

# WHEN LEAD MEETS RED MEAT



Is using lead ammunition a human health hazard?

In recent years, agencies have been implementing regulatory bans and phase-outs of lead ammunition in some areas, and the messaging in these efforts—and in regulations—often warn hunters and their families about lead poisoning from eating animals shot with lead ammunition. But how much should hunters worry about the health effects of eating animals shot with lead ammo?

There are legitimate reasons hunters might choose alternative ammunition. Lead bullets can sicken or kill individual birds when they ingest lead fragments, which can cause localized effects to some species. For example, lead is no small issue for the recovery of endangered

California condors where every individual is important, and agencies and organizations are addressing that threat. Hunters may want to take advantage of a clean wound channel and less meat loss when a shot didn't go exactly as planned, or they may need a solid bullet for

very large game where deep penetration and performance on big bones is important.

All these important and interconnected subtopics deserve their own discussions, but the broader subject is far too complex for one article. This issue of *Fair Chase* emphasizes the food value of hunting, so to allow for a meaningful discussion of human health and lead ammunition, we are focusing solely on that topic here. It is up to the reader to gather as much information as possible to inform and support your ammunition choices.

## HEAVY METAL

Lead poisoning has been known in humans for at least 2,500 years. 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 (the gray lead we normally think of) and also in various organic lead compounds, such as in cartridge primers. Most lead exposure in humans comes from organic lead compounds like lead additives in gasoline, lead paint, and certain industrial compounds. Organic lead compounds have properties that make them easily absorbed through the skin, mucus membranes, and lung tissue. On the other hand, metallic lead used in bullets is much harder for the body to absorb.

The Centers for Disease Control and Prevention (CDC) monitors basic levels of toxicants in the U.S. population. The baseline blood lead levels in humans have

decreased 86 percent since the 1970s as we removed the most widespread sources of lead exposure (gas, paint, etc.). The medical profession considers a blood lead level of less than 3.4 micrograms per deciliter (mcg/dL) in adults to be within normal limits. Children are more sensitive to lead because their digestive systems absorb lead at twice the rate of adults and because they are growing rapidly. Some say there is no safe level of lead, but despite ample research, there is currently no evidence in the medical literature for concern with lead levels below 2 mcg/dL.

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 percent of the lead stored in adults is in bones and teeth. In bones, lead does not circulate in the body, but it can be mobilized as a person ages, especially if osteoporosis starts to mobilize calcium and lead into the bloodstream decades after being deposited. In females, lead stored in bone can remobilize into the bloodstream during pregnancy, lactation, or after menopause. Because of the greater susceptibility to lead poisoning of a fetus 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 age 6.



This deer was shot with a lead bullet. The bright white spots scattered throughout its body are fragments of lead from that bullet. These fragments can be eaten by scavengers, such as eagles, when they feed upon a gut pile or carcass left out in the field. © USGS.gov

### LEAD AND RED MEAT

The soft nature of metallic lead not only allows for bullet expansion, but it allows 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 and hunting regulations showing the scatter of lead fragments in a carcass. Some pictures represent worst-case scenarios from a high-velocity, lightweight bullet that impacted solid bone. Nonetheless, lead bullets do fragment. Recent research shows even skeptical hunters that there is more lead in our venison (and farther from the wound channel) than we thought. With a well-placed shot in the lungs, bullet fragments in the four quarters and backstraps should be minimal. Most of the contamination comes from the scraps of meat taken from the area near the wound channel, which typically end up in the "grind pile" for burger.

The Minnesota Department of Natural Resources experimentally shot 80 carcasses and evaluated the presence of lead. High-velocity ballistic-tip bullets left an average of 141 fragments, an

average of 11 inches from the wound channel. Soft-core and bonded bullets fragmented less and left 80-86 fragments 9-11 inches from the wound channel. Some fragments were too small to see with anything but an X-ray image.

The whole topic of lead in venison was set afire in 2007 when a North Dakota dermatologist had 95 packages of venison burger X-rayed and found that 53 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 bird organization, suspicions raged about his motives. It is noteworthy that bird biologists author most peer-reviewed papers on human health and lead ammunition in the U.S.

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 percent of the burger packages had at

least 1 metal fragment. Twenty percent had only 1 fragment, 7 percent had 2 fragments and 5 percent had 3 to 8 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 percent, but only 2 percent 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 percent of commercially processed burger and 92 percent of hunter-ground packages were free of lead.

