## E41 Estimation of Time Since Death Using Body Cooling Models of Pigs: A Pilot Study

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After attending this presentation, attendees will understand the correlation between postmortem cooling of the body, rectal temperature, ground surface temperature, and ambient temperature, which is essential for estimating time since death in the early stages of decomposition.

This presentation will impact the forensic science community by establishing a method to study algor mortis of pig carcasses and by presenting a formula for estimating time since death in the early stages of decomposition.

A facility for decomposition research using animal specimens was established at the Korean Police Investigation Academy (KPIA) in 2013. Various experiments are conducted to test the effects of different variables on the rate of decomposition. Currently, KPIA recommends that crime scene investigators employ the Henssge nomogram method at the death scene, which is the estimation of time since death using rectal and ambient temperature; however, there is a paucity of research on the effects of heat radiation and the Henssge nomogram. *Ondol* is a traditional floor-heating system in Korea, where the floor is heated from below and the heat radiates to warm the room. Bodies are commonly found indoors in Korea and the application of the Henssge nomogram is problematic due to the effects of the *ondol* heating system on the rate of postmortem heat loss in the body. The goal of this study is to test the effects of the Korean floor-heating system on heat loss using adult pig models and to create a novel formula for estimating time since death during the early stages of decomposition

Four 40Kg pigs (*Sus scrofa*) were killed by administering a euthanasia drug for each animal per the Soonchunhyang University Institutional Animal Care and Use Committee protocol. Three electric mattress pads were placed on the ground to maintain a constant temperature of the substrate similar to the *ondol* heating system. Each pig was placed on four different surfaces: low-heat, medium-heat, and high-heat electric mattress pads (experimental group), and the ground (control). Four temperature measuring probes were placed in each pig, inside of the rectum, on the body surface, between the body and the surface of mattress pad/ground, and on the mattress pad/ground. The probes were connected to a temperature data logger system, and a WatchDog® 2000 mini station was located at the research site to measure the ambient temperature. The temperature was recorded every minute and the pigs were monitored hourly for 48 hours by Closed-Circuit Television (CCTV). Statistical analysis was performed using the Statistical Analysis System (SAS) (version 9.3) program.

Spearman's Rank Correlation results demonstrate the magnitude of the relationship between four body temperatures and ambient temperature.

| | Ambient temperature | Inside rectum | Between body and pad/ ground | Surface of body | Pad/ Ground |
|---|---|---|---|---|---|
| **Ambient temperature** | 1 | | | | |
| **Inside rectum** | 0.550 | 1 | | | |
| **Between body and pad/ ground** | 0.451 | 0.999 | 1 | | |
| **Surface of body** | 0.842 | 0.956 | 0.945 | 1 | |
| **Pad/ Ground** | 0.208 | -0.304 | -0.332 | 0.048 | 1 |

The rectal temperature and the temperature between the body and the surface of the pad/ground are strongly correlated with postmortem cooling of the body rather than ambient temperature. The rate of cooling of the body is represented by a cube function of time rather than an exponential or bi-exponential function.

The results of this pilot study demonstrate that postmortem cooling is correlated with the rectal temperature and the temperature between the body and the surface where the body was laid. It indicates that postmortem cooling of the body is more influenced by ground surface temperature than by ambient temperature. Additionally, the study demonstrated that pigs can be good animal models that can substitute for human cadavers when studying the process of decomposition.

**Time Since Death, Postmortem Cooling, Early Stages of Decomposition**