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ORIGINAL PAPER

Dose-response inhibitory effects of purified cathinone from khat (*Catha edulis*) on cortisol and prolactin release in vervet monkeys (*Chlorocebus aethiops*)

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Abstract This study reports acute and sub-chronic effects of cathinone on hormonal alterations in single-caged vervet monkeys. Fourteen adult vervet monkeys were used, 12 of which were treated and 2 controls. Pre-treatment phase of 1 month aimed at establishing baseline levels of hormones while treatment phase of 4 months considered the dose- and time-response effects of cathinone on serum cortisol and prolactin levels. Test animals were allocated four groups of three animals each and administered 0.8, 1.6, 3.2 and 6.4 mg/kg body weight of cathinone orally while controls were administered normal saline. Treatment was done at alternate days of each week. Serum prolactin and cortisol immunoassays were done. Hormonal data was analysed by repeated measures ANCOVA. Results indicate a dose [$F_{(4, 8)}=218$, $P<0.001$] and time [$F_{(18, 142)}=21.7$, $P<0.001$] dependent effect of cathinone on cortisol levels with a significant dose by week interaction [$F_{(71, 142)}=4.86$, $P<0.001$]. Similarly, there was a decrease in serum prolactin [$F_{(4, 8)}=267$, $P<0.001$] with escalating doses of cathinone with a significant dose x week interaction [$F_{(59, 118)}=13.03$, $P<0.001$]. The findings demonstrate that at high doses and long-term exposure, cathinone causes hormonal alterations probably via changes in hypothalamo-hypophyseo-adrenocortical and gonadal axes integrity.

Keywords Brain · Cathinone · Cortisol · Prolactin · Vervet monkeys

Introduction

Khat has been used as a culturally sanctioned stimulant not only to many countries of eastern Africa but also in the Middle East. Cathinone [S-(−)-alpha aminopropiophenone] is the primary psychoactive alkaloid of khat (Kalix 1984; Kalix and Braenden 1985). The general semblance between biochemical effects of cathinone and those of amphetamine as well as their chemical structure points to the similarity in mechanism of action of both substances (Cox and Rampes 2003; Houghton 2004; Graziani et al. 2008), with equal potential for abuse (Kalix 1984). Acute and chronic exposure of khat and cathinone in consumers have been shown to cause a wide range of effects from mental, respiratory, digestive to reproductive dysfunction. Research findings in humans and experimental animals have reported changes in sleep patterns, mood, attention, aggression, anxiety, locomotor activity, and affiliative behaviours (Pantelis et al. 1989; Kalix 1994), learning and memory (Kimani and Nyongesa 2008) and sexual behaviour (Tariq et al. 1990). There is growing evidence in literature indicating that khat and cathinone induce psychostimulation primarily via meso-striato-corticolimbic dopaminergic pathway (Kalix 1990), although there may be other systems involved. The addiction potential, analgesia and anorexic effects of khat and cathinone are believed to be partly mediated via this pathway (Gosnell et al. 1996). This is consistent with studies demonstrating the involvement of

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