### LEAD BULLETS AND HUMAN HEALTH

There is no question that lead is toxic to humans, but often, people speak too generally about lead poisoning from all causes rather than specifically about whether metallic lead fragments from ammunition pose a health risk to my family. Metallic lead slowly absorbs in the human digestive tract, so what is the risk if I get a burger with a lead fragment? A meal only takes 24-72 hours to pass completely through a person from table to toilet. Can a relatively insoluble lead fragment moving with food through your system in that time be a problem—especially if an average meal passes out of the acidic stomach in four to five hours?

After the food pantries were cleared in North Dakota, a blood lead level survey was conducted on 736 North Dakotans. It was widely reported that those who consumed wild game had twice the blood lead levels as those who did not. Media coverage of this was extensive, but even those who consumed game meat still had blood lead levels that averaged 1.27 mcg/dL—less than half the normal threshold (3.4 mcg/dL) and nearly identical to the national average at the time (1.25 mcg/dL). To some, this seemed like an example of 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 people consumed sea ducks, the higher their blood lead level. Those eating the equivalent of 1-5 whole ducks per month had lead levels of 6-7 mcg/dL. When the consumption rate approached “daily” status, lead levels averaged 12-17 mcg/dL. This study is often cited to illustrate the dangers of lead poisoning to hunters, but we need to keep a couple things in perspective. Meals from waterfowl and small game differ from big game because more small game meals probably contain lead. Notably, researchers reported that some participants had high lead levels yet ate few birds. One of the two studies measured lead levels at 7.8 mcg/dL in people who “rarely” ate ducks so they concluded there must be another source of lead exposure. In fact, they also showed statistically significant relationships between human blood lead levels increasing with the frequency of consumption of whales and fish, which were probably not shot with shotguns.

those who consumed game meat had somewhat higher lead levels, but those who reloaded their own ammunition had 52 percent higher blood lead levels. Those who consume 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, 35 percent of participants reported target shooting and 15 percent were reloaders.

The problem with other sources of lead confusing these results is familiar to me. If I were a survey subject, it would show that I hunt and eat venison twice per week year-round. It also would show I have had elevated blood lead levels (mcg/dL) of 18.4 (2013), 8.9 (2015), 16.7 (2018-19), 8.5 (2020), 5.7 (2022), 6.0 (2023), and 8.8 (2024). My doctor talks to me about lead every time. This sounds like a clear case of elevated lead levels from bullet fragment ingestion—except my family has used nothing but solid copper bullets since 2009. My lead exposure comes from weekly pistol competitions and frequent reloading of ammunition. There are several sources of lead exposure related to my hobby and I have implemented actions to reduce my exposure. This had nothing to do with lead in venison. My example highlights the importance of not looking at lead levels with simplistic categories like “hunters vs. nonhunters” or “frequency



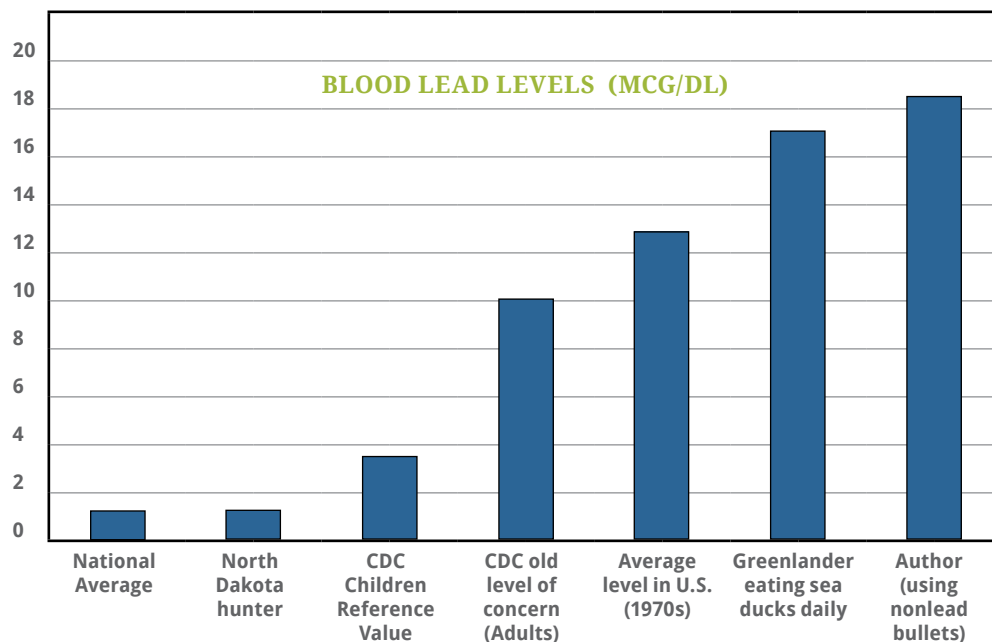
Those who shoot lead ammunition regularly and frequently reload their own ammunition can experience high lead levels in their blood. The author is no exception.

