Outdoor Fac

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POSTMORTEM THIGH TEMPERATURES IN MULE DEER[1]

Determination of the time a deer was killed is sometimes important to a wildlife agency. A reliable estimate of the time of death can provide information related to research efforts, court evidence, or a basis for further investigation. Gill and O'Meara (1965) found that, of several postmortem characteristics, the carcass temperature is the best single indicator of time of death in white-tailed deer (*Odocoileus virginianus*). This Leaflet gives the results of a Colorado study made of postmortem thigh temperatures of 35 vehicle-killed mule deer (*Odocoileus hemionus*) to establish a method for estimating the time deer were killed.

METHODS

Several hundred deer were picked up from the highway in the course of a deer-vehicle accident study during 1968 through 1970. Motorists, the Colorado State Patrol, or officials who shot the injured animals reported times of death for 35 deer. These 35 were used for postmortem observations of thigh temperatures. One, 3, 5, 10, 14, and 2 animals were collected during November, December, January, February, March, and April, respectively. No collections were made during the late spring, summer, or early fall because of the relatively high ambient temperatures. All animals were intentionally left whole for the entire observation period. Most carcasses were picked up promptly from kill sites and transported 5-10 miles to an area near Glenwood Springs for observations. All deer were placed on their sides on bare ground or snow and were not, in most cases, moved again during observations. No conscious effort was made to place the carcasses in a shaded area.

The skin of the inner side of the hind leg was cut at approximately the midpoint of a line between the femur-tibia joint and the anus. Pocket meat thermometers (range 0 - 120°F) or Weston dial testing thermometers (range 25 - 125°F) were inserted 3-4 inches into the thigh muscle (quadriceps). The thermometer shafts were pressed down at approximately a 45 degree angle to the inner surface of the thigh (Fig. 1). Care was taken to place the bulb near the center of the muscle mass, which is the portion with the highest temperature. Temperatures were taken as soon after death as possible, and at 4- to 6-hour intervals until the ambient temperature was approached. In addition, the ambient temperature (°F) was recorded to the nearest degree each time the thigh temperature was taken. Live weights were taken with a 300-pound-capacity (Chatillon) scale and recorded to the nearest pound.

Fig. 1. A pocket meat thermometer is inserted into the thigh muscle from the inner side of the hind leg. Care must be taken to place the thermometer bulb near the center of the muscle mass (the portion with the highest temperature)

RESULTS AND DISCUSSION

A cubic polynomial in time was fitted by least squares to the thigh temperature record of each animal. The range of R^2, the coefficient of multiple correlation, for the 35 polynomials was

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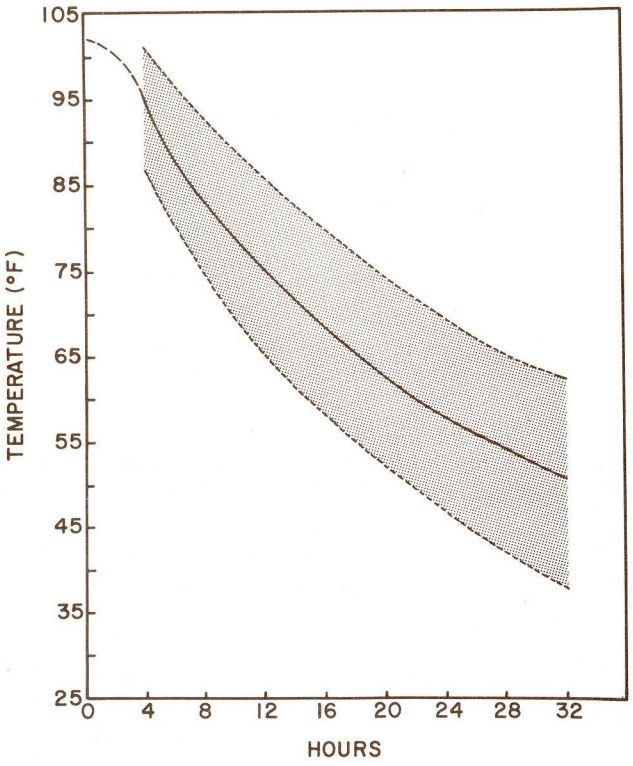

Fig. 2. Mean postmortem mule deer thigh temperatures with 95 percent confidence that 86 percent of temperatures are within maximum and minimum ranges. The dashed portion of the curve was fitted by eye.

0.9889 to 0.9999 with a range of the standard error of estimate from 0.36 to 3.34 degrees. The thigh temperatures of each deer were plotted versus time along with the corresponding cubic polynomial. This relationship revealed a consistent underestimation of the thigh temperatures during the time interval from 0 to 6 hours after death. The fitted curve was adjusted by fitting a smooth curve by eye to the data in the time interval from death until 6 hours later. The smooth curve joined the cubic polynomial before 8 hours after death. The thigh temperatures for each deer were predicted from the adjusted curve at each 4-hour interval after death. The mean, minimum, and maximum values of the predicted thigh temperatures for the 35 deer were determined at the end of each 4-hour interval until 32 hours after death (Fig. 2). Prior to 32 hours after death, all the thigh temperature curves showed a monotonic decreasing trend toward the after-death mean ambient temperature for the 32-hour period.

Nonparametric tolerance intervals were constructed using the minimum and maximum predicted thigh temperatures for each 4-hour interval. With a random sample of 35 deer, one can be 95 percent confident that at least 86 percent of the predicted thigh temperatures are between the given maximum and minimum values (Dixon and Massey 1969:563, Table A25b). Similarly, the probability that another deer, obtained randomly from the same population, has its thigh temperature between the bands in Figure 2 at a given time is 0.943.

It is obvious from Figure 2 that all deer do not cool at the same rate following death. The mean (±SD) thigh temperature (°F) of 18 mule deer whose thigh temperatures were taken within 30 minutes of death was 102.04 ± 1.11 degrees. The minimum and maximum values were 100.0 and 103.5, respectively. Thus, one is 95 percent confident that 76 percent of deer temperatures fall between 100.0 and 103.5 within 0.5 hour after death.

The thigh temperature should be a function of the ambient temperature, body weight, and other factors not studied. For instance, the correlation between the predicted thigh temperatures and the mean ambient temperatures 32 hours after death was $r = 0.54$ ($p = 0.001$), while the correlation between the body weights and the predicted thigh temperatures 32 hours after death was $r = 0.38$ ($p<0.05$).

While Figure 2 does not take enough variables into account to enable one to state precisely how long a mule deer has been dead, it can help to narrow the possible time of death providing one has a deer similar to the mean (±SD) weight (101.8 ± 28.5 lb) that was exposed to similar mean (±SD) ambient temperatures (30.2 ± 7.4 degrees) prior to 32 hours after death. For example, thigh temperatures taken 4 and 8 hours after death are likely to be similar, but unlikely to be similar to those taken 20 to 32 hours after death; also, a deer which has been dead 4 hours can be reliably distinguished from one which has been dead 12 to 32 hours on the basis of thigh temperatures.

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