H5 A Meta-Analysis of Carcass Decomposition on O'ahu, Hawaii

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After attending this presentation, attendees will understand how carcass decomposition is affected by seasons in a tropical climate.

This presentation will impact the forensic science community by demonstrating that although there may be temperature differences between seasons, this may not affect carcass decomposition.

When bodies are not discovered in the early postmortem period, they will decompose. Often decomposition leads to loss of physical evidence that increases the difficulty of identifying the deceased or establishing the cause of death; however, some postmortem changes introduce new forms of evidence. For example, fixed lividity can be used to establish body positioning. To best use postmortem changes as physical evidence, investigators must understand how they are influenced by the environment. This need has prompted several decomposition experiments to investigate the relationships between carcasses, environment, and decomposition; however, few studies have been conducted to investigate seasonal variation of carcass decomposition. The current study is a meta-analysis of environmental and decomposition data for summer and winter months on the island of O'ahu in an attempt to understand how postmortem changes are influenced by season.

Data from three previous decomposition experiments were analyzed to test the null hypothesis that carcass decomposition in the summer is not different than in the winter. Decomposition experiments were conducted during two summers (June 2013 and June 2014) and one winter (December 2014-January 2015). Each of the experiments was replicated three times with a total of nine swine (*Sus scrofa domesticus*) carcasses comprising the current dataset. To assess decomposition, mass loss and Total Body Score (TBS) were measured; mass loss was not measured in the Summer 2013 study. To further characterize decomposition, the pH, oxidation-reduction potential, and temperature of larval masses on all carcasses were also measured. Environmental temperature and relative humidity were measured at intervals of one hour during the course of decomposition. Accumulated Degree Days (ADD) were calculated using 0°C as base temperature. Descriptive and inferential statistics were generated using Prism 6 for Windows®, Version 6.05. Ambient temperature and relative humidity data were compared using a one-way Analysis Of Variance (ANOVA). Carcass mass loss, TBS, pH, oxidation-reduction potential, and larval mass temperature were compared using two-way ANOVA with Tukey's multiple comparisons test.

Ambient temperature in the summer experiments was significantly ($P < 0.001$) greater than in the winter experiment; however, no significant difference was observed in relative humidity. Although this difference in ambient temperature was observed, carcass decomposition was not significantly different between seasons. Similarly, a significant seasonal effect on larval mass temperature, pH, and redox was not observed. Carcasses lost approximately 80% of their mass during the experiment, which occurred by 275 ADD. Little mass was lost after this time. TBS also reached a maximum value (25), but this occurred by 150 ADD. The chemistry of the larval masses in all experiments was characterized as a warm, reducing, relatively neutral environment with temperature ranging from 30°C-40°C, pH values from 6.5-7.5, and oxidation-reduction potential from -100 millivolts to -300 millivolts.

These data show that carcass decomposition at this study site was not significantly different between summer and winter. The study's null hypothesis that carcass decomposition does not differ between summer and winter is accepted by this research. These results are surprising because the ambient temperatures between summer and winter were significantly different; temperature is well established as an important modulator of decomposition processes. The lack of significant difference in decomposition between seasons can be attributed to the tropical climate as it might not get sufficiently cold to slow carcass decomposition significantly. Another possible explanation is that the temperature of the larval masses, similar in all seasons, was able to compensate for the drop in ambient temperatures during the winter. A particularly interesting observation was that a maximum TBS was reached before a maximum mass loss. This has been interpreted to mean that some components of decomposition processes are not accounted for by TBS, an indirect measure of decomposition based on gross postmortem change. Although the current data are insightful, additional experimental studies will be conducted to further understand the seasonal dynamics of decomposition on O'ahu.

Total Body Score, Taphonomy, Season