Food Agriculture*, *69*, 15–20.

Holtius, L. B. (1987). *Vrais Crabes. Méditerranée et Mer Noire. Zone de Peche 37* Révision 1 Vol. 1. Rome: Fishes FAO D'identification Des Espèces Pour Les Besoins de la Peche.

Kaçar, B., & Kovancý, Ý. (1982). *Bitki Toprak ve Gübrelerde Kimyasal Fosfor Analizleri ve Sonuçlarýn Deðerlendirilmesi. Ege Üniversitesi Ziraat Fakültesi yayýnlarý No: 453*. Turkey: Izmir.

Kifer, R. R., & Bauersfeld, P. E. (1969). Relative chemical composition and nutritive values of king crab (*Paralithodes camtshatica*) and blue crab (*Callinectes sapidus*). *Fish. Ind. Res.*, *5*, 121–132.

Lauer, B. H., Murray, M. C., Anderson, W. E., & Guptill, E. B. (1974). Atlantic queen crab (*Chionoecetes opilio*) Jonah crab (*Cancer borealis*) and red crab (*Geryon quinquedens*). Proximate composition of crab meat from edible tissues and concentrations of some major mineral constituents in the ash. *Journal of Food Science*, *39*, 383–385.

Lopez, A., Williams, H. L., & Ward, D. R. (1980). Essential elements in raw, boiled, steamed and pasteurized crab meat. *Journal of Food Science*, *46*, 1128–1131.

Moustafa, E. K., Moharram, Y. G., El-Sokkary, I., & Telb, A. I. (1987). Total mercury and its distribution in blue crab and deep water pink shrimp from Alexandra coast. *Die Nahrung*, *31*, 773–776.

Radhakrishnan, C. K., & Ntarajan, R. (1979). Nutritive value of the crab *Podophthalmus vigil* (Fabricus). *Fish. Technol.*, *16*, 37–38.

Reddy, N. R., Flick, G. J., Arganosa, G. C., & Young, R. W. (1991). Composition and pesticide and herbicide residue analysis of fresh and 40-year old pasteurized blue crab (*Callinectes sapidus*) meat. *J.Food Prot.*, *54*(4), 298–301.

Siddiquie, P. J. A., Akbar, Z., & Qasim, R. (1987). Biochemical composition and caloric values of three edible species of Portunidiae crabs from Karachi. Pakistan. *J. Sci., Ind., Res.*, *30*(2), 119–121.

Sidwell, V. D., Bonnet, J. C., & Zook, E. G. (1973). Chemical and nutritive values of several fresh and canned finfish, crustaceans and mollusks. Part 1: Proximate composition, calcium and phosphorus. *Marine Fisheries Reviews*, *35*(12), 16–32.

Sidwell, V. D., Buzzell, D. H., Foncannon, P. R., & Smith, A. L. (1977). Composition of edible portion of raw (fresh or frozen) crustaceans, finfish and mollusks. Part 2: macroelements, sodium, potassium, chlorine, calcium, phosphorus and magnesium. *Marine Fisheries Reviews*, *39*(1), 1–11.

Thompson, M. H., & Farragut, R. N. (1966). Amino acid composition of the Chesapeake Bay blue crab (*Callinectes sapidus*). *Comparative Biochemistry & Physiology*, *17*, 1065–1069.

Tsai, D., Chen, H., & Tsai, C. (1984). Total lipid and cholesterol content in Blue Crab, *Callinectes sapidus* Rathbun. *Comparative Biochemistry & Physiology*, *78*(1), 27–31.