



### H104 Why the “Kontroversy”? Is Kratom a Killer? The Emergence of Mitragynine in Drug-Associated Deaths in West Tennessee

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**Learning Overview:** After attending this presentation, attendees will have: (1) become familiar with the mechanism of action, adverse effects, and the legal status of kratom; (2) examined the epidemiology of kratom users; and (3) studied the relationship between mitragynine and other drugs on death certificates.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by increasing awareness that kratom, the herbal medicinal plant native to Southeast Asia, with the major alkaloid mitragynine, continues to be increasingly implicated in drug toxicity-related deaths, either in multidrug toxicity and, rarely, as a sole cause of toxicity. Understanding the patterns of kratom use and associated drugs may be of use for the formation of public policy regarding this drug on the state and federal levels.

*Mitragyna speciosa* is a tropical evergreen tree that is a member of the coffee family, and is native to Southeast Asia, including Thailand, Malaysia, and Indonesia. The plant is commonly called “kratom” in Thailand. The leaves of the plant have been used in traditional herbal medicine for decades by being chewed, smoked, or brewed into a tea. The leaves contain over 25 various natural alkaloids, including the main indole alkaloid mitragynine, which reportedly accounts for approximately 66% of the alkaloid content. Mitragynine is an agonist of the  $\mu$ -,  $\kappa$ -, and  $\delta$ -opioid receptors; however, it is unique in that it has stimulatory effects at low doses and behaves as a sedative at higher concentrations. The controversial kratom has been shown to have addictive properties, and withdrawal symptoms have been reported anecdotally and in literature. The Drug Enforcement Administration (DEA) briefly added kratom to its list of Schedule I drugs in August 2016, but reversed its decision in October 2016 due to a large public outcry and currently the DEA classifies kratom as a “Drug and Chemical of Concern.”

All autopsy records and toxicology records (from the National Medical Services [NMS] laboratory) occurring in the jurisdiction of the West Tennessee Regional Forensic Center from 2015–2019 were reviewed for mitragynine. Mitragynine began to emerge at the West Tennessee Regional Forensic Center in 2016, with three positive cases. No cases were detected in 2017, and seven cases were detected in 2018. Three cases have occurred in 2019 thus far.

Of the 13 deaths that had mitragynine detected on postmortem toxicology, 11/13 (85%) were male, 13/13 (100%) were White, and the median age at the time of death was 32 years (range 22–54). In 12/13 (92%) of these deaths, mitragynine was listed on the death certificate in combination with other drugs. One death could not determine the degree mitragynine contributed, and was therefore not listed on the death certificate. In one death, mitragynine was listed as the sole cause of death in part 1, along with coronary artery disease and chronic alcoholism as contributing conditions.

A quantifiable mitragynine level was available in 10/13 (77%) of cases (NMS laboratory did not quantify mitragynine until 2017; thus, in the remaining three cases, the level was qualitative only). Of quantified levels, the median mitragynine level was 73.5ng/mL (range 25–680ng/mL). When multidrug toxicity was involved, drugs on the death certificate included fentanyl (6/12, 50%), alprazolam (6/12, 50%), ethanol (4/12, 33%), morphine (4/12, 33%), heroin (3/12, 25%), and 7-amino clonazepam (3/12, 25%).

This study demonstrates that mitragynine emerged in West Tennessee around 2016 and has continued to increasingly appear in deaths in West Tennessee, which is in concordance with NMS laboratory data. Interestingly, 2017 had no deaths with positive postmortem results for mitragynine. 2018 had the majority of the mitragynine-associated deaths, and already three deaths have been seen in association with it in 2019 (as of July 2019). A majority of the affected decedents were White males with a median age of 32 years. When mitragynine was seen in conjunction with multidrug toxicity, other opioids and central nervous system depressants were the most commonly seen, including fentanyl and alprazolam. Based on the high numbers of mitragynine in conjunction with fentanyl, perhaps the mitragynine powder is used as a bulking agent for fentanyl. Rarely, mitragynine is seen as a sole cause of death. Mitragynine continues to be detected on postmortem toxicology across the nation, and this study is presented to help further educate and help form future policy regarding kratom and to also prevent further deaths.

#### Kratom, *Mitragyna speciosa*, Toxicology