Game Meat Hygiene and Human Toxicology

Conventional and Innovative Hunting Rifle Bullets

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Threatment of the Issue in Three Parts

1. Comparative lead content of agriculturally produced meat and game meat
2. Game meat hygiene
3. Human Toxicology

Comparative lead content in the meat of domestic animals and game animals

0.02 mg/kg

No difference in the median value

0.02 mg/kg

Comparative lead content in the meat of domestic animals and game animals

Kind of meat (number of samples)	**Lead content in mg/kg** <0.100; > 0.100			**Share of total consumption**
	Median (50% Percentile)	95% Percentile	Maximum value	
Pork (n=5244)	0.02	0.06	1.443	41.9%
Beef / Sheep / Goat (n= 7229)	0.02	0.078	0.800	20.0%
Poultry (n=3343)	0.02	0.060	0.312	12.3%
Game meat (n=2521)	0.02	1.525	867.0	0.2%

Table 1: Lead contents in different kinds of meat (without processed products and offal) as well as their share of average consumption of meat and meat products; values in green are below, values in red are above threshold value for meat of 0.100 /kg; source: EFSA (2010)

Lead Content of Selected Foods Median Value in mg/kg

source: EFSA Journal 2010; 8(4):1570

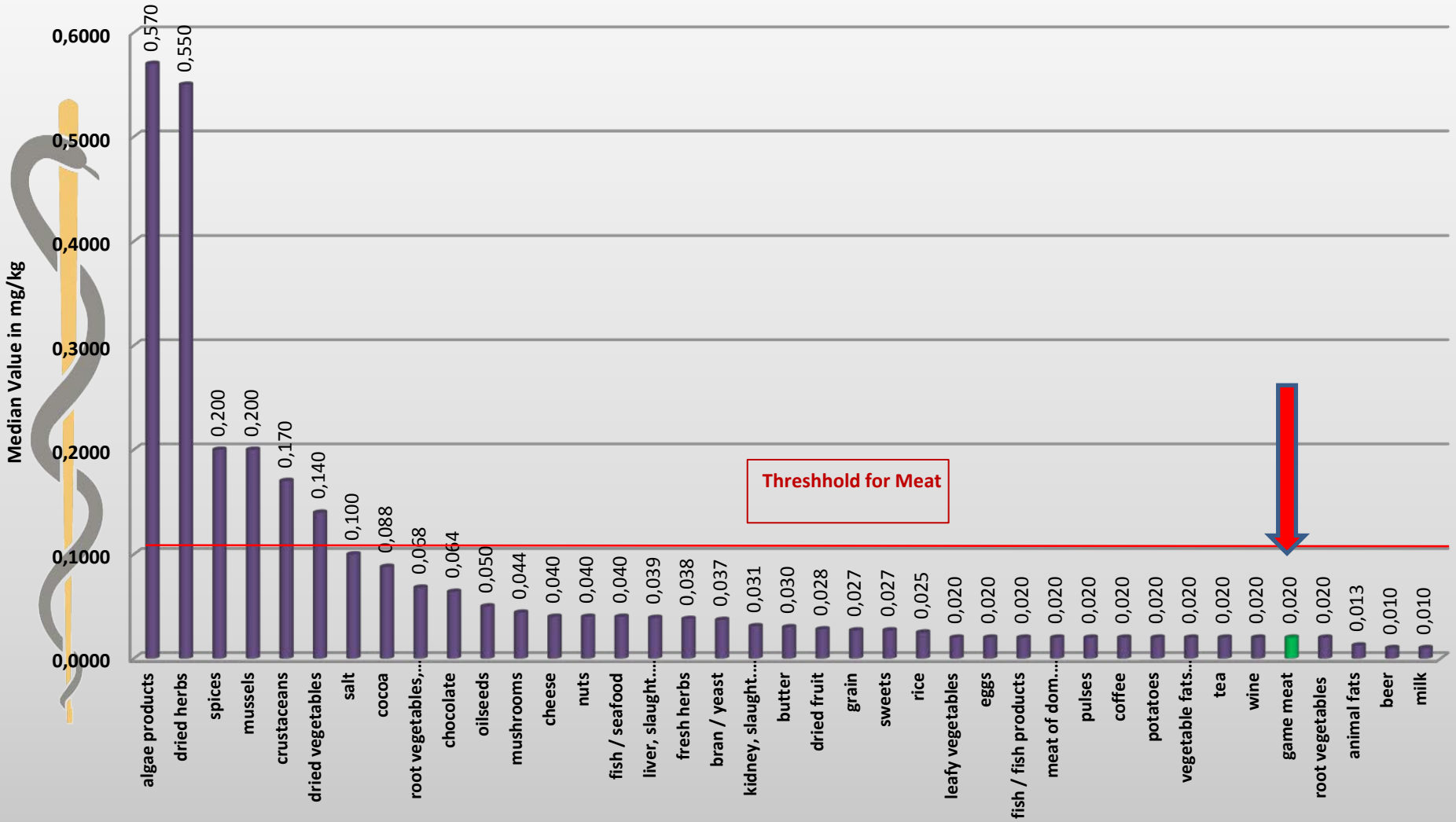

Figure 3a: Lead Content of Selected Foods Median Value in mg/kg
source: EFSA (2010)

