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DRIVEN BY IMPULSE: THE ROLE OF REWARD SENSITIVITY IN ADOLESCENTS USING E-CIGARETTE

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ABSTRACT

Adolescent vaping has emerged as one of the key public health issues because it has been associated with behavioral and mental health problems. This paper has investigated the connection between the use of e-cigarette and reward system dysregulation and impulsivity among adolescents, and the particular issue of whether the reward system dysregulation can be used to mediate the relationship between vaping and impulsive behavior. According to the quantitative design, a sample population of 140 adolescents was recruited by use of purposive sampling, with standardized self-report instruments given to the individuals to complete, including those individuals displayed the use of e-cigarettes at least twice a week during the previous month. Pearson correlations and mediation analysis indicated that the increased e-cigarette consumption was linked to increased impulsivity and dysregulation of the reward system but the mediation effect of dysregulation of the reward system was not significant. These findings imply that where reward system dysregulation is not necessarily the focal point of connection between vaping and impulsivity, patient-focused and prevention-oriented interventions should be implemented, taking into account the impact of the environment, psychology, and neurobiology.

Introduction

E-cigarettes have quickly found their way into the lives of adolescents, including in schools, social media, and during social events, and they are being advertised as a healthy alternative to smoking through their streamlined appearance and attractive flavors that lead to the false perception that they are a healthier option to smoking. This epidemic in vaping has been a major worry among parents, teachers, and health practitioners especially with the emerging evidence on how the developing adolescent brain is susceptible to the immediate gratification of nicotine as well as the long-term effects. The accumulating body of scientific evidence indicates the urgent interaction between the reward system and self-control at the adolescent stage, and vaping prominence and effects of the behavior could be embedded in the neurobiological mechanisms. This paper will thus discuss the overlap between the use of e-cigarettes and dysregulation in the reward system and impulsivity as a means of understanding not only why vaping has become so widespread among adolescents but also how it could influence the health and behavior of the future. This work will contribute to the creation of more effective preventive, intervention, and policy responses by combining contemporary scientific knowledge and real-life trends so that behaviors early in life can have long-lasting impacts.

Impulsivity

Impulsivity, which refers to the propensity of behaving without adequate considerations, is an indication of a clash between the short-term

activities and the long-term self-control (Kahneman, 2011). Modern studies have long been associated with impulsivity and behavioral and neurobiological mechanisms despite its long-term identification (Hippocrates, Plato, Freud), where it is particularly high in adolescence and tends to decrease with age (Casey et al., 2008; Steinberg, 2008; Somerville et al., 2010). Impulsivity is listed as a major feature of such disorders as ADHD, substance use disorders, and borderline personality disorder (APA, 2013) and has been estimated to occur in 10-20 percent of the general population (Sharma et al., 2014; Moeller et al., 2001). In Asia and Pakistan, the links with aggression, self-harm, psychological distress, and sensation-seeking are emphasized, even in the case of e-cigarettes users (Wang et al., 2014; Lim et al., 2021; Alharthi et al., 2024; Fatima et al., 2023; Khan et al., 2023; Shujaat et al., 2018). Impulsivity is conceptualized through theoretical models as multidimensional including deficits in processing rewards, premature responding, and deficits in planning (Moeller et al., 2001), and the models focusing on personality highlight the difference between adaptive and maladaptive impulsivity (Dickman, 1990; Zuckerman, 1994), and models of the neuroeconomic model describe preference to immediate rewards (Ainslie, 1975; Rachlin et al., 1991; MacKillop et al The model by Barratt also further sub-measures impulsivity in attentional, motor, and non-planning areas, also using BIS-11 (Barratt, 1959; Patton et al., 1995). All in all, impulsivity is a construct with a developmental and situational impact that is crucial in adolescent high-risk behaviors, such as substance use, aggression, and self-injury (Rosenbaum et al., 2019; Bozzini et al., 2021).

