

LEAD IN VENISON:

GRAY TOXIN OR RED HERRING?

THERE IS NO QUESTION LEAD IS TOXIC AND HARMFUL TO HUMANS. BUT ARE HUNTERS WHO USE LEAD BULLETS AT RISK? IT DEPENDS

Lead is a concern of bird enthusiasts because individual raptors (eagles, hawks, condors) die from lead poisoning after consuming bullet fragments and shotgun pellets in unretrieved game animals and gut piles. Because of their concern for raptor mortality, some bird-based organizations and environmental groups are mounting

an aggressive campaign to make hunters aware of human health issues associated with consuming venison shot with lead bullets. Suddenly, bird biologists are very concerned about my family's health. How much of this is really just an effort to save birds, and how much is a legitimate concern for the health of venison consumers?

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First off, there are other reasons hunters might choose nonlead bullets. Lead bullets do kill individual birds when they consume even small fragments, but this is not an important population-level effect and thus not an issue of conserving populations in most cases. The California condor is an obvious exception to this because the data is overwhelming that lead bullet fragments from hunting in condor range is a serious impediment to recovering this endangered species.

Other reasons to choose nonlead bullets might be related to personal concerns for individual birds or the overall image of hunters to the general populace. This topic is far too complex to cover comprehensively in one article, so I will focus here only on the issue of lead bullets and human health.

HEAVY METAL

Your parents were right when they warned you about the dangers of all that heavy metal emanating from your bedroom. They warned you about the headaches, the lack of concentration, and of you spacing out all the time. Parental disapproval of loud music has not been a problem throughout most of human existence, but lead poisoning with those same side effects has been known in humans for at least 2,500 years. Some have blamed the death of Beethoven and the fall of the Roman Empire on lead poisoning. Research since then has revealed that high exposure to lead can cause impairments in brain function, heart problems, digestive issues, neurological ailments and developmental delays in children.

Lead is found in an inorganic metallic form that is the gray lead we normally think of, but also in an organic lead form used in various lead compounds. Most lead exposure in humans has been from organic lead compounds like lead additives in gasoline, lead paint and certain industrial compounds. Besides being so widespread in the past, organic lead has properties that make it very easily absorbed through the skin, mucus membranes and lung tissue. On the other hand, metallic lead that is used in most bullets is much harder for the body to absorb (rarely through the skin).

HISTORY OF LEAD

The Centers for Disease Control and Prevention (CDC) is responsible for monitoring basic levels of toxicants in the U.S. population. The baseline blood lead levels in humans has decreased 86% since the 1970s as we removed the most widespread sources of lead exposure (gas, paint, etc). The CDC considers a blood lead level of less than 10 micrograms per deciliter (mcg/dL) in adults to be an acceptable level.

In 1971, the CDC lowered this threshold from 60 to 40, and then lowered it again to 30 in 1978, to 25 in 1985, and then to 10 in 1991. Despite this CDC threshold of 10 mcg/dL, more recent research indicates a higher incidence of heart problems and childhood development issues when chronic levels were between 2 and 10 mcg/dL. Children are more sensitive to lead because their digestive systems absorb lead at twice the rate of adults and because they are growing rapidly. Because of these concerns, in 2012, the CDC reduced the threshold for children to 5 mcg/dL (adults remained at 10 mcg/dL). Some say there is no safe level

of lead, but despite ample research, there is currently no evidence for concerns about lead levels below 2 mcg/dL.

GAUGING THE THREAT

Blood lead levels are the standard for monitoring a person's exposure, but lead in the blood only reflects exposure in the last 30–60 days. More than 90% of the lead stored in adults is in bones and teeth. When stored in bones, lead is stable and not circulating in the body. But it can be mobilized later as a person ages, especially if osteoporosis starts to mobilize calcium and lead into the bloodstream, even decades after it was deposited. With females, lead stored in bone can be remobilized into the blood stream during pregnancy, lactation or after menopause. Because of the greater susceptibility of the fetus to lead poisoning and long-term effects on child development, extra caution with lead is warranted in pregnant women (or those planning to become pregnant) and children under 6 years of age.