Comparative Lead Ingestion from Foods on the Basis of Average Consumption

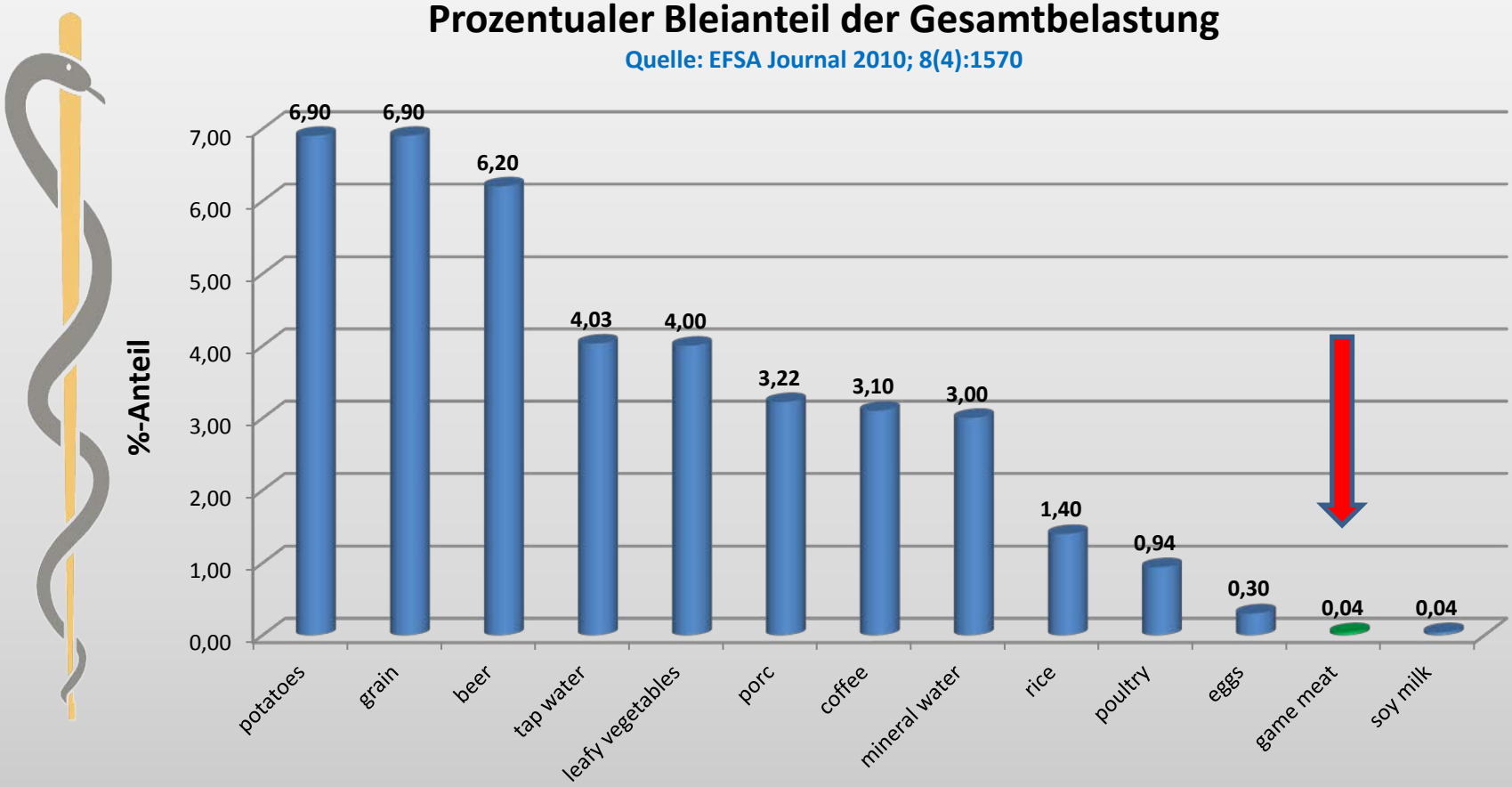

Figure 3b: Percentage of selected foods of the total lead ingestion on the basis of average consumption; source: EFSA (2010)

Lead Content of Wild Boar Meat in the Median Value

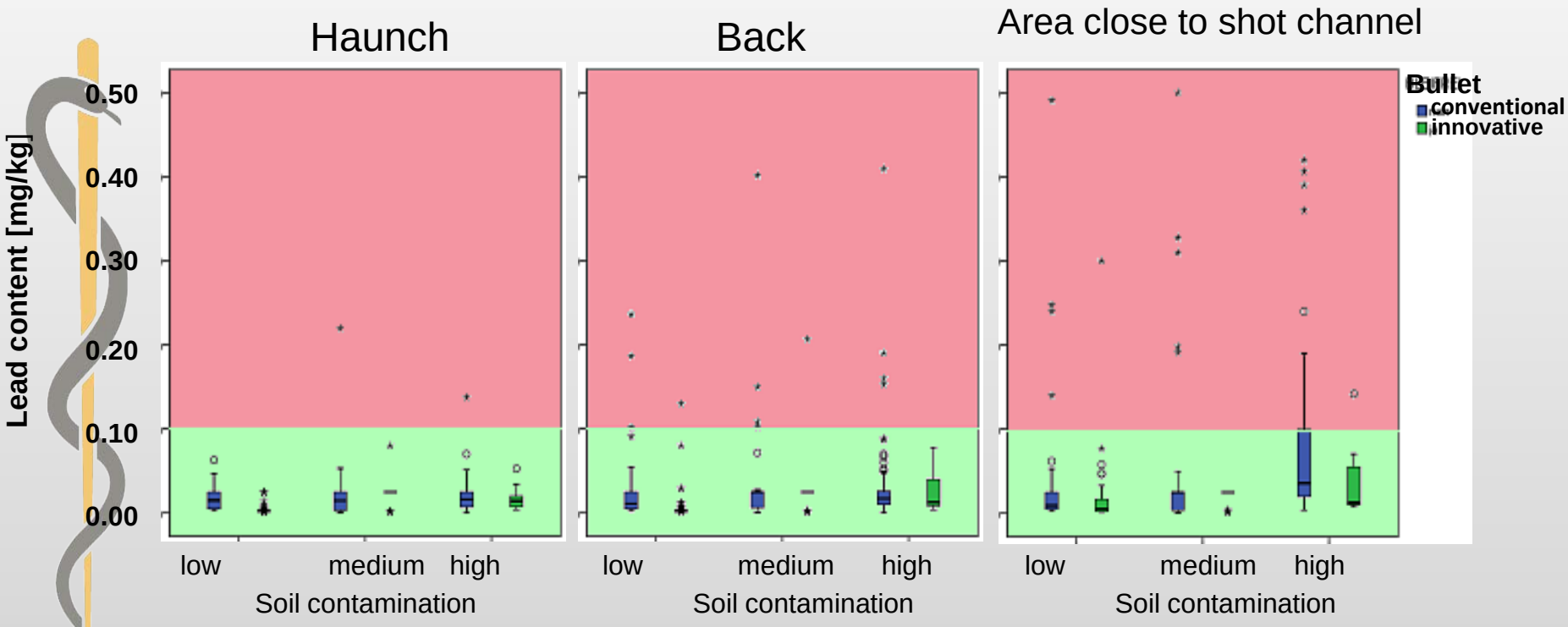

Figure 4: Boxplot displaying the lead content of wild boars from regions with different lead background levels shot with conventional (lead-containing) and alternative bullets; area below threshold value of 0.100 mg/kg in green, above in red colour; from Mueller-Graf u. Sommerfeld (2013), modified.

