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Club drugs inflict damage similar to traumatic brain injury

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What do suffering a traumatic brain injury and using club drugs have in common? University of Florida researchers say both may trigger a similar chemical chain reaction in the brain, leading to cell death, memory loss and potentially irreversible brain damage.

A series of studies at UF over the past five years has shown using the popular club drug Ecstasy, also called MDMA, and other forms of methamphetamine lead to the same type of brain changes, cell loss and protein fluctuations in the brain that occur after a person endures a sharp blow to the head, according to findings a UF researcher presented at a Society for Neuroscience conference held in San Diego this month.

“Using methamphetamine is like inflicting a traumatic brain injury on yourself,” said Firas Kobeissy, a postdoctoral associate in the College of Medicine department of psychiatry. “We found that a lot of brain cells are being injured by these drugs. That’s alarming to society now. People don’t seem to take club drugs as seriously as drugs such as heroin or cocaine.”

Working with UF researchers Dr. Mark Gold, chief of the division of addiction medicine at UF’s McKnight Brain Institute and one of the country’s leading experts on addiction medicine, and Kevin Wang, director of the UF Center for Neuroproteomics and Biomarkers Research, Kobeissy compared what happened in the brains of rats given large doses of methamphetamine with what happened to those that had suffered a traumatic brain injury.

The group's research has already shown how traumatic brain injury affects brain cells in rats. They found similar damage in the rats exposed to methamphetamine. In the brain, club drugs set off a chain of events that injures brain cells. The drugs seem to damage certain proteins in the brain, which causes protein levels to fluctuate. When proteins are damaged, brain cells could die. In addition, as some proteins change under the influence of methamphetamine, they also begin to cause inflammation in the brain, which can be deadly, Kobeissy said.

Kobeissy and other researchers in Gold's lab are using novel protein analysis methods to understand how drug abuse alters the brain. Looking specifically at proteins in the rat cortex, UF researchers discovered that about 12 percent of the proteins in this region of the brain showed the same kinds of changes after either methamphetamine use or traumatic brain injury. There are about 30,000 proteins in the brain so such a significant parallel indicates that a similar mechanism is at work after both traumatic brain injury and methamphetamine abuse, Kobeissy said.

"Sometimes people go to the clubs and take three tablets of Ecstasy or speed," Kobeissy said. "That may be a toxic dose for them. Toxic effects can be seen for methamphetamine, Ecstasy and traumatic injury in different areas of the brain."

About 1.3 million people over the age of 12 reported using methamphetamine in the previous month, according to the 2006 National Survey on Drug Use and Health. In 2004, more than 12 million Americans reported having tried the drug, the survey's findings show.

People often think the effects of drugs of abuse wear off in the body the same way common medications do, but that may not be the case, Gold said.

"These data and the previous four years of data suggest some drugs,

especially methamphetamine, cause changes that are not readily reversible," Gold said. "Future research is necessary for us to determine when or if methamphetamine-related brain changes reverse themselves."

Gold and Dennis Steindler, director of UF's McKnight Brain Institute and an expert on stem cells, are planning studies to find out if stem cells can be applied to repair drug-related brain damage.

UF researchers are also trying to uncover all the various ways drugs damage and kill brain cells. During their protein analysis, researchers discovered that oxidation was damaging some proteins, throwing the molecules chemically off balance.

"When proteins are oxidized they are not functional," Kobeissy said. "When proteins are not working, the cell cannot function."

Neurologist Dr. Jean Lud Cadet, chief of the molecular neuropsychiatry branch of the National Institute on Drug Abuse, said analyzing proteins is important to understanding how drugs such as methamphetamine affect the brain.

"I think saying the results of methamphetamine abuse are comparable to the results of a traumatic brain injury is a new idea," Cadet said. "I agree with (the findings). Our own work shows that methamphetamine is pretty toxic to the brains of animals. In humans, imaging studies of patients who use methamphetamine chronically show abnormalities in the brain.

"Abuse of methamphetamine is very dangerous."

Source: University of Florida