Lead level in mallard (*Anas platyrhynchos*)

Nivelul plumbului in raţa mare (*Anas platyrhynchos*)

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Cuvinte cheie: *raţă mare, plumb, ficat, rinichi, muşchi*

Abstract

The study was carried out on a hunting ground belonging to AJVPS Arad, county Arad. Lead (*Pb*) was determined in Mallard (*Anas platyrhynchos*) tissues (muscles) and organs (liver, kidneys) to see the contamination level of this tissues and organs and also the impact on humans health because in our days more and more wild game meat take a increasing percentage in humans food ratio. The Mallard is one of the most widespread duck species. Mallard has 50-62 cm length, 800-1400 g weight and lives about 11 years. It prefers rivers and shallow pounds with a lot of reed. It is a migratory species that is flying long distances to find food and unfrozen water, so it is a exposed to lead contamination that is under dust form in atmosphere. But another reason why lead level in Mallard can be higher that in other flying specie (pheasant, woodcock, quail, and pigeons) are the lead shot shells that are used for duck hunting. It is known that the ducks can ingest these lead shot shells and so they are often exposed to lead intoxications. This is why in our days more ammunition for waterfowl are steel made or different type of alloys. Lead is known to be one of the most common pollutants with a large range of effects on human health: lead affects nervous system, digestive tract, kidneys, bones, enzymes. Lead has also mutagenic effect, carcinogenic effect, teratogenic effect.

Rezumat

Studiul a fost efectuat pe un teren de vânătoare aparţinând AJVPS Arad, judeţul Arad. Plumbul (*Pb*) a fost determinat în ţesuturi (muşchi) şi organe (ficat, rinichi) de raţă mare (*Anas platyrhynchos*) pentru a determina nivelul de contaminare şi de asemenea impactul asupra sănătăţii umane deoarece în zilele noastre carnea de vânat are un procent tot mai crescut în hrana umană. Raţa mare este una dintre cele mai răspândite specii de raţe. Raţa mare are o lungime de 50-62 cm, o greutate de 800-1400 g şi trăieşte aproximativ 11 ani. Preferă râurile şi bălţile mai puţin adânci cu mult stuf. Este o specie migratoare care parcurge în zbor distanţe mari pentru a găsi apă neîngheţată, deci este expusă contaminării cu plumb prin pulberile atmosferice. Dar un alt motiv pentru care nivelul plumbului în raţa mare poate fi mai ridicat decât în alte specii de zburătoare (fazani, sitari, prepeliţe, porumbei) sunt alicele de plumb folosite pentru vânătoarea de raţe. Este cunoscut faptul că raţele pot ingera alicele de plumb fiind astfel expuse intoxicaţiei cu plumb. Acesta este motivul pentru care în aceste aceste zile tot mai multă muniţie destinată vânării păsărilor de apă este confecţionată din oţel sau diverse tipuri de aliaj. Plumbul este unul dintre cei mai frecvenţi poluanţi cu o gamă largă de efecte asupra sănătăţii animale şi umane: plumbul afectează sistemul nervos, tubul digestiv, rinichii, oasele, enzimele. Plumbul are de asemenea efecte mutagene, carcinogene şi teratogene.

Materials and methods

The aim of the study was to determine lead levels in mallard tissues and organs from a hunting ground placed in county Arad during three hunting season (2010-2011, 2011-2012 and 2012-2013). The samples were collected from mallard's during organized hunting according to Romanian Law 407/2006.

In each hunting season were collected samples from 20 mallards (10 females and 10 male).

The samples (liver, kidneys and muscles) were weight with analytical balance and then were mineralized at CHEM MarsX digester with the aid of HNO_3. Lead level was determined by atomic absorption spectrometer Shimadzu AAS 6500 with graphite furnace.

The data were statistically performed by 1way ANOVA using Bonfferoni correction with GraphPad Prism Software.

Obtained data were compared to MAL (0.1 ppm) established by Romanian Law (Ord. ANSVSA 97/2005) (7) and European Law (Directive 1881/2006) (6).

Results and discussion

After lead determination in Mallard tissues and organs, the obtained results showed differences between the two sexes, but in all three hunting seasons males showed insignificantly ($p > 0.05$) lower values in liver comparative than females.

Lead level liver (figure 1) was insignificantly ($p > 0.05$) higher in hunting season 2010 - 2011 comparative to hunting season 2011 - 2012 and hunting season 2012 - 2013 comparative to hunting season 2012 - 2013 in both males and females.

In hunting season 2010 - 2011 comparative to 2012 - 2013 one, lead levels in liver were strongly significantly ($p<0.001$) higher in mallard males and significantly ($p<0.01$) higher in females.

Lead levels in kidneys were insignificantly ($p>0.05$) lower in mallard males comparative to females in all three hunting seasons (figure 2).