Exceedances of threshold value for lead in roe deer and wild boar

Partial sample	Ammunition	Roe deer Lead content mg/kg <0.100; > 0.100			Wild boar Lead content in mg/kg <0.100; > 0.100		
		Median	Maximum	>0,100	Median	Maximum	>0,100
Haunch	Lead-containing	0.005	73.000	3.9%	0.002	1.101	2.7%
	Alternative	0.005	0.228	0.4%	0.002	0.080	-
Back	Lead-containing	0.007	189.293	5.8%	0.019	650.100	11.4%
	Alternative	0.004	0.090	-	0.003	0.207	2.0%
Shot Channel	Lead-containing	0.015	4727.979	16.3%	0.025	276.237	20.0%
	Alternative	0.007	1.260	2.1%	0.013	1.300	3.0%

Table 2: Lead contents in different partial samples from roe deer and wild boar, shot with conventional and innovative ammunition; values in green are below threshold, values in red above threshold value of 0.100 mg/kg; source: Mueller-Graf u. Sommerfeld.

➢**0.005 to 0.023% of the meat consumption could contain excessive lead values**

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Game Meat Hygiene

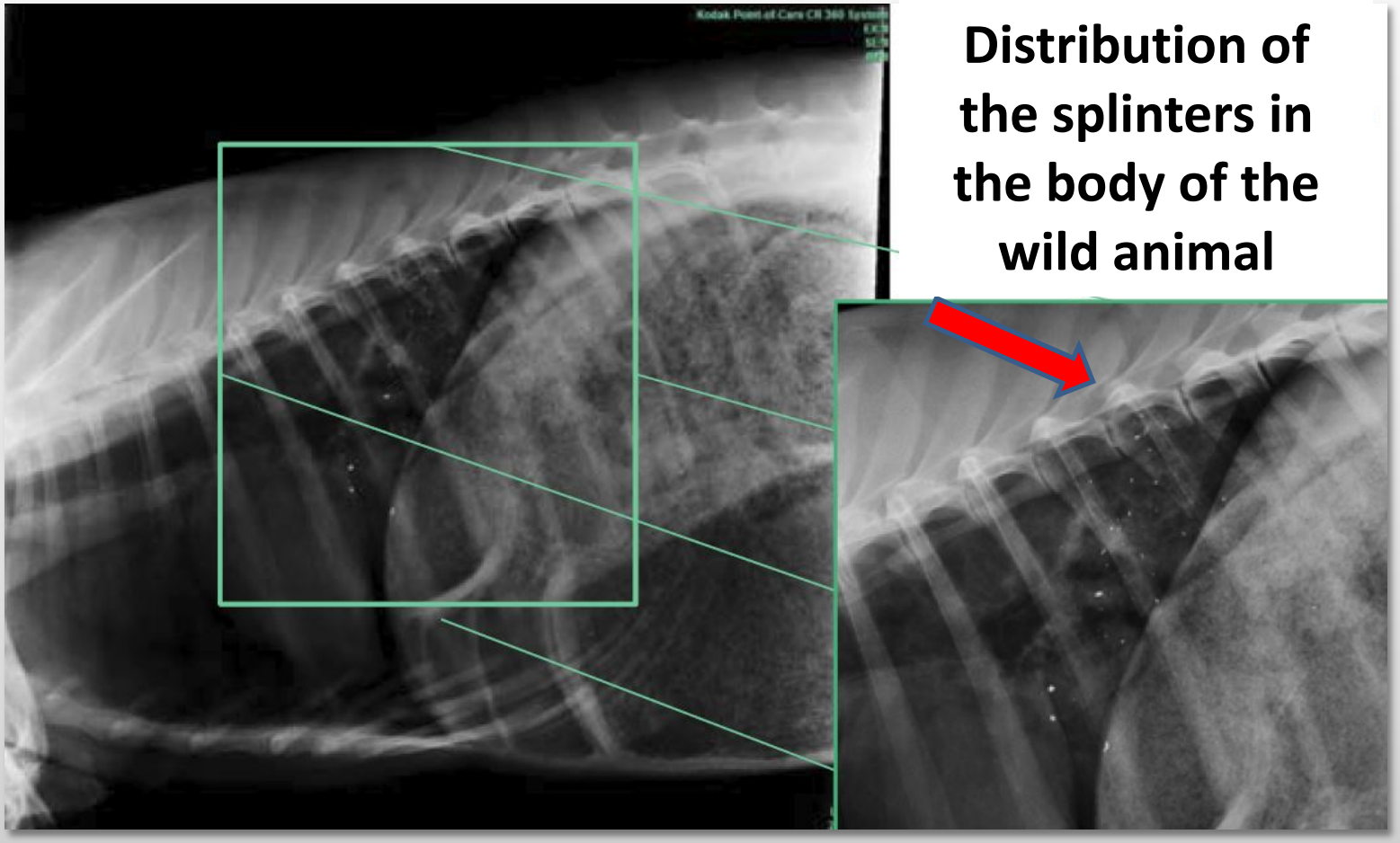

Figure 5: Radiologic pictures of a shot roe deer; uneviscerated – untreated in the sense of game meat hygiene; in the hide; bright points represent metal splinters (souce: Krone Trinogga 2011)