E-cigarettes

E-cig fields were introduced in Beijing in 2003 and hit the market in the U.S. in 2007, as a battery-operated device, which heats a liquid containing nicotine to produce a vapor that can be inhaled (Bullen et al., 2010). Combated as less harmful substitutes of consumable cigarettes, these products provide the nicotine, a fairly acting sympathomimetic, which penetrates the blood-brain boundary in a matter of seconds (Kenny, 2011) and were originally advertised as a mood booster and harm reducer (Goniewicz et al., 2014). Regardless of these assertions, initial health authority test results of e-cigarette products found carcinogens and toxins (CDC, 2010; FDA, 2009) which led to global regulation efforts such as sales bans, importation restrictions, legal disputes over the boundaries of FDA regulation (CASAA, 2010; Singapore Ministry of Health, 2010; U.S. Court of Appeals, 2010). With the debate over the use of vaping to quit smoking continuing, the countries started to treat e-cigarettes as medicines (MHRA, 2013), and the reports published by the public health agencies, including the Royal College of Physicians, recognized the potential harm-reduction value but pointed to the necessity of more convincing evidence (McNeill et al., 2016; Etter, 2011). As its popularity among adult smokers and nicotine-naive adolescents increased, chemical tests subsequently confirmed the presence of toxic substances in the manner of the combustible cigarette smoke, associating vaping with cardiovascular, respiratory, oral, and mental damages (Jaswal et al., 2025; Bhatnagar, 2016; Vardavas et al., 2015; Lanza et al., 2016; Yuan et al., 2015; Lechner et al., 20

The use of e-cigarettes has been rising at an incredible speed all over the world, with 68 million users estimated in 2020 (WHO, 2021) and prevalence patterns among adolescents being alarmingly high, 10 per cent of U.S. high-school students reporting use in the past 30 days in 2023 (CDC, 2023) and 2025 (FDA, 2025). In Asia, 7.5% of adults and 9.1% of adolescents are observed using them (Cho et al., 2020; Lim et al., 2022), and others are rising in the countries of the region (WHO, 2021). Although the national data is less developed in Pakistan, the findings regarding the prevalence of vaping are 5.7% at the university level, and the misunderstandings regarding vaping as a safer alternative to smoking are widespread, even among non-smokers (Sami et al., 2020; Jaswal et al., 2025). Among young people, vaping is also related with impulsivity, externalizing behavior, substance use, suicide thought, and future switch to smoked cigarettes (Bold et al., 2017; Chadi et al., 2019; Soneji et al., 2017).

Notably, e-cigarettes are designed in a way that stimulates the mesolimbic dopamine system fast with the help of nicotine and attracting sensory stimuli, which causes dysregulation in the process of reward systems and changes the experimentation into compulsive use (Yuan et al., 2022; Goriounova et al., 2012). These neural weaknesses, coupled with increased global availability and distillation of safety, underscore the necessity of more stringent regulation, prevention mechanisms, and research to curb the long-term risks of the public-health (U.S. Department of Health and Human Services, 2016).

Reward System Dysregulation

Reward system dysregulation is a maladaptation of the brain reward circuitry or a phenomenon that is associated with multiple psychiatric disorders and addictions (Nestler et al., 2001). Initial experiments by Olds and Milner (1954) established that the biological explanation of reward-driven behavior was possible through electrical stimulation of certain areas of the brain, which could induce rats (and subsequently humans) to make repeated attempts to enjoy the performance of the neural circuit, meaning that some bodily mechanisms aimed at impactful neural stimulation. Motivation, reinforcement, and pleasure are controlled by the reward system that is under the strong impact of dopamine (Schultz, 2015; Berridge and Robinson, 2016; Volkow et al., 2017). This system becomes skewed to produce addiction, in which compulsive seeking and loss of control occur as a result of repeated drug use (Koob, 2001). Modern neuroimaging research also demonstrates how the long-term use of substances, including cocaine, suppresses dopamine transmission and reward-based decision-making and learning (Goldstein, 2023). These results indicate the role of impaired reward processing in causing maladaptive behaviors and reinforce theoretical hypotheses such as the Reinforcement Sensitivity Theory (Gray, 1970, 1982; Bijttebier et al., 2009) that explain individual differences in sensitivity to reward and punishment using systems such as the BAS, BIS, and FFFS.