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BLOOD LEAD LEVEL (MCG/DL)	DOCUMENTED SIDE EFFECTS
0-2	NONE CURRENTLY RECOGNIZED.
3-9	Some long-term increased risk of death due to heart attack and stroke
5-9	Reduced academic performance in children
10-19	ALL OF THOSE ABOVE, PLUS: Possible spontaneous abortion, reduced newborn birth weight, possible blood pressure changes, possible kidney issues.
20-39	ALL OF THOSE ABOVE, PLUS: Headache, fatigue, sleep problems, digestive problems, mood swings, memory and attention deficits.
40-79	ALL OF THOSE ABOVE, PLUS: Abdominal pain, nerve tingling, abnormal sperm counts, hypertension, anemia, kidney damage, gout, difficulty concentrating, short-term memory loss.
80+	ALL OF THOSE ABOVE BUT WORSE.

LEAD MEETS RED MEAT

The soft nature of metallic lead not only allows for expansion of the bullet, but it tends to allow the bullet to come apart and fragment when it hits meat and bone. It is not hard to find X-ray photos on the internet or in hunting regulations showing the scatter of lead fragments in a deer carcass. Many of these pictures represent worst-case scenarios from high-velocity, light-

weight bullets that impacted solid bone. Nonetheless, lead bullets do fragment a lot, and recent research is showing even the most skeptical hunters that there is more lead in our venison (and farther from the wound channel) than we previously thought. Controlled studies documented lead fragments as far as 11 inches from the wound channel. With a well-placed shot in the rib cage, bullet fragments in the four quarters and

backstraps should be minimal. Most of the contamination comes from the scraps of meat that are taken from the area near the wound channel. These are the scraps that typically end up in the "grind pile" for burger. Commercial meat processors may be less worried about keeping these scraps out of your burger as they maximize the amount of meat you get back.

STUDIES ON DEER

The Minnesota Department of Natural Resources experimentally shot 80 carcasses (deer and sheep) and evaluated the presence of lead in each. High-velocity ballistic tip bullets left an average of 141 fragments, an average of 11 inches from the wound channel (some were farther). Softcore and bonded bullets fragmented less and left "only" 80-86 fragments 9-11 inches from the wound channel. Some fragments were too small to see with anything but a sensitive X-ray image, but with this amount of fragmentation, you obviously want to keep all bloodshot meat out of your burger and sausage.

The whole topic of lead in venison was set afire in 2007 when a North

Don't believe the hype: There is no record of anyone ever getting sick from consuming lead bullet fragments from hunter-shot whitetails.

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Dakota dermatologist had 95 packages of venison burger X-rayed and found 53 of them contained some trace of lead. This lit the fuse on an explosion of news articles and caused the removal of all donated venison from charitable food pantry shelves in at least four states. When it became known that the dermatologist was on the board of directors of a national raptor organization, suspicions raged about his motives and other researchers followed up with similar studies.

A study of 30 deer harvested with lead bullets in Wyoming and processed by 22 different meat processors found a similar number of average lead fragments per deer (136), and 32% of the burger packages had at least one metal fragment. Twenty percent of the packages had only one fragment, 7% had two fragments and 5% had three to eight fragments. Burger packages always have more lead fragments than steaks and roasts.

The Minnesota Department of Agriculture tested 1,029 commercially ground burger packages and found fragments in 26%, but only in 2% of 209 packages containing whole cuts of meat. In a 2008 Wisconsin study, researchers collected 183 packages of venison burger from hunters' freezers, food pantries and meat processors.

They found 85% of commercially processed burger and 92% of hunter-ground packages were free of lead.

LEAD BULLETS AND HUMAN HEALTH

There is no question lead is toxic and harmful to humans, but often people speak generally about medical complications from lead poisoning rather than specifically about metallic lead fragments from bullets. I'm not interested in how Beethoven died, but I am interested in whether lead bullet fragments pose a health risk to me and my family.

Metallic lead absorbs slowly in the human digestive tract, so what is the risk if I happen to get a burger with a lead fragment? It only takes 24–72 hours for a meal (or fragment) to pass completely through a person from table to toilet. Can a relatively insoluble lead fragment moving through your system that fast be an issue, especially if the average meal is completely passed out of the stomach in 4–5 hours?

After the food pantry clearing in North Dakota, a blood lead level survey was conducted of 736 North Dakotans. It was widely reported that those who consumed wild game (game birds, deer, etc.) had significantly higher blood lead levels than those who did not. In fact, wild game consumers had twice the blood lead level. Media coverage of this was extensive, but even those who

consumed game meat still had blood lead levels that averaged 1.27 mcg/dL — about half the absolute lowest, most conservative safe level (2 mcg/dL) and nearly identical to the national average (1.25 mcg/dL). No participants in the study had levels above the CDC threshold (10 mcg/dL). This strikes me as an example of some people trying to make a big deal out of something that was not a health issue at all.

