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Short-Term Effects of Transitioning from Conventional to Electronic Cigarettes on Body Mass Index in Young Adult Males: A Prospective Cohort Study

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A B S T R A C T

Introduction: Nicotine is known to influence appetite suppression and energy expenditure, potentially contributing to the lower body mass index (BMI) observed among smokers. However, the short-term metabolic impact of switching from combustible cigarettes to electronic cigarettes (e-cigarettes) remains uncertain. **Objective:** This study aimed to evaluate the effect of transitioning from conventional cigarettes to e-cigarettes on BMI among young adult male smokers over a three-month period. **Method:** A prospective cohort study was conducted involving 47 male smokers aged 20–40 years. Participants were allocated into two groups: those who switched to e-cigarettes (n = 30) and those who continued smoking conventional cigarettes (n = 17). BMI was assessed at baseline and after three months. Data were analyzed using paired and independent t-tests to evaluate intra- and intergroup differences. **Result:** In the e-cigarette group, BMI slightly declined from 24.16 ± 4.42 to 24.06 ± 4.59 kg/m² (Δ = –0.11 ± 0.63, p = 0.379), whereas in the conventional group, BMI increased marginally from 22.54 ± 3.63 to 22.63 ± 3.63 kg/m² (Δ = +0.09 ± 0.52, p = 0.486). The between-group difference in BMI change was not statistically significant (p = 0.289). **Conclusion:** Short-term transition to e-cigarette use did not result in significant changes in BMI among young adult male smokers. These findings suggest that e-cigarettes are metabolically neutral over short durations and should not be regarded as effective tools for weight control. Further longitudinal studies are warranted to explore longer-term metabolic outcomes.

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1. INTRODUCTION

Nicotine is widely acknowledged for its pharmacological influence on energy balance, particularly its capacity to suppress appetite and enhance energy expenditure, which has been associated with lower body mass index (BMI) among habitual smokers (Sobkowiak & Lesicki, 2013). The emergence of alternative nicotine delivery systems, such as electronic cigarettes (e-cigarettes), has sparked considerable debate regarding their metabolic impact. In recent years, e-cigarettes have gained popularity as both smoking cessation aids and lifestyle products perceived to be less harmful than combustible tobacco. According to the World Health Organization, the global use of e-cigarettes has increased substantially, especially among adolescents and young adults.

This trend is particularly evident in Southeast Asia, including Indonesia. Recent national survey data indicate that 10.6% of Indonesian males aged 15–24 years are active users of e-cigarettes (Indonesian Ministry of Health, 2022). The widespread adoption of these products, especially among youth, is often driven by perceptions that vaping is a safer alternative and may aid in controlling body weight. These assumptions, however, are not yet supported by robust empirical evidence, particularly regarding metabolic consequences. Thus, evaluating the short-term effects of e-cigarettes on BMI among young adults holds public health significance, especially in regions experiencing a sharp rise in usage.

Previous research has shown that the metabolism of nicotine, including absorption and elimination, varies between conventional and electronic delivery methods (Piliguian et al., 2014). Genetic polymorphisms, particularly in enzymes such as CYP2A6, further contribute to interindividual differences in nicotine processing. These biological factors, combined with behavioral components such as compensatory eating, physical activity patterns, and stress responses, complicate the relationship between nicotine use and weight regulation (Mohtadji, 2019; Lamota et al., 2008).

Despite emerging evidence on the neurobiological effects of nicotine on appetite-regulating pathways (Li et al., 2025), current literature lacks consensus on the metabolic implications of e-cigarette use. Short-term experimental studies in animal models have yielded conflicting results regarding body weight changes following exposure to e-cigarette vapor (Easwaran et al., 2024; Shi et al., 2019). In humans, the behavioral context of nicotine consumption, including its use for perceived weight control, further obscures the clarity of outcomes (Jackson et al., 2019; Mason & Leventhal, 2021).

Given these uncertainties, this study seeks to evaluate the short-term effects of switching from conventional cigarettes to e-cigarettes on BMI in young adult male smokers in Indonesia. The study hypothesizes that continued nicotine exposure through electronic delivery systems may stabilize or slightly reduce BMI over a three-month period. Recognizing the limitations in objectively measuring behavioral confounders such as diet and exercise, the study employed consistent instructions across groups to minimize their influence.

By focusing on a high-prevalence demographic group in a Southeast Asian context, this research aims to fill a critical gap in empirical knowledge and provide insights relevant for public health strategies. Understanding whether e-cigarettes exert measurable effects on weight regulation can inform clinical counseling, regulatory guidance, and youth-focused health education campaigns, particularly in countries like Indonesia where misconceptions about the health impact of vaping remain widespread.

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2. METHODS

Research Design

This study employed a prospective cohort design to evaluate the short-term effects of switching from conventional to electronic cigarettes (e-cigarettes) on body mass index (BMI) in young adult males. Conducted over a three-month period, the research aimed to assess whether transitioning to e-cigarettes results in significant changes in BMI, based on the hypothesis that continued nicotine exposure through alternative delivery may stabilize or reduce BMI.

Population and Sample

Study Population and Sampling

Participants were recruited using purposive sampling at the Dental and Oral Hospital, Faculty of Dentistry, Universitas Padjadjaran, Bandung. Eligible participants were male, aged 20 to 40 years, with a history of daily smoking for at least one year. Smoking status was confirmed by an expired-air carbon monoxide (CO) level of ≥7 parts per million (ppm). Exclusion criteria included current acute illness, use of medications known to influence weight or metabolism, and female gender.