Game Meat Hygiene

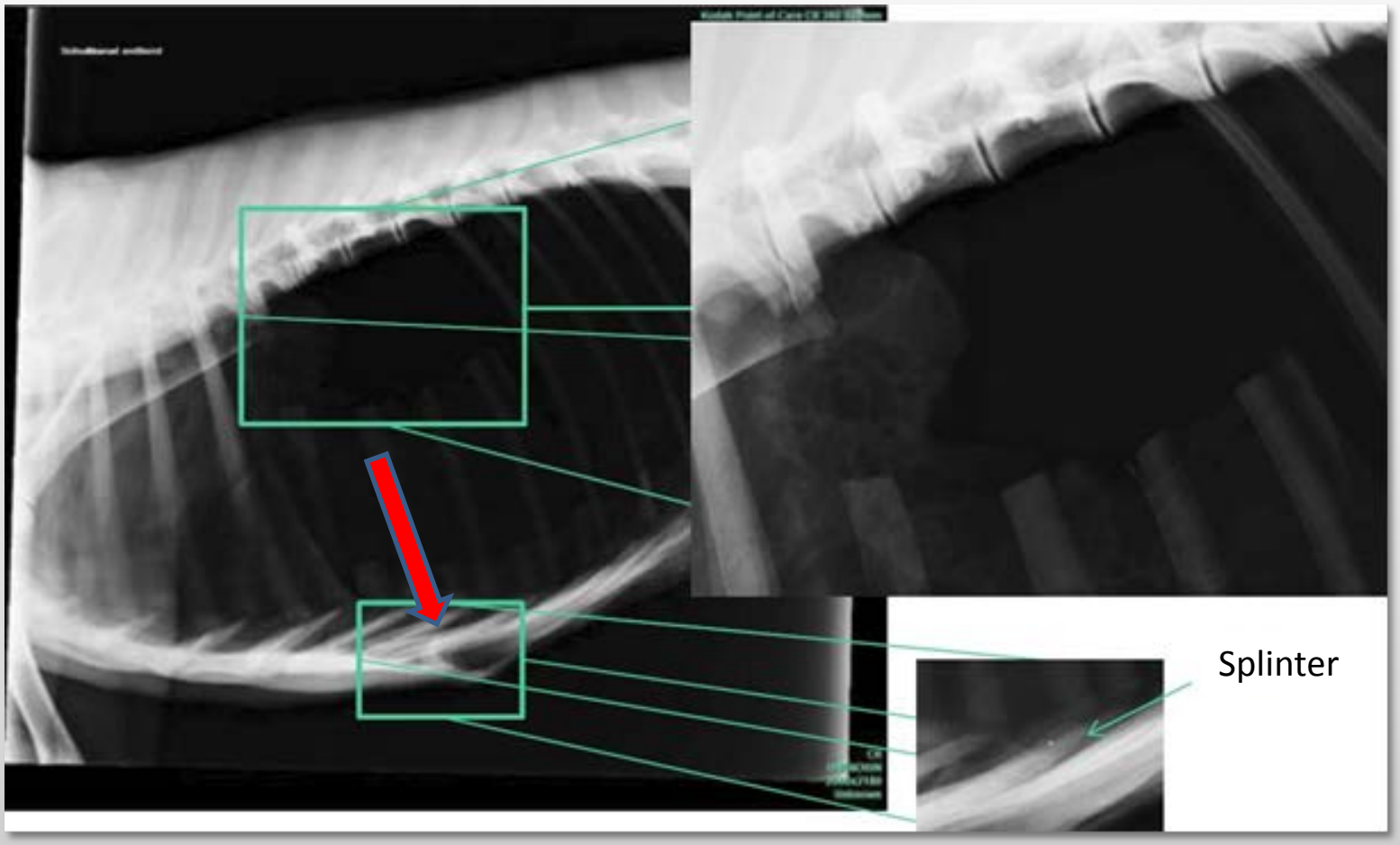

Figure 6: radiologic pictures of a shot roe deer; eviscerated – after treatment according to game meat hygienic standards; removed from the hide (source: Krone Trinogga 2011)

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Human Toxicology

The toxicological effect of ingested metal particles depends in principle on:

- **the used metal of the projectile**
- **the ingested size of the particle**
- **the biologic solubility of the metal**
- **the ingested quantity of metal**
- **the way of ingestion (oral oder inhalative)**
- **relevant for hunting bullets is only the oral ingestion**

Human Toxicology

Toxicological attention needs to be placed above all on the metals mainly used in hunting bullets:

- **Copper** — essential trace element
- **Zinc** — essential trace element
- **Lead** — non-essential metal

Human Toxicology

The oral absorption rate addionally depends on the food composition and is for:

- **Copper** — **30 to 40 %**

  toxic window:
  A: 1.5 – 5 mg/day
  C: 1 – 4 mg/day

- **Zinc** — **30 to 40 %**

  Toxic window:
  A: 10 – 25 mg/day
