

**Exposure of adolescent brain to nicotine via vaping: A major concern**

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Dear Madam,

Electronic Nicotine Delivery Systems (ENDS), also referred to as vapes or e-cigarettes, were primarily introduced to provide a safer alternative to conventional smokers. However, in recent years, an increasing trend of using ENDS has been observed in non-smokers, particularly adolescents. Targetted commercials with desirable flavours, sleek designs, and a sense of modernisation associated with these devices may cause their rising popularity among this age group. According to a cross-sectional survey on e-cigarette awareness conducted at the Aga Khan University Hospital (AKUH), Karachi, only 6.80% of respondents had heard of them from medical professionals. In comparison, 63.90% of attendants heard about them from their friends and 41.80% through media.<sup>1</sup> This study reveals that the vape trend mainly owes to peer and media influence rather than medical advice, making this trend in adolescents of Pakistan a rather alarming issue due to the vulnerability of the developing brain towards addictive substances, particularly nicotine.

Addiction to cigarettes, whether conventional or electronic, is primarily due to the presence of nicotine. Although nicotine concentration varies greatly depending upon the product and the use, nicotine salt in ENDS is more bioavailable than in combustible cigarettes, predisposing users to more nicotine than conventional cigarettes.<sup>2</sup> Furthermore, aerosols generated by e-cigarettes may have comparable or higher nicotine concentrations than traditional tobacco cigarettes. In a recent study, a primary nicotine metabolite (cotinine) was 244.8 ng/mL (IQL 8.4-1255.8), higher than 155.2 ng/mL (IQR: 68.8–579.2) reported in conventional adolescents smokers.<sup>2</sup> Thus, e-cigarettes predispose users to more nicotine than traditional cigarettes.

The findings mentioned above are exceptionally concerning as adolescence is a delicate developmental stage with increased clinical susceptibility to addictive

substances. Furthermore, brain regions required for developing executive functions and emotional control undergo a significant rearrangement during this time. Therefore, even sporadic nicotine use by adolescents can cause dependent symptoms. In contrast, prolonged nicotine exposure upregulates prefrontal brain receptors and pathways crucial in cognitive control that are not fully developed until the mid-twenties.<sup>3</sup> Such interference with neuronal circuit formation has been linked to emotional instability and may result in increased anxiety and a depressed state in adulthood.<sup>3</sup> Moreover, teens who use pods are more likely to use cannabis and other addictive drugs in their vaporised form as these devices encourage their users to experiment and customise.<sup>4</sup>

Renowned vaping companies like JUUL continue to present e-cigarette use as glamorous and intriguing through social media endorsement with teen actors and young influencers. This misleading advertising strategy associating a euphoric state with ENDS use triggers the urge in young individuals to exploit such products while seeking recognition among their peers.<sup>5</sup> While considering the inadequate evidence on the long-term effects of teen vaping, evidence-based approaches in Pakistan should immediately be implemented to reduce the use of ENDS based on the previously executed methods for tobacco control. Implied and overt health claims, celebrity endorsements and use of characterising flavours should be regulated while keeping proper surveillance on the marketing of vaping brands. Acting now could prevent catastrophic long-term consequences.

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