A31 A Comparison of Skin Color Change in Terrestrial and Aquatic Decomposition and Its Potential Value as an Indicator of Postmortem Interval (PMI)

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After attending this presentation, attendees will better understand how skin color changes during decomposition in terrestrial and aquatic (submerged) environments and how the use of reflectance spectrometry can allow objective quantification of skin color as a function of time.

This presentation will impact the forensic science community by providing results from three controlled porcine experiments in an area of very little previous research. This presentation will add to existing research in the field of forensic taphonomy by broadening understanding of porcine decomposition in terrestrial and aquatic conditions and by enabling a better appreciation of these processes in human decomposition. This research presents a novel in-field reference guide for estimating: (1) the PMI or Postmortem Submergence Interval (PMSI) of an unknown individual; and, (2) the original skin color of the unknown individual and, as such, adds to the existing armory of techniques for the identification of severely decomposed human remains.

Bodies found in aquatic environments show markedly different decomposition to those found in terrestrial situations.[1] One of the most obvious, visually arresting differences is in skin color. The processes of decomposition can change the original skin color of an individual dramatically, particularly in cases with long PMIs.[2] As skin color can be used to make a preliminary assessment of the ancestry of an individual, any skin color changes as a result of decomposition can cause misidentification of unknown remains, as was the case in the aftermath of the 2004 Asian tsunami.[3] In addition, skin color changes can cause confusion regarding the stage of decomposition reached, complicating PMI estimation.[4]

This presentation combines the results from three separate porcine decomposition experiments, conducted between 2013 and 2016 in outdoor decomposition facilities at Cranfield University and the University of Huddersfield in the United Kingdom. As such, it represents a substantial accumulation of knowledge on the visible alterations to skin color as a result of decomposition in terrestrial and aquatic environments and marks the first time such experiments have been attempted in a United Kingdom climate.

In the first experiment, the cadavers of two domestic pig (*Sus scrofa*) were left on the surface to decompose for 49 days, while skin color (represented by L*a*b* scores) was recorded across the torso and back using a hand-held Konica Minolta reflectance spectrophotometer. The second experiment utilized four domestic pig cadavers, two surface deposited and two submerged in tanks of tap water for a total of 56 days; skin color measurements were taken across the bodies using a hand-held HunterLab MiniScan EZ 4500L spectrophotometer. The third experiment focused on the color change of eight excised swatches of porcine skin, submerged in canal water (freshwater) at 5°C and 18°C for a total of 35 days.

In the data from both terrestrial and aquatic environments, preliminary statistical tests found a significant correlation ($p < 0.01$) between PMI and skin color, measured using L*a*b* scores. In the surface-deposited pigs, the skin visibly darkened as PMI increased, the correlation between PMI and L* reaching a peak at day 45 ($R^2 = 0.83$). In the submerged pigs and skin swatches, a significant correlation ($p < 0.05$) was found between PMSI and skin color, particularly in the a* scores, which represent hues on the red-green spectrum. The nature of the water in which the submersion occurs was found to influence the skin color change as well. The skin of the pigs submerged in tap water turned a peachy-pink color, whereas those in canal water lightened visibly and gained an obvious greenish hue.

The linear relationship and statistically significant correlation between L*a*b* scores and PMI and PMSI suggest that it may be possible to use quantifiable skin color change as a method for estimating PMI or post-submersion interval, particularly in originally light-skinned individuals.

A preliminary reference tool produced from combined L*a*b* scores for in-field use in time-sensitive forensic cases is presented here. The color swatches can be used: (1) to give an early indication of PMI or PMSI; and, (2) even to allow back extrapolation to estimate the original shade of an individual's skin color. This has important implications for the identification of unknown human cadavers found in terrestrial, surface depositions and those found submerged in freshwater aquatic environments.

Reference(s):

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Decomposition, Skin Color, Postmortem Interval