K9 Arsenic-Fed Piglets: Assessing Heavy Metal Levels in Decomposing Pig Tissues and Soil Samples

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After attending this presentation, attendees will better understand the arsenic levels found in decomposing tissue and affiliated soil samples.

This presentation will impact the forensic science community by developing standards by which arsenic levels can successfully be detected in tissue during decomposition.

The goal of this study is to develop standards by which arsenic levels can be successfully detected in pig tissue during decomposition. An essential goal of a forensic toxicologist is the analysis of biological matrices for the presence of drugs, metals, and other toxins as they assist investigations associated with the potential use of these materials acutely prior to homicidal-death. Currently, there are several methods available for the assessment of heavy metals such as arsenic in human tissue collected during a typical autopsy.[1] However, when one considers examining decomposing tissues these tests are limited in their ability to detect heavy metals like arsenic. A method has been developed that allows the detection of arsenic levels in decomposing pig tissue (hair, skin, muscle, and bone) as well as from soil and insects. The purpose of the experiment is to set minimal expectations of arsenic levels in these tissues. Little data specific to how arsenic might degrade during decomposition is available. Understanding this process would help assess acute-toxic antemortem dosages specific to death events.

Conducting this research and presenting this work begins a conversation specific to heavy metal findings in human tissues that will improve the ability to meet the *Daubert* standards. The experiment began with the feeding of arsenic (potassium arsenate) to four piglets; the feeding of arsenic was at sub-lethal concentrations over a three-day period. The piglets received a total of 2.8mg/kg of arsenic during this time. On the fourth day the pigs were euthanized. The housing and feeding of the pigs during this stage of the experiment was in accordance with Texas Tech University IUCAC procedures. Two additional piglets were not fed arsenic. After euthanization, all six piglets were set out for surface decomposition. In doing so, each pig was placed in a separate cage.

Soil samples were taken before placement and acted as control samples to evaluate if an increase in arsenic levels could be detected in the soil. Tissue samples were also taken from the pigs at the start of this stage of the experiment. Additional tissue samples were taken after ten days, seventeen days, thirty days, sixty-six days, and ninety days. Toxic assessment of these tissue samples began shortly after they were taken. The samples were prepared using standard methods for digesting tissue prior to assessment using a nitric acid/hydrogen peroxide (3:1 ratio) bath. The tissue samples were analyzed in a Thermo FS95 GF95 graphite furnace.[2,3]

Decomposition took place rather quickly due to the arid summer environment in which the pig carcasses were subjected to. By the tenth day, several pigs showed skeletal material denude of soft tissue, specifically at the limbs.[4] The pigs that were dosed with arsenic displayed a faster decomposition rate in comparison to the control pigs. Entomological activity was observed in all carcasses starting on the first day, but by the end of the assessment period the arsenic-dosed pigs showed great evidence of insect activity. Toxicological assessment shows that considerable levels of arsenic concentration were identifiable in all tissue samples. Soil samples also showed an increase in

arsenic concentrations. Pre-carcass decomposition soil samples averaged 1.69ppm of arsenic. The average amount of arsenic found in the soils on day ten was 2.57ppm. This observation might be due to soil acidity activity drawing the arsenic from the pig carcass into the soil.[5] There was no significant change in the arsenic concentrations from the soil under the control pigs (Table 1).

Table 1. Soil Samples and Arsenic Levels

Day	n	Range	Mean	SD
Day 1	6	1.46-1.86	1.69	0.159
Day 10	4	1.94-2.95	2.57	0.400

Arsenic concentrations are measured in ppm.

Table 2. Tissue Samples and Arsenic Levels for Day 10

	n	Range	Mean	SD
Control Pigs	2	0.003-0.024	0.013	0.014
Arsenic-Fed Pigs	4	0.017-0.0648	0.037	0.021

Arsenic concentrations are measured in ppm.

This research provides evidence that arsenic concentrations are identifiable in decomposing tissues (Table 2). The data obtained from this study demonstrate that arsenic concentrations will accumulate in the soil beneath a decomposing carcass. In conclusion, this research helps set standard expectations for analyzing arsenic concentrations in decomposing tissues and soil samples.

Reference(s):

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3. Rudy, M. 2010. Chemical composition of wild boar meat and relationship between age and bioaccumulation of heavy metals in muscle and liver tissue. Food Additives & Contaminants: Part *A, 27*(4), 464-472.
4. Galloway, A., Birkby, W., Jones, A., Henry, T., and Parks, B., Decay Rates of Human Remains in an Arid
5. Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological profile for Arsenic. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Arsenic, Decomposition, Toxicology