Further to this structure, Carver and White (1994) operationalized the sensitivity to rewards and punishment on the basis of BIS/BAS scales, they found that Behavioral Activation System is overactive and Behavioral Inhibition System is dysregulated, which predisposes an individual to reward-seeking, impulsivity, and vulnerability to substance use, and poor threat detection/risk-taking respectively. These processes are especially applicable to the adolescents, whose brain is highly reward sensitive yet immature in terms of self-regulation (Steinberg, 2008; Somerville et al., 2010). Dysregulated reward processing particularly in the dopamine system could be one of the factors that lead to the initiation and continued use of e-cigarette by adolescents who are aware of the dangers (Goldstein et al., 2011). Therefore, the dysregulation of reward systems can be identified as a major mediator between impulsivity and e-cigarette smoking in the current research, which provides a neurobiological basis of how increased sensitivity to reward and weak inhibitory control and reinforcements influence teens to start vaping, continue, and develop risky behaviors (Casey et al., 2008; Volkow et al., 2017; Ewing et al., 2014).

Vaping among adolescents is influenced by a collectivistic society in Pakistan where individual choice is not the only factor that influences the behavior of the group of people, but also family honor, community expectations and cultural norms, where a behavior construed as deviant would lead to shame (sharam) and loss of family respect (izzat) (Hofstede, 2011). Discreet vaping among the privileged youth has been normalized by urbanization, global trends in social media, as well as the elite school's subcultures, whereas the tighter communal controls in the countryside ensure that it remains a rarity (Khan et al., 2023; Ali et al., 2022). Social conformity among peers, authoritative parenting, and little or no personal autonomy are further factors that make teenagers resort to covert vaping as a bonding factor and as a rebellious measure (Triandis, 1995). These cultural factors are interacted with the Islamic system in Pakistan, where intoxicants are absolutely forbidden under the injunctions of the Quran in Surah Al-Ma'idah and Prophetic

teachings which categorize all intoxicating drugs, including even those containing nicotine, as haram, which is confirmed by other modern fatwas (Darul Uloom Deoband, 2019). Therefore, there is a conflict between globalized youth culture, neurobiological vulnerability, and stringent religious-moral prohibitions that adolescents have to deal with. The idea of cultural pressures, religious doctrine, dysregulation of the reward system, and impulsivity interacting to shape the development of the vaping behavior is critical in forming specific culturally-based prevention and intervention interventions that consider both the biological and sociocultural source of adolescent substance use.

It is increasingly being pointed out how neurodevelopmental vulnerability, specifically dysregulation of the reward system and high impulsivity in this vulnerable period in brain development, is tightly linked to the rapid rise in the use of e-cigarettes by adolescents (Goldstein et al., 2011; Yuan et al., 2022). The evidence continuously shows that exposure to nicotine during adolescence increases the reward sensitivity, interferes with the dopaminergic signaling, and depletes the brain of its ability to be responsive to natural reinforcers, which combine to predispose adolescents to risk-taking, compulsive, and self-control impairment (Alasmari et al., 2022; López-Ojeda et al., 2024). Behavioral research also shows that teenagers with more impulsivity, sensation seeking, and lack of emotional regulation are much more likely to start or continue vaping, with impulsivity being a key predictor of the first use of e-cigarettes (Davis et al., 2022; Reff et al., 2021; Mittal et al., 2022). The contribution of emotional vulnerabilities to it is also properly established, and the results indicate that adolescents whose coping or negative-affect relief depends on vaping show more reward-controlled trends and continuous dependence on nicotine (Brockenberry et al., 2022). On the community level, the popularity of vaping among adolescents due to flavored products, assumed safety, and targeted marketing is a symptom of a bigger public health issue because, when exposed to it at a young age, a person becomes more vulnerable to addiction in the future (Tippur et al., 2023; Grant et al., 2019). Combined, such literature evidences that adolescent vaping cannot be perceived as a simple behavioral trend but a neurobiologically-installed pattern due to the dysregulation of the reward system, impulsivity traits, and developmental risk, and that the prevention and intervention strategies in this context should be focused.

