H22 Forensic Taphonomy: Investigating the Relationship Between Gross Postmortem Change and Mass Loss

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After attending this presentation, attendees will understand that there is a significant positive correlation between gross postmortem change and carcass mass loss.

This presentation will impact the forensic science community by allowing investigators to accurately estimate mass loss, which will facilitate the estimation of postmortem interval as well as providing a dataset that is foundational to the development of an objective method to estimate carcass decomposition.

One of the most challenging components of a death investigation is estimating the Postmortem Interval (PMI). This is most likely due to corpse decomposition being poorly understood. Typically, death investigators estimate the PMI based on non-standardized methods such as anecdotal evidence and visual judgment based on mass loss. Though these methods provide valuable and needed information for a death investigator, many factors such as seasons, climates, and differences in perception skew the estimation of PMI. The search for a standardized way to estimate PMI across differing death scenes remains unresolved. Recently, a decomposition scoring system (Total Body Score (TBS)) was established to visually describe and document the progress of decomposition; however, it remains to be determined if TBS, an indirect measure of decomposition, is correlated to actual mass loss, a direct measure of decomposition. This is important to determine because a newly established method to estimate PMI requires an estimate of soft tissue mass loss, the primary variable in the visual estimation of PMI. If it can be determined that mass loss and TBS are correlated, then it would be possible to estimate soft tissue mass loss more effectively. This, in turn, will allow criminal investigators to estimate PMI more effectively.

To address this gap in knowledge, a 17-day experiment was conducted to measure mass loss and its relationship to TBS. Three swine carcasses (*Sus scrofa domesticus*) were placed in a field setting in Palolo Valley, Oahu, HI. Carcasses were killed by means of electrocution and placed at the site one hour postmortem. Carcasses were weighed (kg) and TBS was measured twice a day for 13 days and once a day every other day for the remainder of the experiment.

Using Spearman's Rank Correlation, a significant ($P < 0.0001$, $R^2 = 0.962$) positive relationship between mass loss and TBS was observed. This relationship was described with a fourth order polynomial equation ($y = -0.0008x^4 + 0.049x^3 + 0.78x^2 + 5.4x - 10.88$) where y=soft tissue mass loss (%) and x=TBS. Thus, the fact that TBS can be used to accurately estimate mass loss is concluded. In practice, an investigator would calculate TBS as x, then substitute x for TBS in the above equation. For example, a TBS of 14 would equate to a mass loss of approximately 17%. It is expected that this approach will aid criminal investigators in estimating postmortem interval more effectively by allowing crime scene investigators to generate a quick and accurate estimation of PMI based on the calculated mass loss percentage and the TBS.

The current results show that gross decomposition has a direct relationship to the mass loss of a carcass. In other words, the physical characteristics of a corpse can provide insight into the amount of decomposition that has occurred. This study is important because it contributes to a limited dataset of direct decomposition measurements. This dataset provides a quantitative assessment of taphonomy on Oahu, HI. It is important to consider that the patterns observed in this experiment are specific to the tropical climate in which they were conducted. This study also does not take into account how decomposition patterns can change based on antemortem wounds. With refining, this study could be used by investigators to identify gross postmortem change and estimate mass loss.

Postmortem Interval, Decomposition, Death Investigation

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