Another well-publicized study showed an Inuit community in Greenland had high blood lead levels after subsisting largely on shotgun-killed sea ducks. The more often a person consumed sea ducks, the higher their blood lead level. Those eating ducks less than once per week had lead levels under the CDC threshold (10 mcg/dL), but when consumption rate approached "daily," lead levels exceeded the threshold (10–17 mcg/dL). This study is often cited to illustrate the dangers of lead poisoning to hunters, but we need to keep things in perspective. There are few hunters who consume game shot with lead on a daily basis throughout the year.

ADDITIONAL STUDIES

A study of venison consumption in Italy found hunters had blood lead levels of 3.4 mcg/dL, which was twice the level of nonhunters (1.7 mcg/dL); but again, even the hunters had



levels only one-third of the CDC recommended threshold. When you look closer at this study, you see that there was no relationship between lead levels and those who ate game meat, so why was there a difference between hunters and nonhunters? Perhaps there was another source of lead confusing the results.

This was clearly the case in Norway when those who consumed game meat had somewhat higher lead levels, but those who reloaded their own ammunition had 52% higher blood lead levels. This indicates that often those consuming game meat are also exposed to other sources of lead that may not be captured in the study design. In the famous North Dakota study above, 35% of participants reported target shooting and 15% were reloaders.

The problem with other sources of lead confusing these results is a familiar one to me personally. If I were the subject of a blood lead survey, it would show that I hunt and eat venison twice per week year-round. It would also show that I have had elevated blood lead levels (mcg/dL) of 18.4 (2013), 8.9 (2015), 16.7 (2018), and most recently 16.7 again (2019). This sounds like a clear case of elevated lead levels from bullet fragment ingestion, except for the fact that my whole family has used nothing but solid copper bullets since 2009.

My lead exposure comes from weekly action pistol competitions and frequent reloading of ammunition with lead bullets. There are several sources of lead exposure related to my hobby, but I have implemented ways to reduce my exposure. My example highlights the importance of not looking at lead levels with simplistic categories like "hunters vs. nonhunters" or "frequency of game meat consumption" without a full accounting of all the potential other sources of lead that hunters are exposed to.

There is no record of anyone ever getting sick from consuming lead bullet fragments. However, there is ample research that shows ingesting metallic lead (bullet fragments and bird shot) can increase blood lead levels. Whether that is a health hazard depends on amount of lead consumed, frequency of consumption, passage rate, your age, sex and even differences between individuals.

A temporary elevation of blood



Hunters are among the most careful of food processors when it comes to gun-shot deer carcasses. However, the fact remains that the Center for Disease Control does not list lead in venison as a human health risk.

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levels following occasional swallowing of a fragment is not going to result in a heart attack or loss of memory, but since lead is a toxin, it is still good advice to minimize your intake. Studies show that those of us who butcher our own meat have less lead in our venison and that most of the problem is with burger and not whole cuts.

There are rare and unusual cases in the medical literature of people retaining a piece of lead in their digestive tract for a long time; this is most commonly shot pellets in their appendix. In these cases, blood lead levels can rise to high levels requiring medical attention. There are even cases of gunshot victims having elevated blood lead levels from the bullets that were not removed, especially if they are lodged near a joint.

We certainly see cases of raptor advocates exaggerating the dangers to hunters of lead bullet ingestion out of their concern for bird deaths. Some of the messaging, especially from Europe, is downright hysterical. You can't blame them for being passionate about what they love, but we have to make our personal decisions based on good science. There are legitimate reasons for hunters to think about their sources of lead exposure and do all they can to minimize their intake. Whether

that means a switch to nonlead ammunition is up to you depending on your assessment of the health risk and other reasons you may want to switch. If you have a wife of child-bearing age or kids around the table, your risk is different than a single person eating venison infrequently.

CONCLUSION

Those who consume high quantities of lead-killed venison should take precautions to lessen the risk and monitor their blood lead levels. However, all evidence indicates you would have to eat a lot of blood-shot burger frequently to maintain enough metallic lead in your digestive system for these fragments to be a dangerous source of lead poisoning.

There is probably good reason the CDC has never identified lead bullet fragments in venison as a health issue.

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