Dopamine Hypothesis Theory

Dopamine Hypothesis: The concepts of dopamine and its main effects on reward processing, motivation, learning, and addiction are postulated by the Dopamine Hypothesis, which was first introduced by Carlsson and Van Rossum in the 1960s, and later developed by Robinson and Berridge (1993), which suggested that dysregulation of dopamine is the cause of psychiatric disorder and maladaptive behaviour. This theory says that hypersensitivity in the dopamine systems predisposes a person to compulsive reward-seeking and impulsiveness including drug use (Volkow et al., 2004). This nicotine-induced overstimulation of dopamine in the context of e-cigarettes can probably disrupt the reward system in the brain and result in reduced sensitivity to natural rewards and the growth of reliance on high-intensity reinforcement methods such as vaping (Robinson et al., 2003; Koob et al., 2010). This dysregulation continues the compulsive use, especially among those adolescents who already have a high level of reward sensitivity and poorly developed self-regulatory control, and thus are highly susceptible to addiction to nicotine (Schultz, 2002; Volkow et al., 2017). In this way, the Dopamine Hypothesis offers a robust neurobiological explanation in the interaction of altered reward functioning and impulsivity in the development and persistence of e-cigarette smoking among adolescents.

Rationale of the Study

The severe increase in the number of adolescents using e-cigarettes has become an essential problem of social health significance because of the belief that vaping is a less harmful method compared to smoking, the popularity of flavored products, and peer pressure in culturally and religiously oriented societies such as Pakistan (Wills et al., 2015;

Cullen et al., 2019). There is growing evidence that the use of e-cigarettes by young people is associated with addiction, cognitive and emotional impairment, and the high likelihood of other substances (Yuan et al., 2015; Chadi et al., 2019). Certainly, the fact that the brain networks of prefrontal and reward reinforcement are still developing makes adolescents especially susceptible, as this increases their sensitivity to nicotine-based mollification, impulsivity, and the influence of social pressures (Casey et al., 2008; Bold et al., 2017). Nevertheless, little is known about the neurobiological and behavioral processes of adolescent vaping, especially the role of dysregulation of the reward system and impulsivity in triggering and sustaining the use of e-cigarettes. It is the reason why this study had been planned: to explore the synergistic action between impulsivity and dysregulation of reward systems on adolescent vaping, to combine behavioral, neurobiological, and cultural approaches to the issue, and to present the evidence-based recommendations of preventing and interventions strategies in relation to this vulnerable group of the population.

Aims of the Study

The main objective of the present study is to examine the relationship between using e-cigarettes and the impulsivity in teenagers. In particular, the study aims:

- To test the relationship in the use of e-cigarettes, dysregulation of the reward system and impulsiveness in the adolescents.
- To determine mediation between the use of e-cigarette and impulsivity in adolescents by reward System dysregulation.

Research design

This study is done through correlational research design, as the purpose of this research is to learn the relationship between use of e-cigarette and impulsivity and how this relationship may happen through dysregulation of a reward system.

Sampling Strategy

In this research, the sampling technique to be used will be purposive:

Sample size

The G*Power analysis was used to determine the sample size. N=140 was the sample size of adolescents (boys N=101, girls N=39). The sampling was done across various schools, academies and colleges that were available in various towns in Lahore. The process of data collection was carried out through face-to-face activities by visiting the sampled sites.

Participant Characteristics

The age of the participants in this research will be between 13 and 19 years, since this is the age group that is most likely to be involved in the e-cigarette smoking. Male and female participants were used. The sample of the study will be on the adolescents who have used e-cigarettes in the past or at present and the sample will be classified according to the degree of use which will be rarely, weeklies, occasional, and frequent users.

