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Short Communication

Cd and Pb Levels in the Soft Tissue of Black Mussel (*Mytilus galloprovincialis*) Collected from Marmara Sea, Pendik District Coastal Area, Istanbul, Turkey

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ABSTRACT

The aim of this study was to determe cadmium and lead concentrations in the whole soft tissue of the black mussels (*Mytilus galloprovincialis* Lamarck, 1819) (n=60) caught from Pendik district coasts of Istanbul, Turkey. According to legal standards of Turkish Food Codex (TFC) and United Nations Environment Programme (UNEP) standards the level of Cd was low white that of Pb was high. The highest Pb concentration found in the whole soft tissue of mussels at S4 was 8.66 (February), 6.64 (January), 4.72 ppm Pb (July 2011) whereas in S5 it is 8.66 (November), 8.14 (February), 6.64 (October), 4.57 ppm (June 2012).

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Authors' Contributions

FEK, AA, NB and YG conceived the project, executed the experiments, analyzed the data and wrote the article. AA and YG aanalyzed heavy metals.

Key words

Cadmium, lead, heavy metal pollution, *Mytilus galloprovincialis*, black mussel.

Heavy metals in the aquatic environments, which may originate either from natural or anthrpogenic sources such as mining, chemical production, waste burning etc., are responsible for most of the levels observed in coastal waters (Kljakovic-Gaspic *et al.*, 2010; Rehman *et al.*, 2007; Bashir *et al.*, 2013). All heavy metals such as cadmium (Cd), lead (Pb) and mercury (Hg) are toxic even at relatively low doses in living organisms. They accumulate generally in marine organisms from the aquatic environment, especially in various molluscan species and pose health risk to humans, even in trace amounts (Kobal *et al*., 2004; Mora *et al.*, 2004; Borak and Hosgood, 2007; Mok *et al*., 2014). To protect public health, authorities have established regulatory limits (Turkish Food Codex) and monitoring programs for hazardous metals to determine whether shellfish are safe to consume. The presence of heavy metals in aquatic animals depends on many factors such as species, size, feeding conditions, amount and duration of contaminant, temperature, salinity, pH, dissolved oxygen etc. (Stankovic *et al*., 2012; Boran and Altınok, 2010). *Mytilus* is commonly used in biological research laboratories as bioindicator organisms since they accumulate heavy metals in their bodies (Thebault *et al.*, 2008).

In the present study Cd and Pb levels have been determined in soft tissues of mussels, *Mytilus galloprovincialis*.

Materials and methods

A total of 60 samples of the mussel (3-5 cm in length) were collected manually from equal spaced five different locations along the coastline of Pendik, a center of recreational, marina and yacht activities and urban wastewaters (Okay *et al*., 2014; Neşer *et al.*, 2008; Balkıs *et al.*, 2012; Taşkın *et al.*, 2011). The mussels collected were transferred to the laboratory in ice cold plastic bags and stored at -20ºC until the analysis. Glass equipment cleaned with 10% nitric acid and plastic tools were used for dissection. Whole soft tissue of mussels were seperated rinsed with tap water and Milli-Q water to remove sand and other particles according to United Nations Environment Programme (UNEP), and weighed before acid digestion (UNEP, 1991, 1993).

Cd and Pb concentrations were determined in soft tissues of mussels with Atomic Absorption Spectrophotometer (AAS-SHIMADZU-6701F) using accredited

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Table I.- Concentrations of Pb and Cd (mg/kg dry wt.) in soft tissues of mussel *Mytilus galloprovincialis* caught from five different sites (S1-S5) of Pendik district coasts, Istanbul, Turkey.

Stations / Months	S1		S2		S3		S4		S5	
	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd
July-2011	1.71	0.05	1.48	0.10	1.89	0.12	0.23	0.04	4.46	0.14
Aug-2011	1.23	0.04	1.48	0.15	2.62	0.08	0.49	0.11	4.57	0.16
Sept-2011	2.52	0.05	1.44	0.14	1.45	0.05	1.48	0.14	3.28	0.16
Oct-2011	1.34	0.06	1.66	0.09	1.46	0.12	4.46	0.08	6.64	0.13
Nov-2011	1.29	0.02	1.89	0.13	1.33	0.08	4.57	0.12	8.66	0.09
Dec-2011	1.60	0.07	1.24	0.15	1.66	0.09	3.28	0.16	4.72	0.12
Jan-2012	1.70	0.10	2.37	0.08	1.90	0.12	6.64	0.11	3.93	0.08
Feb-2012	1.44	0.01	2.35	0.19	4.56	0.13	8.66	0.16	8.14	0.09
Mar-2012	1.60	0.10	2.61	0.07	0.25	0.08	4.72	0.11	2.61	0.11
Apr-2012	1.81	0.03	1.48	0.11	4.56	0.13	3.93	0.13	3.56	0.09
May-2012	1.91	0.08	1.44	0.15	1.12	0.08	8.14	0.13	0.30	0.09
June-2012	1.61	0.02	1.66	0.10	0.56	0.06	0.90	0.16	0.15	0.13

methods (Loring and Rantala, 1992). Intercalibration mussel homogenate (IAEA-436 and MA-MEDPOL-1/TM) samples from IAEA MEL-Laboratory, Monaco were used as control for analytical methods.

