



Apr 12th, 9:00 AM - 10:00 AM

The Prevalence of Lead Fragments from Shotgun Slugs/ Muzzleloader Bullets in Ground Venison Meant for Human Consumption

Genevieve Alexander
Illinois Wesleyan University

Given Harper, Faculty Advisor
Illinois Wesleyan University

Follow this and additional works at: <https://digitalcommons.iwu.edu/jwprc>



Part of the [Environmental Sciences Commons](#)

Alexander, Genevieve and Harper, Faculty Advisor, Given, "The Prevalence of Lead Fragments from Shotgun Slugs/Muzzleloader Bullets in Ground Venison Meant for Human Consumption" (2014). *John Wesley Powell Student Research Conference*. 1.
<https://digitalcommons.iwu.edu/jwprc/2014/posters/1>

This Event is protected by copyright and/or related rights. It has been brought to you by Digital Commons @ IWU with permission from the rights-holder(s). You are free to use this material in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s) directly, unless additional rights are indicated by a Creative Commons license in the record and/ or on the work itself. This material has been accepted for inclusion by faculty at Illinois Wesleyan University. For more information, please contact digitalcommons@iwu.edu.

©Copyright is owned by the author of this document.

The Prevalence of Lead Fragments from Shotgun Slugs/Muzzleloader Bullets in Ground Venison Meant for Human Consumption

Jinny Alexander and Dr. Given Harper*

Environmental Studies Program, Illinois Wesleyan University

Introduction

- Hunting is an important population management tool for white-tailed deer (*Odocoileus virginianus*) in Illinois. The State of Illinois allows the use of vertical bows and crossbows, shotguns with slugs, muzzleloading rifles, centerfire revolvers, and centerfire single-shot handguns for hunting deer.
- The majority of firearm hunters in Illinois use lead shotgun slugs, which fragment upon impact when striking bone in wild game (Grund et. al., 2010; Figure 1).

