



A19 A Preliminary Investigation Into the Effects of Previous Freezing on Human Decomposition

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After attending this presentation, attendees will understand the effects of prior freezing on human decomposition and whether frozen human corpses display the suite of decompositional traits previously identified in frozen pig proxies.¹

This presentation will impact the forensic science community by providing preliminary answers to the questions of how previous freezing impacts the rate and pattern of human decomposition and whether there are visible external features that may identify previously frozen human corpses during decomposition, as were identified in pig proxies.

Freezing is an important forensic taphonomic variable as subjects may be stored in the frozen condition prior to use in taphonomic studies. Additionally, perpetrators may freeze victims in attempts to delude investigators by complicating Postmortem Interval (PMI) estimation. Freezing may impact decomposition by decreasing the viability of enteric bacteria responsible for driving putrefaction and research has shown that previous freezing significantly decreases the rate of decomposition in pigs.¹⁻³ In line with recent calls to validate results of forensic taphonomic studies using animal models with follow-up research utilizing human subjects, this study investigated human frozen decomposition.^{4,5} It was hypothesized that the decrease in viable bacteria after freezing would result in a slower rate of decomposition in frozen human subjects, and human and pig subjects would show similar externally visible effects of previous freezing.

All subjects in this study were deposited at the Complex for Forensic Anthropology Research (CFAR) at Southern Illinois University. To understand how previous freezing alters the progression of “normal” human decomposition, two comparisons were made. A previously frozen human subject deposited on September 18, 2015, the fall season in southern Illinois, was compared to a never-frozen human control deposited on the same date and to never-frozen human subjects deposited in the fall of 2012-2015 ($n=5$). Additionally, the pattern of human frozen decomposition was compared to previously reported results from a similar study using pig proxies to identify whether the markers of decomposition observed in frozen pigs are identifiable in frozen humans as well.

One adult human subject was frozen at -18°C for 172 days. Fresh subjects were deposited immediately upon arrival at CFAR. Human donors arrived at CFAR within eight days of death and were kept in morgue refrigeration prior to deposition. All subjects were placed nude, directly on ground surface, within chain-link enclosures to minimize scavenging. Total Body Score (TBS), abdominal circumference, digital images, and written observations concerning insect activity, scavenging, and weather were collected daily.⁶ To quantify decomposition rate, Kelvin Accumulated Degree Days (KADD) were used to measure the thermal energy required for each subject to reach several TBS thresholds: early decomposition ($\text{TBS} \geq 6.0$); halfway through early decomposition ($\text{TBS} \geq 12.5$); advanced decomposition ($\text{TBS} \geq 19.0$); halfway through advanced decomposition ($\text{TBS} \geq 23.0$); and skeletonization ($\text{TBS} \geq 27.0$). Bloat was quantified by analyzing the percent difference in abdominal circumference for each subject.



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The previously frozen human subject decomposed faster than its paired never-frozen human control during both early and advanced decomposition. Percent difference in abdominal circumference was 105% for the frozen subject compared to 123% for the control. Bloat in the control subject was more rapid, substantial, and sustained. In addition to minimal bloat, the previously frozen subject displayed several differences in decomposition pattern, including grayer, pasty overall color, an absence of green discoloration, earlier onset of bone exposure, and a faster deflation of tissues compared to the control subject. With the exception of earlier onset of bone exposure, differences in decomposition pattern were consistent with previous frozen pig decomposition research. Compared to never-frozen human subjects deposited in the fall at CFAR, the previously frozen subject fell within the range of thermal energy necessary to achieve early and advanced decomposition, but at $TBS \geq 23.0$ and $TBS \geq 27.0$, the frozen subject decomposed more rapidly.

In this preliminary investigation, prior freezing was found to increase the rate and alter the pattern of human decomposition. Additionally, the rate of frozen human decomposition did not progress as expected based on previous research on frozen pig decomposition, but expected effects on visible external features were observed. Further research is ongoing.

Reference(s):

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