The highest lead values in males kidneys were in hunting season 2010 - 2011 and than decreasing to the lowest values in hunting season 2012 - 2013, but the differences were insignificantly ($p>0.05$).

In females the differences were insignificantly ($p>0.05$) higher in hunting season 2010 - 2011 comparative with hunting season 2011 - 2012 and hunting season 2011 - 2012 comparative with hunting season 2012 - 2013.

In hunting season 2010 - 2011 lead levels in mallard females were strongly significantly ($p< 0.001$) higher comparative with hunting season 2012-2013.

In muscles lead levels were insignificantly ($p> 0.05$) lower in mallard males than in females in all three hunting seasons (figure 3).

In males lead levels were insignificantly higher in hunting season 2010 - 2011 comparative with hunting season 2011 - 2012 and hunting season 2011 - 2012 comparative with hunting season 2012-2013.

In hunting season 2010-2011 lead levels in mallard males muscles were strongly significantly ($p< 0.001$) higher than in hunting season 2012-2013.

In females lead levels in muscles were significantly ($p< 0.01$) in hunting season 2010 - 2011 comparative with hunting season 2011 - 2012; strongly significantly ($p<0.001$) higher in hunting season 2010 - 2011 comparative with hunting season 2012 - 2013 and insignificantly ($p> 0.05$) higher in hunting season 2011 - 2012 comparative with hunting season 2012 - 2013.

Comparative with Romanian Law (Ord. ANSVSA 97/2005) (7) and European Law (Directive 1881/2006) (6) that establish the MAL for lead (0.1 ppm) lead levels were strongly significantly ($p< 0.001$) lower in all three hunting season not only in mallard males, but also in mallard females.

In mallard males, lead level in muscles varied between: 0.027-0.081 ppm (mean value: 0.051 ppm) in hunting season 2010 - 2011; 0.027-0.053 ppm (mean value: 0.035 ppm) in hunting season 2011 - 2012 and 0.013-0.037 ppm (mean value: 0.025 ppm) in hunting season 2012 - 2013.

In mallard females lead level in muscles varied between: 0.037-0.092 ppm (mean value: 0.065 ppm) in hunting season 2010-2011; 0.026-0.049 ppm (mean value: 0.041 ppm) in hunting season 2011 - 2012 and

0.016-0.052 ppm (mean value: 0.031 ppm) in hunting season 2012 - 2013 (Table 1).

In liver lead level varied between: 0.024-0.043 ppm (mean value: 0.035 ppm) in hunting season 2010 - 2011; 0.022-0.068 ppm (mean value: 0.031 ppm) in hunting season 2011 - 2012 and 0.014-0.031 ppm (mean value: 0.025 ppm) in hunting season 2012 -2013.

In females lead level varied between: 0.019-0.103 ppm (mean value: 0.056 ppm) in hunting season 2010 - 2011; 0.026-0.079 ppm (mean value: 0.045 ppm) in hunting season 2011-2012 and 0.019-0.051 ppm (mean value: 0.032 ppm) in hunting season 2012 - 2013 (Table 1).

Lead level in mallard males kidneys varied between: 0.037-0.062 ppm (mean value: 0.047 ppm) in hunting season 2010-2011; 0.024-0.064 ppm (mean value: 0.038 ppm) in hunting season 2011 - 2012 and 0.019-0.042 ppm (mean value: 0.029 ppm) in hunting season 2012 - 2013.

In females lead level varied between: 0.037-0.102 ppm (mean value: 0.070 ppm) in hunting season 2010-2011; 0.037-0.069 ppm (mean value: 0.048 ppm) in hunting season 2011 - 2012 and 0.025-0.060 ppm (mean value: 0.035 ppm) in hunting season 2012-2013 (Table 1).

Table 1

Lead (*Pb*) value (ppm) in Mallard tissues and organs (muscles, liver, kidneys)

Hunting season	Tissues and organs		Mallard ♂	Mallard ♀
2010-2011	Muscles	Highest value	0.081	0.092
		Lowest value	0.027	0.037
		Mean value	0.051	0.065
	Liver	Highest value	0.043	0.103
		Lowest value	0.024	0.019
		Mean value	0.035	0.056
	Kidneys	Highest value	0.062	0.102
		Lowest value	0.037	0.037
		Mean value	0.047	0.070
2011-2012	Muscles	Highest value	0.053	0.049
		Lowest value	0.027	0.026
		Mean value	0.035	0.041
	Liver	Highest value	0.068	0.079
		Lowest value	0.022	0.026
		Mean value	0.031	0.045
	Kidneys	Highest value	0.064	0.069
		Lowest value	0.024	0.037
		Mean value	0.038	0.048
2012-2013	Muscles	Highest value	0.037	0.052
		Lowest value	0.013	0.016
		Mean value	0.025	0.031
	Liver	Highest value	0.031	0.051
		Lowest value	0.014	0.019
		Mean value	0.025	0.032
	Kidneys	Highest value	0.042	0.060
		Lowest value	0.019	0.025
		Mean value	0.029	0.035

Comparative with the values obtained by other researchers (Szymczyk and Zalewski, 2003) (5) the obtained data were much lower not only in Mallard liver but also in muscles.