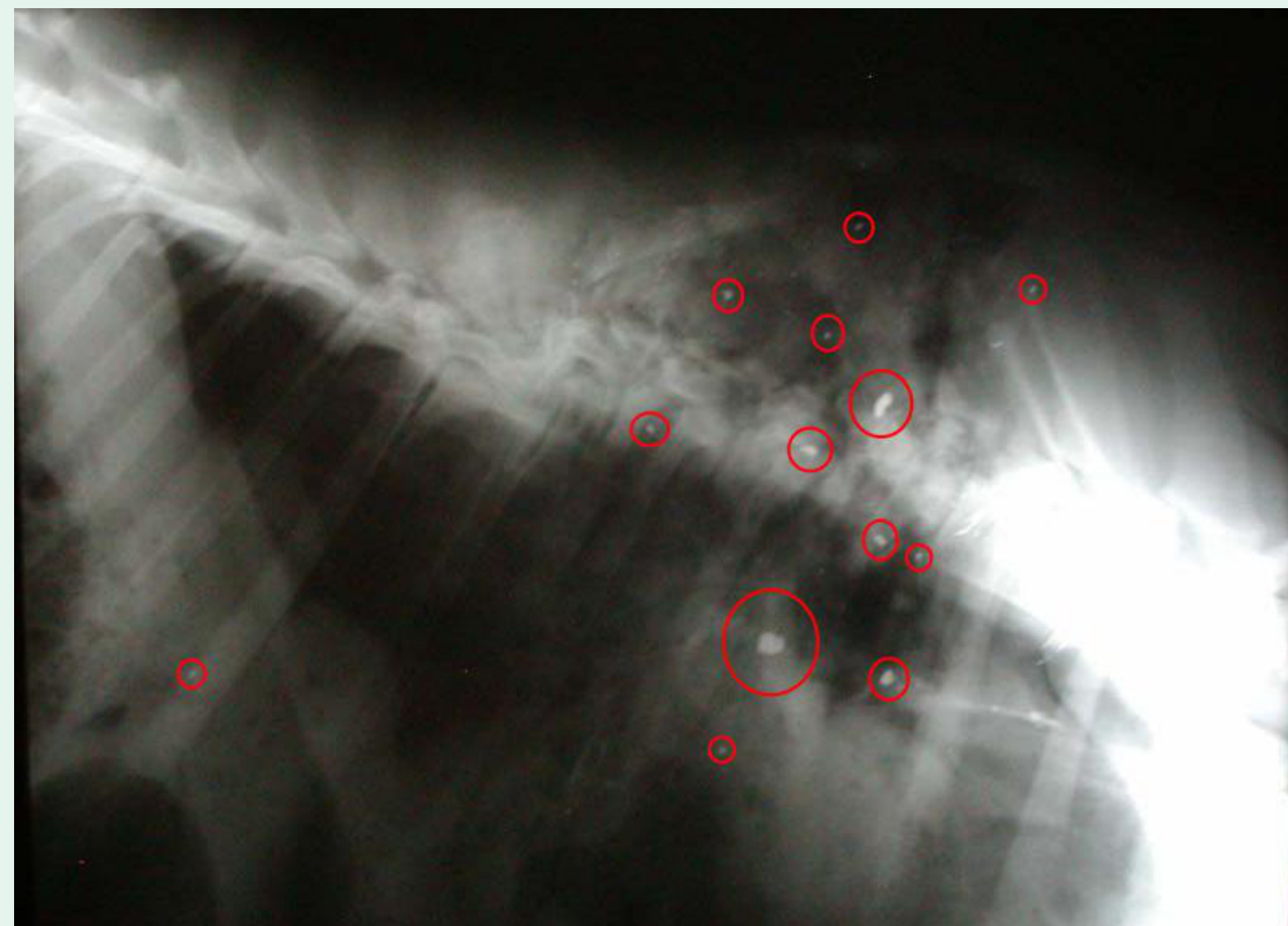


Figure 1. X-ray of a deer carcass showing lead fragments after it was shot with two lead shotgun slugs. Red circles indicate slug fragment remains (Neumann 2009; www.soarraptors.org).

- Cornatzer et al. (2009) found that 59 of 100 ground venison packets collected from firearm-killed deer in North Dakota contained lead. People who consumed wild game on a regular basis had elevated blood-lead levels (Iqbal et. al., 2009).
- Lead fragments in game animals may also pose a threat to scavenging wildlife.
- Few studies have documented the presence of lead fragments from shotgun slugs and muzzleloader bullets in ground venison meant for human consumption in Illinois. In this study, ground venison packets obtained from firearm-harvested and bow-killed deer during the 2012-13 and 2013-14 Illinois deer hunting seasons were tested to determine the presence of lead fragments.

Methods

- Ground venison packets (13x7 cm, N = 10; Figure 2) were obtained from hunters who harvested deer with shotguns/muzzleloaders from Bureau, Brown and McLean Counties, IL, during the 2012-13 and 2013-14 hunting seasons. Ground venison packets (13x7 cm, N = 10) were also obtained from a hunter who harvested two deer with a crossbow in McLean County in 2013. All samples were x-rayed at the Prairie Oak Veterinary Clinic in Bloomington, Illinois, to detect potential fragments (Figure 3). Adobe Photoshop was used to identify possible lead fragments, which had CMYK K-values (a measure of darkness) $\geq 49\%$.



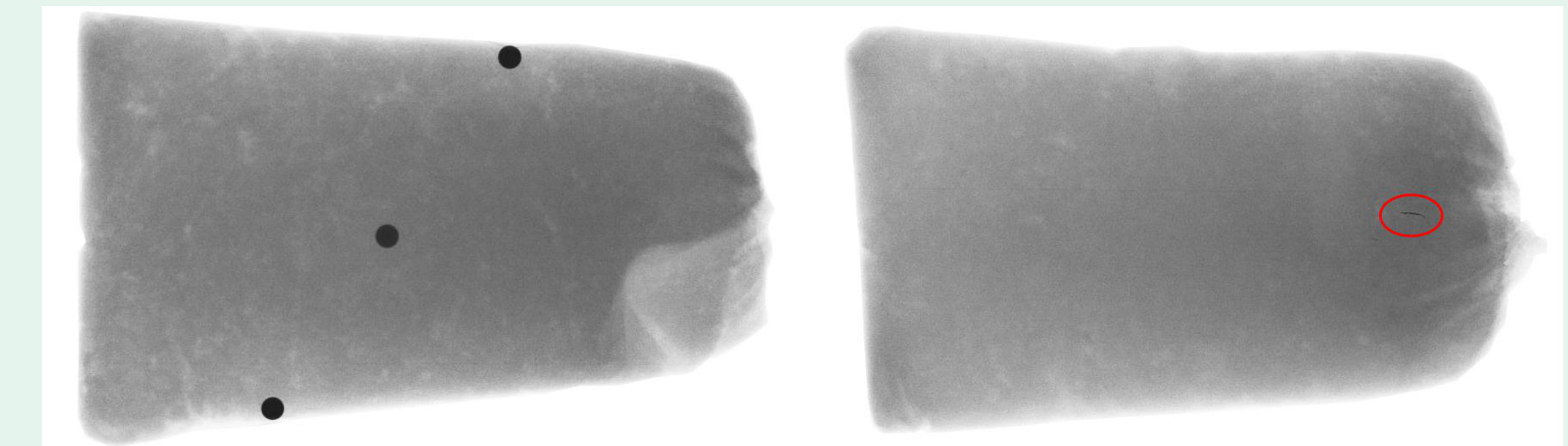
Figure 2. Ground venison packets that were x-rayed.