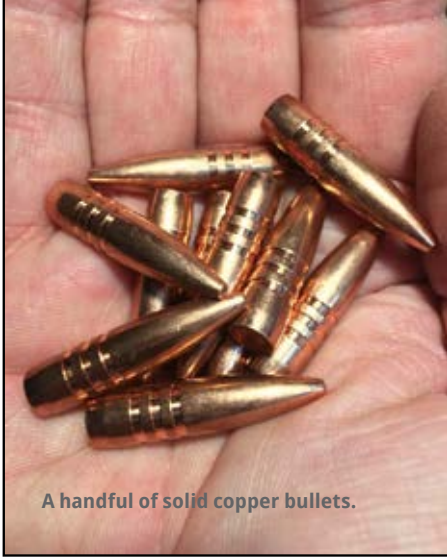
In Ontario, research on lead levels of First Nation Cree waterfowl hunters found that blood lead levels were related to whether the person was actively on the hunt, not whether they ate the game meat harvested with lead. A study of venison consumption in Italy found hunters had blood lead levels of 3.4 mcg/dL, twice the level of nonhunters (1.7 mcg/dL). But again, even hunters were at normal levels. A closer look shows there was no relationship between lead levels and those who actually ate game meat, so why was there a difference between hunters and nonhunters? Perhaps, like in Ontario, another source of lead confused the results. This was also the case in Norway when

those who consumed game meat had somewhat higher lead levels, but those who reloaded their own ammunition had 52 percent higher blood lead levels. Those who consume 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, 35 percent of participants reported target shooting and 15 percent were reloaders.

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A handful of solid copper bullets.

of game meat consumption” without accounting for other potential sources of lead that hunters encounter. You can find a lot of articles and manuscripts that warn hunters of health issues by conflating lead poisoning from unrelated sources and then using that to recommend or regulate their ammunition choice.

We know that having lead bullet fragments and birdshot in your digestive system long enough or frequently enough can increase blood lead levels, but whether that presents a health hazard depends on the amount of lead consumed, frequency of consumption, passage rate, age,

sex, and even differences between individuals. A temporary elevation of blood levels following the occasional swallowing of a fragment differs from long-term sustained levels from some environmental source. There are rare cases in the medical literature

that are frequently cited when talking about lead ammunition where people retained a piece of lead in their digestive tract for a long time, most commonly with shot pellets in the appendix. Other cases where children swallow a handful of birdshot or a lead bullet are not relevant when talking about hunter health. One crazy New Zealander who ate lead-tainted bush meat every day is not a great reason for all hunters to switch ammo. In these unusual cases, blood lead levels can rise to the point of requiring medical attention.

Those who frequently consume 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 lead fragments (not just game meals) more than once per week to maintain enough metallic lead in your digestive system to raise lead in your blood above the normal background levels. Each person should consider how often they consume game shot with lead, what percent of those packages may contain at least one fragment, and calculate how often they might ingest metallic lead.

If you search for this topic in the scientific literature you will find papers warning that lead in game meat is a human health hazard. If you read carefully you will see these comments are not derived from data, they are simply warnings that metallic lead ammunition represents “potential exposure,” “a source of,” or a “potential pathway” for health issues caused by other more dangerous sources of lead. It is very telling that the CDC, Food and Drug Administration, Environmental Protection Agency, and American

Academy of Pediatrics make no mention of lead in game meat as a human health risk on their websites dedicated to warnings about sources of human lead exposure.

#### WHOSE CHOICE IS IT?

There are legitimate reasons for hunters to think about all their sources of lead exposure and do what they can to limit their lead intake. A switch to nonlead ammunition for health reasons should be up to the individual and depend on their personal situation and assessment of health risk. Many people feel that personal decisions about health risks should be under their control and not used as questionable justification for government regulations. The issue of lead ammunition use is complex enough; it is important we don't confuse it even more with speculation and exaggerated misinformation about human health if the true concern is really sickness and death in individual birds. ■

A version of this article originally appeared on the NRA Hunters' Leadership Forum website.



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