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Potential therapeutic effects of thymoquinone on treatment of amphetamine abuse

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Dear Editor,

The prevalence of drug abuse has diverted from traditional drugs such as opioid and cannabis to modern, synthetic and psychoactive drugs such as amphetamine groups, the amphetamine (AT) and methamphetamine[1]. Amphetamine is used medically to treat several disorders such as attention deficit hyperactivity disorder, narcolepsy, depression and minor obesity[2]. However, AT has also gained its popularity as a recreational drug due to its psychostimulant effects. Parallel to that, illegal AT is increasingly manufactured by adding and mixing different drugs, binding agents and new psychoactive substances[3].

Amphetamine-like stimulants (predominantly AT and methamphetamine) are new trend among the youths and became the second most common forms of illicit substance abuse[4]. According to World Drug Report (2016), the global seizures of AT fluctuated annually between 20 and 46 tons since 2009. The number of amphetamines users was also showing an increasing trend from 33.9 million in 2015 to 35.7 million in 2016[5].

Amphetamine drug induces neurotoxicity through several mechanisms, with its predominant action on dopamine system

causing dysfunction[6]. Overdose and uncontrollable consumption of AT will lead to addiction and unwanted psychological effects such as psychosis and anxiety[7,8]. Since early 1980, several studies were conducted to observe the effects of AT on behaviour, biochemical changes and neurotoxicity in order to explore potential treatments for AT abusers. But still, there is no substitute drugs or specific treatment for AT abusers as compared to the methadone substitute for opioid abusers which is used to reduce withdrawal symptoms and addiction[9–11].

In this current era, many natural compounds are explored for their therapeutic effects in healing various diseases instead of chemical drugs[12]. These include thymoquinone (TQ), the bioactive compound found in *Nigella sativa* plant. It shows anti-oxidant, anti-inflammatory, anticancer as well as neuroprotective properties[13,14]. Previous studies highlighted TQ to have a great therapeutic potential in inhibiting the development of tramadol (an opioid drug) tolerance and dependence[15]. In another study, El-Shamy *et al.* (2013) reported that TQ has the potential to reduce monoamine neurotransmitter in the cortex and hippocampus of rats after treatment with nicotine[16]. A study also reported that *Nigella*

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sativa possesses the ability to modulate neurotransmitters release and reuptake such as dopamine, serotonin, gamma-aminobutyric acid, and acetylcholine and gives a positive effect on reduction of drug tolerance[17].

To date, a recent study from El-Naggar *et al.* reported that methanol extraction from *Nigella sativa* can modify amino acid neurotransmitter level in rat brain region which can be used for the treatment of neurodegenerative disease[18]. Other study also mentioned that TQ has a potential to upregulate gene expression involved in morphine addiction pathways[19].

As a conclusion, we proposed that TQ might be a good candidate for the treatment of AT abuse through its interaction with dopamine neurotransmitter. Thus, further molecular studies are worth to be explored to prove its therapeutic effects in the treatment of AT abuse.

Conflict of interest statement

The authors declared that no conflict of interests based on this study.

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