

Measurement of Fatty Acid Changes in Post-Mortem Belowground Carcass (Sus-scrofa) Decomposition: A Semi-Quantitative Methodology for Determining the Post-Mortem Interval

Authors : Nada R. Abuknesha, John P. Morgan, Andrew J. Searle

Abstract : Information regarding post-mortem interval (PMI) in criminal investigations is vital to establish a time frame when reconstructing events. PMI is defined as the time period that has elapsed between the occurrence of death and the discovery of the corpse. Adipocere, commonly referred to as 'grave-wax', is formed when post-mortem adipose tissue is converted into a solid material that is heavily comprised of fatty acids. Adipocere is of interest to forensic anthropologists, as its formation is able to slow down the decomposition process. Therefore, analysing the changes in the patterns of fatty acids during the early decomposition process may be able to estimate the period of burial, and hence the PMI. The current study concerned the investigation of the fatty acid composition and patterns in buried pig fat tissue. This was in an attempt to determine whether particular patterns of fatty acid composition can be shown to be associated with the duration of the burial, and hence may be used to estimate PMI. The use of adipose tissue from the abdominal region of domestic pigs (*Sus-scrofa*), was used to model the human decomposition process. 17 x 20cm piece of pork belly was buried in a shallow artificial grave, and weekly samples (n=3) from the buried pig fat tissue were collected over an 11-week period. Marker fatty acids: palmitic (C16:0), oleic (C18:1n-9) and linoleic (C18:2n-6) acid were extracted from the buried pig fat tissue and analysed as fatty acid methyl esters using the gas chromatography system. Levels of the marker fatty acids were quantified from their respective standards. The concentrations of C16:0 (69.2 mg/mL) and C18:1n-9 (44.3 mg/mL) from time zero exhibited significant fluctuations during the burial period. Levels rose (116 and 60.2 mg/mL, respectively) and fell starting from the second week to reach 19.3 and 18.3 mg/mL, respectively at week 6. Levels showed another increase at week 9 (66.3 and 44.1 mg/mL, respectively) followed by gradual decrease at week 10 (20.4 and 18.5 mg/mL, respectively). A sharp increase was observed in the final week (131.2 and 61.1 mg/mL, respectively). Conversely, the levels of C18:2n-6 remained more or less constant throughout the study. In addition to fluctuations in the concentrations, several new fatty acids appeared in the latter weeks. Other fatty acids which were detectable in the time zero sample, were lost in the latter weeks. There are several probable opportunities to utilise fatty acid analysis as a basic technique for approximating PMI: the quantification of marker fatty acids and the detection of selected fatty acids that either disappear or appear during the burial period. This pilot study indicates that this may be a potential semi-quantitative methodology for determining the PMI. Ideally, the analysis of particular fatty acid patterns in the early stages of decomposition could be an additional tool to the already available techniques or methods in improving the overall processes in estimating PMI of a corpse.

Keywords : adipocere, fatty acids, gas chromatography, post-mortem interval

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