K73 Cross-Reactivity of Cathinone Derivatives and Other Designer Drugs in Commercial Enzyme-Linked Immunosorbent Assays

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After attending this presentation, attendees will gain an understanding of designer drugs, particularly "bath salts" or cathinone derivatives, and their prevalence in our society. In addition, the audience will also learn about the immunoassay techniques involved in screening for these substances and how the compounds cross-react in such commercial assays.

This presentation will impact the forensic science community by serving as a resource for cross-reactivity data of designer drugs in commercial Enzyme-Linked Immunosorbent Assays (ELISAs), an important factor to consider when screening biological specimens for drugs of abuse.

Designer drugs have been no stranger to the drug market in the United States over the past few decades. Recently, "legal highs" in the form of "bath salts" or "research chemicals" have dominated the drug scene as substances that are labeled "not for human consumption" in order to bypass recent regulations. While a number of bans have been put in place regarding such compounds, the abuse of these designer drugs has been on the rise while manufacturers have been staying one step ahead of the law with constantly evolving modifications to structures. When an intoxication or fatality occurs, presumptive techniques, such as immunoassays, are employed to quickly screen biological specimens for common drugs of abuse. However, since cathinone derivatives are fairly new, few assays have been created for the detection of such compounds. It is hypothesized that during routine drug screens by ELISA, the cathinone derivatives and other designer drugs may be missed. In a toxicology lab, a negative screen would not be further investigated and the substances may never be detected. For this reason, it is important to investigate the cross-reactivity of such designer drugs by analyzing across several commercial immunoassays.

In this large-scale experiment, ELISA reagents from Immunalysis, Neogen®, OraSure®, and Randox® were evaluated to determine the cross-reactivity of 30 designer drugs, including 24 phenylethylamines (including MDPV and eight cathinone derivatives), 3 piperazines, and 3 tryptamines. The study determined the percent cross-reactivity for the compounds in 16 commercial immunoassays, targeting amphetamine, methamphetamine/MDMA, benzylpiperazine, mephentermine, methylphenidate, ketamine, MDPV, mephedrone/methcathinone, PCP, and cotinine.

Cross-reactivity towards the "bath salts" was 0.5% – 4% in the assays targeting other phenylethylamines such as amphetamine or methamphetamine/MDMA. Compounds such as MDA, MDMA, ethylamphetamine, and α-methyltryptamine (AMT) demonstrated cross-reactivities in the range of 30% – 250%, but were consistent with both the manufacturer's inserts and published literature. Some assays, such as BZP, cotinine, PCP, mephentermine, methylphenidate, ketamine, and MDPV demonstrated almost no cross-reactivity toward any of the analytes evaluated. The mephedrone/methcathinone kit from Randox® demonstrated cross-reactivity toward cathinone derivatives—with false positives occurring at concentrations as low as 150ng/mL. The mephedrone/methcathinone kit was not a suitable assay for detecting other more traditional amphetamine-derived compounds but may be more fitting for screening postmortem specimens for "bath salts" when putrefactive amines may be present.

This comprehensive study determined the cross-reactivity for 30 designer drugs in biological specimens across 16 commercial immunoassay reagents. Very few "false positives" were observed in this study, which indicates the selectivity of the immunoassays and the antibodies that are employed. However, the fact that very few additional compounds were detected demonstrates a need for more broad-range screening techniques to be applied when analyzing biological specimens by immunoassays for drugs of abuse, specifically the more recent designer drugs.

Immunoassay, Designer Drugs, Cross-Reactivity

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