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A comparative study on the production of ethyl and methyl alcohol in post mortem specimens (blood, brain tissue and muscle)

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This work was designed to study the production of alcohols in post mortem materials over the period between death, sample collection and analyses. The concentration of ethyl alcohol in post mortem materials can increase due to microbiological fermentation of carbohydrate. Specially in the United Arab Emirates (UAE) this effect has to be known, because alcohol consumption is forbidden in Islam, so even low concentrations of ethyl alcohol found in the body can be misinterpreted.

METHOD: We selected four autopsy cases. Blood alcohol concentrations of three of them were negative, in one case 3.8 g/l was measured. Blood, brain tissues and muscles were collected and portioned into different types of containers: Type A were plastic containers filled with N2 gas. Type B were 20 ml headspace glass vials sealed with aluminum caps. The containers were stored at room temperature (26°C), out door temperature, in the refrigerator (RF) at 8°C or in the freezer (FR) at – 20°C. The analyses were carried out after 24 h, 48 h and 72 h storage respectively. 0.1 mL of the blood sample or 100 mg of the tissues were placed into a 20 ml headspace vials and mixed with 1 ml t-butanol in water as internal standard. All samples were analyzed by GC-headspace equipped with a FID and a capillary column HP- DP- 1 for determination of ethyl and methyl alcohol and by GC-headspace equipped with a capillary column HP- 5MS coupled to a MSD for the identification of unknown volatiles.

RESULTS: The headspace GC method was validated for ethyl and methyl alcohol. The method is linear between 0.05 and 4.0 g/l (r = 0.999). The limit of detection (LOD) was 0.03 g/l and the limit of quantification (LOQ) was 0.1 g/l.
The case with the high blood alcohol concentration showed similar concentrations in brain tissue (3.7 g/l) and in the muscle (3.8 g/l) compare to blood (3.8 g/l). No changes in ethyl alcohol concentration were observed during the storage at different conditions except that the portion which had been kept for 72 h at out door temperature showed an about 50 % reduction in the ethyl alcohol concentration. The other three cases with no history of alcohol consumption, muscles showed only very low concentrations of ethyl alcohol (under the LOD), but methyl alcohol rose up to 0.085 g/l. On the other hand in brain tissues ethyl alcohol reached up to 0.4 g/l even when stored at 8°C. Microbiological examination revealed absence of anaerobic bacterial in all samples but the presence of aerobic bacterial and other microorganisms such as fungi and yeast. MSD analyses revealed the presence of further volatiles.

CONCLUSION: Ethyl alcohol could be found in the post mortem material even if there were no history of alcohol consumption. Muscles seem to be the best organ for the determination of an accurate alcohol concentration in post mortem toxicology.

Kew words: *Ethanol, Methanol, Brain, Muscle, Postmortem toxicology*

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