

EXHIBIT 12

**UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF LOUISIANA**

KATHLEEN MOLLER,

Plaintiff,

v.

**MARTIAN SALES, INC.; JOPEN,
LLC; JOHNSON FOODS, LLC; LP
IND., LLC; CAG HOLDINGS, LLC;
RMH HOLDINGS, LLC; ABC
INSURANCE COMPANY and John
Does 1-4,**

Defendants.

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CIVIL ACTION NO.

2:24-CV-228-WBV-DPC

THE HONORABLE WENDY B. VITTER

**MAGISTRATE JUDGE DONNA PHILLIPS
CURRAULT**

EXPERT REPORT OF CHRISTOPHER R. MCCURDY, PHD, BSPH, FAAPS

I have been asked by counsel for the Defendant to review the medical records of Harmony Moller and to formulate opinions within my area of expertise as to the role of kratom, if any, in her death. My fees for this matter are \$500 per hour. My compensation is neither contingent on the outcome of this matter nor the conclusions reached in this report.

My current CV is attached as Appendix A, and my list of materials considered is attached as Appendix B.

QUALIFICATIONS

I have a Bachelor of Science in Pharmacy from Ohio Northern University and previously worked as a licensed retail pharmacist from 1994-2001. After receiving my pharmacy degree, I continued my education at the University of Georgia and earned a Ph.D. in Medicinal Chemistry. This was followed by a three-year National Institutes of Health (NIH) funded postdoctoral fellowship at the University of Minnesota in opioid medicinal chemistry and pharmacology. I was hired as an Assistant Professor in the School of Pharmacy at the University of Mississippi in 2001 and rose to the rank of full Professor with tenure before leaving in December of 2016. In January 2017, I joined the faculty of the College of Pharmacy at the University of Florida and currently serve as Professor and the Frank A. Duckworth Eminent Scholar Chair in Drug Research and

Development. I also serve as the Associate Dean for Faculty Development in the College of Pharmacy. In addition to these roles, I am the Director of the University of Florida's Translational Drug Development Core. I have been continuously funded by the federal government my entire career with grants totaling more than \$50 million. I have been actively researching kratom (*Mitragyna speciosa*) since 2005 with particular focus on the ethnobotany, chemistry, pharmacology, pharmacokinetics, and safety in animals and humans. Most of my work has been in rodents and with collaborators under my guidance and insight. Recently, I have been consulted on two human clinical trials with kratom leaf powders in conjunction with and funded by the United States Food and Drug Administration.

I previously testified as an expert witness in *Susan Eppard, et al. v. JML Wholesale, Inc., et al.*, Case No. 24-004438-NP, Circuit Court of Muskegon County, Michigan. I have no other testimonial history in the last four years.

BACKGROUND AND BASES FOR OPINION

Ms. Moller was a 36-year-old female with a history of recreational drug and alcohol use. According to her autopsy, she was diagnosed with: 1) Abnormally high left coronary ostia takeoff exacerbated by mitragynine use; 2) Pulmonary edema and congestion; 3) Chronic passive congestion of liver; and 4) Mild nephrosclerosis. Ms. Moller donated organs and these were recovered, pre-autopsy by the Louisiana Organ Procurement Agency (LOPA) including the heart with the entire aortic arch intact and long bones. The report of the St. Tammany Parish Coroner's Office in Lacombe, Louisiana determined the final cause of death to be the abnormally high left coronary ostia takeoff exacerbated by mitragynine use. The same report indicated the manner of death was an accident. Femoral blood and vitreous fluid was collected from Ms. Muller on February 7, 2023. The toxicology report from NMS labs conducted on February 24, 2023 was positive for quantifiable Delta-9 Carboxy THC (metabolite of Delta-9 THC) at 10 ng/mL, Delta-9 THC at 8.6 ng/mL, diphenhydramine at 64 ng/mL, promethazine at 18 ng/mL, and mitragynine at 150 ng/mL. The toxicology report was presumptive positive for caffeine and naloxone. Also of note was the hyponatremia (low sodium) with a sodium level of 118 mEq/L (normal above 135

mEq/L). Additionally, a comprehensive drug analysis was conducted at the University of California at San Francisco (UCSF) Clinical Toxicology and Environmental Biomonitoring Laboratory on April 18, 2023 that confirmed the presence of mitragynine (158 ng/mL), 7-OH mitragynine (0.8 ng/mL), diphenhydramine, naloxone, and promethazine. Only mitragynine and 7-OH mitragynine had reported quantified levels. The UCSF analysis utilized a comprehensive drug library consisting of 912 new psychoactive substances, 161 traditional illicit drugs, 27 dietary supplement stimulants, and 93 prescription drugs or over-the-counter drugs.

According to the Jesse E Edwards Registry of Cardiovascular Disease in St. Paul, MN, the heart was acquired on February 10, 2023 and the cardiac findings were: A) High origin of left coronary artery (5 mm above the left sinotubular ridge with inferior aortic wall flap); and B) Cardiomegaly (heart weight 421 grams; normal heart weight reference range for body height 173-411 grams and for body weight 181-411 grams) with mild diventricular hypertrophy.

There have been limited human clinical studies utilizing kratom reported in the literature. A study by Abdullah and Singh (2021) assessed the cardiovascular functioning among regular kratom users in Malaysia and their serum mitragynine levels by subjecting them to electrocardiogram (ECG) and echocardiogram assessments. The mean serum mitragynine level was reported at 10,300 ng/mL with a range from 2500 ng/mL to 22,400 ng/mL. This study concluded that regular kratom use without concurrent use of other substances may not provoke any risk of cardiovascular impairment or toxicity except for prolonged corrected QT (QTc) interval at serum mitragynine concentrations exceeding 9,600 ng/mL with a mean value of 15,925 ng/mL. This value is significantly higher than those reported in most all reported mortality cases where mitragynine was the sole cause or was co-administered with other substances. This report did not characterize the kratom that was used for alkaloid content, nor did any of the subjects report use of any other substances. Torsades de pointes was not observed in any of these subjects.