The data obtained by the two authors were higher than MAL (Directive 1881/2006) (6).

Also comparative with lead level in liver in other countries (Mateo et al., 1998 and Blus et al., 1995) (3) our values were strongly significantly ($p<0.001$) lower.

The data obtained on Mallard tissues and organs by us reveals that lead pollution has a decreasing tendency.

Other conclusion is that lead level is higher in Mallard females than in males.

During this study we found lead shot shells in Mallard's stomach that could be a possibility for the higher levels of lead in some cases.

Regarding the time of the year (winter) in that the Mallard's were hunted some of them were only passing by our country looking for places with unfrozen water so we can find a way to monitor the "flight corridor" of the ducks to make a screening of their level of contamination.

This study can serve to a future project of pollution monitoring,

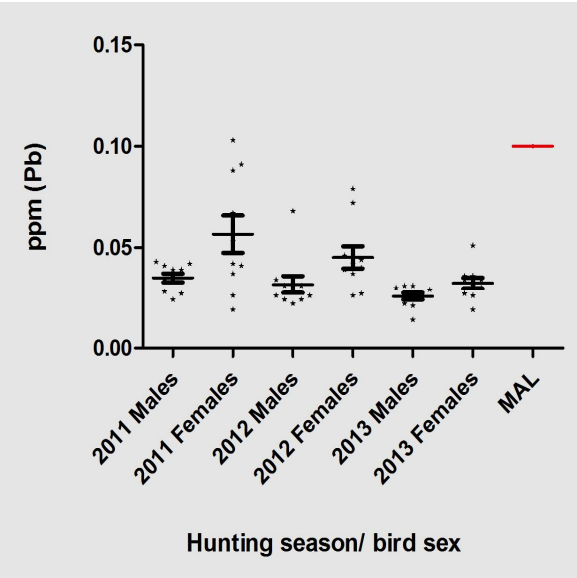

Figure 1. Leal level (ppm) in Mallard's liver

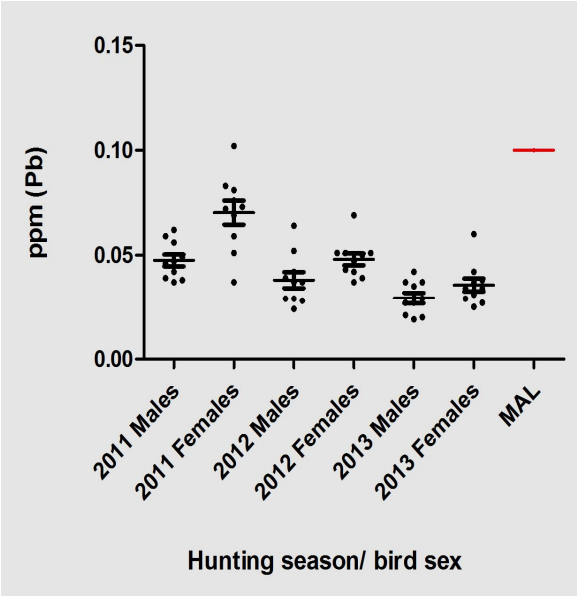

Figure 2. Leal level (ppm) in Mallard's kidneys

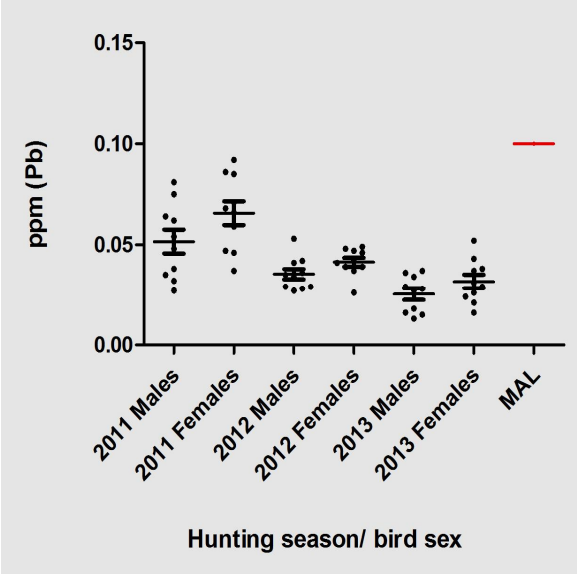

Figure 3. Leal level (ppm) in Mallard's muscles

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