Results and discussion

Table I shows concentration of Pb and Cd in soft tissues of muscles collected from five different sites along Pendik district coastline. In this study, acceptable levels of Cd has been found in the whole soft tissue in mussel samples according to legal standards of Turkish and UNEP. On the other hand, the levels of Pb in this study were found to be higher than Cd levels. The highest Pb concentrations found in the whole soft tissue of mussels at S4 was 8.66 ppm in February and 6.64 ppm, (January) 4.72 ppm in July. At S5 Pb concentration was 8.66 in November, 8.14 in February, 6.64 in October and 4.57 ppm in August. These stations (S4 and S5) especially showed extremely high values in Pb when compared to the other samplings. These stations were affected by active marina, yacht and harbour activities coming from Tuzla shipyard area and numerous industrial and domestic discharges.

Balkıs and Aksu (2012) reported high Cd, Pb, Cr and Zn contents in mussel from Western Black Sea Shelf. The high values were because of anthropogenic (domestic and industrial) inputs via Danube River. Kaya *et al.* (2014) also reported high heavy metal concentration in water and in *Asellus aquaticus* species from Saricay Creek, Canakkale, Turkey that was polluted from industrial activities. Moloukhia and Sleem (2011) reported Cr and Cd accumulation in soft parts and shells of two aquatic molluscs collected from industrial waste areas in coastal waters. Besada *et al.* (2011) reported accumulation of Hg, Cd, Pb, Zn and Cu in wild mussels collected at 41 stations on the Spanish coastal Atlantic and northern coastal waters. Duarte *et al.* (2011) investigated the oxidative stress biomarkers of heavy metal pollution in mussels from the Beagle Channel. They reported relatively moderate levels of pollution in their study area as a result of urban influences. Rank (2009) effects of heavy metals, PCB congeneres, butyltin (BT) and PAH compounds, also intersex in snails (*Littorina littorea*) and DNA damage in blue mussels (*Mytilus edulis*) in a highly contaminated harbour area in Denmark. The anthropogenic activities related to the building/breaking ships contributed significantly to the contamination of harbour water environments and biota. Aksu *et al.* (2011) reported potential risks of heavy metals by trophic chain in the Marmara Sea which significantly affects its coastal areas. Aksu (2005) and Kayhan *et al.* (2007) reported the high Pb, Cd and Hg concentrations in mussels (*M. galloprovincialis*) from the both sides of Bosphorus, European and Anatolian side. Kut *et al.* (2000) also reported high Pb and Cd levels in marine algaes from the North of Bosphorus.

Catsiki *et al.* (2003) investigated heavy metal levels in mussels and surface sediments collected from Thermaikos Gulf, Greece in 1999. In contrast, they found that in all cases the heavy metal concentrations in mussels were below the permissible limits for consuming seafood. Bellas *et al.* (2014) reported high level of pollutants in *Mytilus galloprovincialis* populations located close to major cities and industrialized areas. Kljakovic-Gaspic *et al.* (2010) investigated 6 trace metals (Cd, Cr, Cu, Hg, Pb and Zn) in the coastal waters of the eastern Adriatic in 2006 by using *Mytilus galloprovincialis* as bioindicator species, but found no

health risk for mussel consumers in their study area. Ayas *et al.* (2009) investigated Cd, Cr and Pb levels in two *Patella* species (*P. caerulea* and *P. rustica*) and surface waters of Mersin Bay. When they compared heavy metal concentrations of two species they found that *P.rustica* samples had been contaminated higher amount of Cd and Cr. Farmaki and Thomaidis (2008) reported that marine environment nearby the big cities was found reasonably polluted . When our results were compared those of previous studies it was clearly found that Pb concentration levels in our samples from Pendik district coast were generally higher.

In this study there was no serious hazard to the mussel samples from the Pendik coastal areas in terms of the Cd concentrations. On the other hand, mussels of the Pendik coasts were contaminated with Pb due to anthropogenic and industial activities.

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