Another study conducted by Vicknasingam et al., in Malaysia evaluated the effects of traditionally prepared kratom decoction given to kratom consuming males on pain tolerance. This study did not report the concentrations of mitragynine that were in the drinks, although the authors

described them as approximating mitragynine concentrations that are found in field decoctions. The authors did include a figure with serum concentrations that approximated means from 500 ng/mL to 2,300 ng/mL. There were not adverse events reported in the subjects and the kratom decoction was well tolerated. Unfortunately, this study did not provide any pharmacokinetic parameters aside from a graph of the hourly plasma mean concentrations. The authors mentioned that a full pharmacokinetic study would be published separately, to the best of my knowledge this has not happened.

In the first human clinical trial of subjects in the United States, Tanna et al., reported a defined kratom leaf preparation that was consistently administered at a 2 gram dose to subjects. The level of mitragynine was quantified in the kratom leaf material at 19.48 ± 0.81 mg per gram of kratom leaf powder and serum concentrations were reported as a median C_{max} of 81.9 nM with a range from 50.1 to 177. When converted to ng/mL these numbers are 32.7 ng/mL and a range of 20 ng/mL to 70.6 ng/mL. Two subjects were excluded from the final data due to vomiting that occurred after dosing. That was the only adverse event reported and the 2 gram kratom dose was well tolerated by the other subjects in the study.

Huestis et al., reported the first clinical trial that measured mitragynine and 7-hydroxymitragynine (metabolite of mitragynine) pharmacokinetics after single and multiple daily doses of dried kratom leaf powder. This study involved oral doses of leaf powder at 500, 1000, 2000, and 4000 milligrams with measured mitragynine levels of 6.65, 13.3, 26.6, and 53.2 mg respectively. As an example of the bioanalysis a LC-MS/MS chromatogram was provided of an authentic sample collected at 1.33 hours after a participant received a 1000 mg dried kratom leaf dose (13.3 mg mitragynine) that resulted in a 46 ng/mL plasma concentration of mitragynine. Single dose C_{max} means were reported to range from 17.1 ng/mL at the lowest dose cohort (500 mg) and increasing doses resulted in increasing C_{max} means with the highest concentration mean of 125 ng/mL at the 4000 milligram dose. From the multiple dose study, a similar increasing concentration with increasing doses was seen. The lowest dose cohort had a C_{max} multiple dose mean plasma concentration of 21.4 ng/mL and the highest dose mean was 143 ng/mL. This is the

only multiple dose study data that has been published from a controlled clinical trial where doses of dried kratom leaf were quantified and correlated to plasma concentrations. Accumulation of mitragynine in the multiple dose arm of the study was considered to be low to moderate. There were no reports of adverse events in this study that were provided in the manuscript.

The US FDA has recently completed a single ascending dose study with encapsulated leaf kratom that is under peer-review. I was a member of this study team and can share the data that will be forthcoming in the publication. A portion of this data, including the alkaloid profile and pharmacokinetic parameters were presented publicly at the College on Problems of Drug Dependence in 2024. This study involved single doses of encapsulated dried kratom leaf powder starting at 1 gram and escalating in multiple cohorts to 3 grams, 8 grams, 10 grams, and 12 grams. In total, 40 subjects completed the study with no deaths or serious adverse events occurring. Somnolence, vomiting, and nausea were the most common adverse events reported, indicating that doses up to 12 grams were well-tolerated. There were dose effects observed wherein doses greater or equal to 3 grams produced pupillary constriction indicating an opioid-like effects. The 12 gram dose was the only dose that produced effects commonly associated with drugs of abuse, such as drug liking, good effects, and feeling high. The goal of this study was to obtain pilot data on behavioral effects and safety profile to inform future studies on human abuse potential (currently underway at Baylor University). After each dosing cohort a safety, tolerability, and pharmacodynamic review was conducted by a safety review committee prior to the next, higher dose being permitted to proceed. Each capsule contained 500 mg of dried kratom leaf material and was quantified to contain 5.07 ± 0.71 mg of mitragynine. Accordingly, the 1 gram cohort was dosed with approximately 10 mg of mitragynine and at the highest dose, 12 gram cohort, were dosed 120 mg of mitragynine. The plasma concentrations of mitragynine increased with increasing doses, as expected. The 1 gram dose resulted in a C_{max} of 41.7 ng/mL and the 12 gram dose resulted in a C_{max} of 378.5 ng/mL.

It should be noted that none of the above clinical studies were of sufficient power to thoroughly characterize the safety profile of kratom, nor were they sufficient to capture rare or infrequent adverse events.

CONCLUSIONS

Based on the information provided, reviewed and detailed above, the level of mitragynine present in the decedents blood has been reported to be well-tolerated in humans with no clinically significant adverse events reported. The concurrent use of kratom and marijuana has not been studied in humans. In addition, the combinations of these with or without the other substances present in the decedents system at the time of death and their interactions or risks are unknown. Promethazine and diphenhydramine are also known to cause QT interval prolongation when combined with other drugs or substances that can do the same. All the substances in the decedents system could have contributed a sudden cardiac death and none can be ruled out as the combination has not been evaluated in pre-clinical or clinical studies.

Sincerely,



Christopher R. McCurdy, PhD, BSpH, FAAPS