- 10 one-gram samples were randomly collected from seven packets of firearm-killed deer and three packets of bow-killed deer and sent to the Washington Animal Disease Diagnostic Lab at Washington State University to determine lead levels. The samples were taken from portions of the packet that were not in close proximity to fragments as indicated by the x-rays. Lead levels were determined via inductively-coupled plasma mass spectrometry (ICP) and nitric digest tests.
- 10 deer processing plants in eight Central Illinois Counties (Iroquois, Livingston, McDonough, McLean, Peoria, Rock Island, Stephenson and Vermilion) were contacted in order to determine standard practices in their facility regarding the preparation of ground venison.

Results

- X-rays revealed there was a significantly greater frequency of shotgun-killed venison packets that contained possible lead fragments (6/10 packets) compared to bow-killed venison packets (2/10 packets; $X_{21} = 6.23$, $p = 0.013$).
- The mean number of possible lead fragments per shotgun-killed venison packet (1.10 ± 1.20 ; $\bar{x} + SD$) was significantly greater than the mean number of possible lead fragments per bow-killed venison packet (0.20 ± 0.42 ; $t_{11.20} = -2.24$, $p = 0.023$, one-tailed).
- Fragments ranged in diameter from 0.22 to 4.83 mm, with a mean diameter of 1.05 ± 1.35 mm.
- All of the venison samples sent to Washington State University which were taken from areas not immediately surrounding the fragments tested negative for lead.
- Six out of ten meat processing plants surveyed mixed together deer killed by multiple hunters when preparing ground venison.

Figure 3. X-ray image of two venison packets. Steel BB's (4.5 mm; left) were included in the x-ray image to serve as a reference when assessing darkness of unknown fragments. The red circle marks an area containing a dark spot, indicating the presence of a potential lead fragment.



Discussion

- The initial results of this pilot study suggest that deer killed with lead ammunition may have contained lead fragments.
- The absence of lead in areas of the packets not surrounding possible lead fragments may be due to that fact that small, dust-like lead particles may not be created due to the lower slug/muzzleloader bullet velocity compared to bullets from high-powered rifles (Grund et. al., 2010).
- Fragments found in bow-killed and shotgun-killed deer packets may represent bone fragments.
- Because copper shotgun slugs and bullets tend to fragment less than lead ammunition (Grund et. al., 2010), these would provide a less-toxic alternative to lead ammunition used to hunt deer in Illinois.
- The practices of 60% of the meat processing plants surveyed may expose hunters to lead fragments in ground venison, even if the hunter used copper ammunition.

Future studies

- In order to determine if the fragments are lead, venison samples that surrounded the fragments will be dissolved with a protein liquefying reagent (sodium salicylate, potassium sulfite, sodium hydroxide, isopropyl alcohol, and water). The positive presence of lead will be determined through dissolution with nitric acid, and then through the formation of a precipitate when added to acetic acid and potassium chromate.

Literature Cited

- Cornatzer**, W. E., Fogarty, E. F., and Cornatzer, E.W. 2009. Qualitative and quantitative detection of lead bullet fragments in random venison packages donated to the Community Action Food Centers of North Dakota, 2007. The Peregrine Fund, Boise, Idaho, USA. DOI 10.4080/ilsa.2009.0111
- Grund**, M. D., Cornicelli, L., Carlson, L. T., Butler, E. A. 2010. Bullet fragmentation and lead deposition in white-tailed deer and domestic sheep. *Human-Wildlife Interactions*. 257-265.
- Iqbal**, S., Blumenthal, W., Kennedy, C., Yip, F. Y., Pickard, S., Flanders, W. D., Loring, K., Kruger, K., Caldwell, K. L., and Brown, M. J. 2009. Hunting with lead: Association between blood lead levels and wild game consumption. *Environmental Research*. 109 (8), 952-959.

Acknowledgements

Special thanks to Dr. Matt Fraker for allowing us to use his veterinary facility and x-ray equipment, to Mrs. Honegger for help with designing a procedure to dissolve venison, and to Dr. Lehr for allowing us to use his lab space.