A117 Not All Degree Days are Equal in the Rate of Decomposition: The Effect of Season of Death on the Relationship Between Gross Postmortem Decomposition and Accumulated Degree Days

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After attending this presentation, attendees will better understand the seasonal variation associated with Accumulated Degree Days (ADD) calculations for estimating time since death using gross morphological changes of human remains.

This presentation will impact the forensic science community by demonstrating that seasonal adjustments are needed when estimating time since death from the gross morphological characteristics of human remains in medicolegal death investigations.

The estimation of time since death is an important component of many medicolegal death investigations. Forensic anthropologists commonly calculate the number of ADD necessary to reach the gross morphological changes or stage of decomposition observed on the body.[1] The ADD is then used to estimate the time since death by working backward from the date of discovery until the past date when the calculated degree days are attained; however, seasonal variation in insect activity, humidity, solar radiation, and other factors may affect the ADD necessary to reach different stages of decomposition based on the season of death.[1,2] The purpose of this study was to investigate if there is seasonal variation in the ADD at different stages of decomposition for bodies discovered in an outdoor settings.

Seventy-five individuals donated to the Forensic Anthropology Center at Texas State (FACTS) between 2011 and 2013 were monitored during the decomposition period, and the day each body transitioned from fresh, early decomposition, advanced decomposition, and mummification was recorded.[2,3] The ADD necessary to reach each stage of decomposition was then calculated using local minimum and maximum ambient temperature data. An ADD of zero was recorded if the calculated degrees for a day were negative.[1] Two comparisons were then performed. First, the ADD required to reach each stage of decomposition were compared for bodies placed during traditional seasons: winter (December-February), spring (March-May), summer (June-August), and fall (September-November). Second, the bodies were split into four temperature season categories based on average daily temperature for the month: Temperature Period (TP) 1 — 10°C-15°C (December, January, February); TP2 — 15.5°C-20.5°C (March, April, November); TP3 — 21°C 26°C (May, September, October); and TP4 — 26.5°C-30.5°C (June, July, August). The ADD necessary for each of the following decomposition periods were examined: (1) placement to early decomposition; (2) placement to advanced decomposition; (3) placement to mummification; (4) early to advanced decomposition; and, (5) advanced decomposition to mummification. *T*-tests were used to examine the hypothesis of no seasonal or temperature season variation in ADD required to reach each stage of decomposition.

The results indicate similar decomposition rates for the fall and winter and for the spring and summer. Therefore, the bodies were lumped into two broad seasonal categories: fall/winter and spring/summer. There were statistically significant differences in ADD required for each decomposition period for bodies placed in the fall/winter compared to those placed in the spring/summer. On average, in the fall/winter, 147 ADD were necessary to reach early decomposition, 342 were needed to reach advanced decomposition, and 798 ADD were required from placement to mummification. For the bodies placed in the spring/summer, 76 ADD were needed to reach early decomposition, 209 for advanced, and 512 ADD for mummification. When the bodies were divided based on average monthly temperature, a similar pattern was observed, except for ADD required to reach mummification after placement. There was a negative relationship between average temperature category and ADD required to reach early and advanced decomposition; however, fewer ADD were required to reach mummification in the TP3 (May, September, October) compared to all others. From placement to mummification required 792 ADD in TP1, 737 in TP2, 492 in TP3, and 529 in TP4.

This study demonstrates that it is necessary to control for season of death when using ADD and gross morphological stages of decomposition to estimate season of death. Traditionally, ADD is used in the estimation of time since death rather than calendar days because ADD provides a measure of the thermal energy units available for decomposition and is supposed to take into account temperature differences due to seasonal variation. The results of this study demonstrate that individuals that die during the fall/winter require more ADD than those that die during the spring/summer for all decomposition periods. While temperature is an important factor in postmortem decomposition, seasonal variation in insect activity and other abiotic environmental conditions (e.g., humidity, solar radiation, time below and above thresholds) cause more rapid decomposition that requires less ADD in warmer months compared to colder months in Central Texas.

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