Inclusion and Exclusion Criterion

This study involved adolescents between the ages of 10 and 19 years, as the definition of adolescence given by the World Health Organization defines adolescence (WHO, 2021). In order to be relevantly exposed, the participants needed to have used e-cigarettes more than twice a week in the past month (Sanchez et al., 2023) and to be currently attending a school, college, or other educational establishment (Gardner et al., 2023). The teens were also locked out in case they earned any form of income by buying or selling e-cigarettes (Lim et al., 2022) or had any prior psychological or mental condition that could confound research results.

Assessment Tools

In the study, a collection of standardized and validated assessment tools was used to investigate demographic, behavioral, and psychological predictors of the use of e-cigarettes among adolescents.

Demographic Sheet

Demographic Sheet was used to gather the most important details of the participants including age, gender and education level to provide background of the study.

Modified E-cigarette Evaluation Questionnaire (Kim et al., 2016).

The motivational processes of vaping, such as stimulant effects of vaping, positive and negative reinforcement of vaping, and aversion, were evaluated using the Modified E-cigarette Evaluation Questionnaire (MECEQ; Kim et al., 2016), designed into a 12-item and 7-point Likert scale, with high levels of psychometric reliability and validity. MECEQ demonstrated good internal consistency in current study (α = .877)

Behavioral Inhibition System/ Behavioral Activation System (BIS/BAS) Scales (Carver & White, 1994)

To test the sensitivity of the reward systems, Behavioral Inhibition System/Behavioral Activation System (BIS/BAS) Scales (Carver and White, 1994) were used to test an individual's approach (BAS) and avoidance (BIS) motivations, including a subscale on the drive, fun-seeking, and reward responsiveness, which revealed insights into the risk-taking and compulsive behaviors.The total scale demonstrated good internal consistency in present study (Cronbach's α = .840).

Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995)

Impulsiveness was measured by the Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995), a 30-item self-report measure of attentional, motor and non-planning impulsiveness, which is well-validated in adolescent groups. All these tools cumulatively enabled the investigation of the demographic, motivational, neurobehavioral, and impulsivity-associated correlates of e-cigarette use in adolescents, which aligned with the study subject of the rewards system dysregulation and behavioral risk factors.The scale demonstrated acceptable internal consistency in the present study (Cronbach's α = .786).

Procedure

The research was performed based on the extensive literature review regarding adolescent use of e-cigarettes, dysregulation in the reward system, and impulsivity under the guidance of internal and external advisors, and the formal consent to use MECEQ, BIS/BAS Scales, and BIS-11. The analysis of data was conducted with the help of SPSS with Pearson correlations, mediation, and tests of reliability. The questionnaires were initially refined, pilot-tested, to determine the feasibility of the questions as well as to determine ambiguities to be avoided during the pilot study, with 10 adolescents. Feedback was used to make slight changes, including the deletion of the household income question, that in turn enhanced clarity and response accuracy to the main study. Purposive sampling was used to gather data in the main study where adolescents in schools, colleges and academies of Lahore were sampled. Informed consent and institutional permissions were taken care of, and it was confidential and voluntary. The questionnaires were conducted within groups of people to allow the elimination of stigma and promotion of the truthful reporting of vaping habits. Although the study had its problems like summer holidays and the sensitivity of the participants on the use of e-cigarettes, these strategies enabled a smooth data collection in various educational institutions to give reliable and valid data.

Results

This part gives the statistical tests performed to explore the connections between the motivations in the use of e-cigarettes, the dysregulation of the reward system, and impulsivity among teens. The study hypotheses were examined with the help of descriptive reliability analysis, correlational analysis, regression modeling, and mediation analysis.

Correlation Analysis

Pearson Product-Moment Correlation was a bivariate correlation that was conducted to investigate the relationship in all the variables of study; Use of E-cigarettes, Reward System Dysregulation and Impulsivity among adolescents.