  C: 1 – 7 (22) mg/day

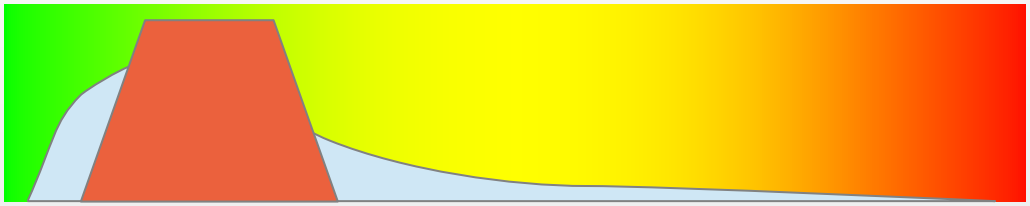
- **Lead** — **5 to 10 %; for children up to 40 %**

Conclusion

- The lead content in meat of agricultural production and game meat does not show any differences in the median value.
- The preparation of the meat according to the hygienic standards applicable for game meat reduces the potential oral ingestion of metal splinters to the mimimum.
- In the median value, lead-containing or lead-free bullet constructions do not show any difference in their impact on the lead content in game meat outside the shot channel.
- A ban on lead-containing hunting ammunition does not factually result in a noticeable reduction of the lead contamination of the total population.
- The quantitatively relevant lead contaminations of the total population are caused by the common foodstuffs and only for a small share by game meat (0.04 %).
- The discussion on conventional or innovative hunting bullets is obviously about a marginal problem.

Classification of conventional lead bullets

relative classification of copper-containing alternative bullets



Game Meat Hygiene,
Human Toxicology