Table 2
Table showing the results of correlation in Use of E-cigarettes, Reward System Dysregulation and Impulsivity

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
1.Reward System Dysregulation	12.08	3.1	–										
2. MECEQ	32.007	15.82	.129	–									
3. Impulsivity	124.72	23.70	.065	.224**	–								

The hypothesized constructs of the relationship between e-cigarette use, impulsivity, and dysregulation of the reward system in adolescents were empirically validated through the correlation analysis. A high positive relationship between the motives of using e-cigarette, including stimulant effects, positive and negative reinforcement, and both motor and attentional impulsiveness was found, which suggests that more impulsive characteristics are expressed among teenagers who vape to feel stimulated, experience pleasure, or relieve stress. Stimulant effects were not significant with non-planning impulsiveness, though. It was also found that e-cigarette reward motives significantly correlated with BIS/BAS variables, with the BS drive, BS fun seeking and BIS positively related to all subtypes of impulsivity, which supports in the first place the hypothesis on the mediating role of dysregulation of reward system. Moreover, the sensitivity to rewards was observed in a substantial correlation between the BAS elements and BIS with the stimulant effects and aversion motives, which means that those adolescents who were more sensitive to rewards or aversion outcome were more motivational to use e-cigarettes. In general, the present results confirm the theoretical assumption that impulsiveness and a dysregulated reward system are major determinants of e-cigarettes use among adolescents.

Mediation Analysis

To test whether e-cigarette use is associated with impulsivity, a simple mediation analysis was conducted using Model 4 of the PROCESS macro on SPSS to test whether dysregulation of the reward system mediated the effect (Hayes, 2022). According to this model, the independent variable (X) was the e-cigarette use, the dependent variable (Y) was impulsivity, and the mediating variable (M) was dysregulation of the reward system. It was found that the use of e-cigarette significantly predicted impulsivity. The mediation aspect by the indirect route via the dysregulation of the reward system was however not significant, which shows that reward system dysregulation does not mediate the relationship between e-cigarette use and impulsivity. These findings partially substantiate the hypotheses of the study as they confirmed the direct relationship between use of e-cigarettes and impulsivity though they did not prove the mediating effect of the dysregulation of the reward system.

Table 3

Table showing Mediation Analysis Showing Reward System Dysregulation as Mediators between Use of e-cigarettes and Impulsivity

		M (RSD)				Y (Impulsivity)		
Antecedent		β	SE	p		β	SE	p
X (MECEQ)	*a*	0.0812	0.0530	.1282	*c′*	0.3279	0.1258	.0101
M (RSD)		–	–	–	*b*	0.0871	0.2001	.6642
Constant	i_1	42.0802	1.8927	< .001	i_2	110.3352	9.5241	< .001
		R^2= 0.18				R^2= 0.32		
		F(1, 148) = 31.66, p < .001				F(1, 148) = 70.04, p < .001		

Note.a represents the effect of MECEQ on RSD, b represents the effect of RSD on impulsivity (IY)and c′ is the direct effect of MECEQ on impulsivity controlling for RSD.

The findings revealed that the use of e-cigarette was a strong predictor of impulsiveness. Nevertheless, the indirect influence via dysregulation of the reward system was not much, so it might not be that RSD mediates this correlation. To some extent, these results justify the hypotheses of the study: it was possible to prove the direct interdependence between the use of e-cigarettes and impulsivity, but the mediation of the reward system dysregulation was not proven by the data.

Discussion

The article has discussed the correlation of adolescent use of e-cigarettes, impulsivity, and dysregulation of the reward system, filling the literature gap on neurobehavioral mechanisms that resulted in vaping (Bold et al., 2017; Koob et al., 2016). The results have shown that the use of e-cigarettes, especially as a form of stimulation, pleasure, or stress relief, was highly correlated with an increased level of motor and attentional impulsivity, which proves the hypothesis that impulsivity is a direct cause of adolescent vaping (Lechner et al., 2017; Romo et al., 2019). Even though both the e-cigarette uses and the impulsivity laws were marked by the dysregulation of reward system, which was measured by using BAS/BIS dimensions, mediation analysis showed no statistically significant indirect effect, which may imply that the impulsivity can be characterized independently of reward processing (Koob et al., 2016; Kim-Spoon et al., 2016). There was some partial support of the association between the e-cigarette use and dysregulation of the reward system with adolescents having stronger novelty- and excitement-seeking (BAS drive and fun seeking) but not always more reward-responsive (Soneji et al., 2017). In general, these findings underscore the developmental risks of adolescents, which underline the significance of focusing on impulsiveness as the target of prevention and intervention measures (Casey et al., 2008; Trinidad et al., 2021). The results indicate that community health strategies must refer to both personal behavioral characteristics and environmental factors, and add evidence to the existing literature on psychological factors of adolescent e-cigarette usages (Yuan et al., 2015; Chadi et al., 2019).

Strengths of the study

- The research paper is a new field since it examines the relationship between the use of e-cigarettes, dysregulation of the reward system, and impulsivity among adolescents and is therefore a unique contribution to the available literature.
- It combines neuropsychological and behavioral theories and it is multi-dimensional in understanding adolescent risk behavior.
- The paper has a high public health value in that it establishes psychological correlates of adolescent e-cigarette smoking, which can be used to prevent the use of the products.
- It provides useful background knowledge to future studies particularly in informing longitudinal or neurodevelopment studies.
- The fact that adolescents are high-risk population in case of developing impulsive and addictive behaviors makes the findings more relevant and applicable in clinical and educational practice.

Implications and Future Directions

- The witnessing high correlation between the motives of using e-cigarettes and impulsivity is significant to highlight the necessity to target impulsivity in adolescent vaping prevention programs.
- The interventions are to be aimed at the self-regulation increase, the delay of pleasure, and the development of emotional coping skills.
- The strategies can minimize the susceptibility of adolescents to impulsive and risk behaviors such as vaping.
- Psychoeducation on impulsivity and its outcomes can be incorporated in school-based programs to improve them.
- These elements of education are especially critical in peer dominated contexts that encourage risk behaviors more to be imitated and promoted.

Limitations

- The use of self-report measures can result in biases of responses because the participants have limited introspective capacity or, they are also

inclined to help answer the questions in a socially acceptable manner.

- The study can be narrow-minded and therefore the results might not be applicable to other age groups like the young adults or Pre adolescents.
- The cultural and context-specific issues within the sampled region (e.g., local norms, availability of e-cigarettes) could have a different impact on the vaping behavior and prevent the generalizability of the findings.
- The paper failed to take into consideration various e-cigarette products and nicotine levels that might have varied effects on impulsivity and motivation.
- Comorbid behavioral disorders (e.g. use of other substances such as caffeine, alcohol or tobacco) were not evaluated, which can be a confounding factor between impulsivity and vaping.

Conclusion

This research showed an important association between the use of e-cigarettes and the impulsiveness among adolescents; it is possible to note that the previous studies expressed the same points relating to the psychological roots of e-cigarette smoking. Nevertheless, it failed to prove the mediating power of the reward system dysregulation in this correlation. This research indicates the nature of adolescent risk behaviors and argues that impulsivity can work in mechanisms other than those that are typically linked to reward sensitivity. Further studies are crucial to unravel the multifactorial mechanisms underlying the use of e-cigarettes by adolescents and to guide a specific intervention.

Declarations

Conflict of Interest

The authors declare no conflict of interest.

Ethics Statement

This study was approved by the Ethical Review Board of the Centre for Clinical Psychology, University of the Punjab, Lahore (Approval No: CCP/2025/013).

Informed Consent

Informed consent was obtained from all individual participants included in the study. For participants below the age of 18, consent was obtained from their guardians.

Author Contributions

Noor Fatima: Conceptualization, Methodology, Data Collection, Formal Analysis, Writing Original Draft, & Editing

Dr.Aasma Yousaf: Guidance in conceptualization, critical review of manuscript drafts, and identification of methodological and conceptual improvements throughout the research process.

Data Availability Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Running Head: E-Cigarettes, Reward System And Impulsivity

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