Intervention and Group Allocation

Participants were voluntarily assigned into two groups according to their preference:

- The e-cigarette group (n = 30): participants switched from combustible tobacco to standardized e-cigarette devices (pod-based or heat-not-burn systems) containing approximately 3% nicotine.
- The conventional cigarette group (n = 17): participants continued smoking regular cigarettes.

All participants were instructed not to alter their dietary or physical activity patterns during the study to reduce behavioral confounding. While these variables were not objectively measured, this control instruction was applied consistently to both groups.

Instrument

BMI was used as the primary outcome variable due to its clinical relevance and frequent use in population-level metabolic studies. Height was measured using a wall-mounted stadiometer, and weight was assessed with a calibrated digital scale while participants wore light clothing and no shoes. BMI was calculated using the standard formula: weight in kilograms divided by the square of height in meters (kg/m^2). Measurements were taken at baseline (Month 0) and at the three-month follow-up (Month 3), using standardized procedures conducted at consistent times of day to minimize diurnal variation.

Data Analysis

All data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics summarized continuous variables as means and standard deviations. Data normality was evaluated with the Shapiro-Wilk test. Paired t-tests were used for within-group comparisons, and independent t-tests for between-group differences in BMI changes (ΔBMI). A significance level of $p < 0.05$ was adopted. Only complete cases were analyzed.

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Ethical Clearance

This study received ethical approval from the Health Research Ethics Committee of Universitas Padjadjaran, Bandung, Indonesia (Approval No. 643/UN6.KEP/EC/2021), and was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to study enrollment.

3. RESULT

Participant Characteristics

A total of 47 male participants completed the study, with 30 individuals in the e-cigarette group and 17 in the conventional cigarette group. All participants were aged between 20 and 40 years and met the inclusion criteria for active daily smoking. Baseline demographic and anthropometric data were comparable between the two groups.

Changes in BMI Within Groups

In the e-cigarette group, the mean BMI decreased slightly from 24.16 ± 4.42 kg/m² at baseline to 24.06 ± 4.59 kg/m² after three months. The mean change (ΔBMI) was –0.11 ± 0.63 kg/m². Paired t-test analysis revealed that this change was not statistically significant (t(28) = 0.89, p = 0.379).

Comparison Between Groups

An independent t-test comparing the ΔBMI between the two groups revealed no significant difference (t(44) = –1.07, p = 0.289). These results suggest that the short-term transition from combustible tobacco to e-cigarette use did not significantly affect BMI compared to continued use of conventional cigarettes.

In the conventional cigarette group, the mean BMI increased from 22.54 ± 3.63 kg/m² at baseline to 22.63 ± 3.63 kg/m² at follow-up. The mean ΔBMI was +0.09 ± 0.52 kg/m², which was also not statistically significant (t(16) = –0.71, p = 0.486).

An independent t-test comparing ΔBMI between the groups showed no statistically significant difference (t(44) = –1.07, p = 0.289). However, it should be noted that the small sample size, especially in the conventional group (n = 17), may limit the statistical power and generalizability of these findings.

Table 1. Changes in BMI Between Baseline and Three-Month Follow-Up

Group	N	Baseline BMI (Mean ± SD)	Follow-up BMI (Mean ± SD)	ΔBMI (Mean ± SD)	p-value (within group)
E-cigarette	30	24.16 ± 4.42	24.06 ± 4.59	–0.11 ± 0.63	0.379*
Conventional cigarette	17	22.54 ± 3.63	22.63 ± 3.63	+0.09 ± 0.52	0.486*

***p-value for between-group ΔBMI comparison: 0.289**

Overall, the study found no significant changes in BMI within or between groups over a three-month period. These findings may reflect the short duration of follow-up, which could be insufficient to detect delayed or cumulative metabolic effects of switching nicotine delivery methods. Additionally, the lack of behavioral or dietary data limits the interpretation of BMI trends

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in the context of possible lifestyle confounders. Future studies should include objective measurements of diet and physical activity to better understand the mechanisms underlying weight changes in smokers transitioning to e-cigarettes.

4. DISCUSSION

This study aimed to assess short-term BMI changes in young adult males who transitioned from conventional cigarettes to e-cigarettes. The results indicated no statistically significant BMI change within or between groups after three months. These findings suggest that, over a short duration, the metabolic effects of switching nicotine delivery methods may be minimal or delayed in their manifestation.

Several explanations may account for the absence of significant findings. One important consideration is the short duration of the study. Previous research has suggested that neuroendocrine adaptations to nicotine exposure, including those affecting appetite and energy balance, may require prolonged periods to influence anthropometric outcomes (Li et al., 2025). This delay may obscure effects that would otherwise emerge with longer observation.

Another plausible factor is the variability in nicotine delivery and absorption associated with e-cigarette devices. Differences in device design, user puffing behavior, and nicotine formulation (e.g., nicotine salts) may result in heterogeneous nicotine bioavailability (Farsalinos et al., 2018; Yingst et al., 2019). These discrepancies complicate direct comparisons and may dampen observable effects on BMI in the short term.

Behavioral elements may also contribute. The perception of e-cigarettes as appetite suppressants or substitutes for eating can influence dietary patterns among users (Jackson et al., 2019; Mason & Leventhal, 2021). However, without objective measures of diet and physical activity, the true impact of such behaviors remains speculative. Future studies should include detailed behavioral and dietary assessments to isolate the influence of nicotine from lifestyle-related factors.

The relatively small sample size—especially in the conventional cigarette group—further limits statistical power, and the homogeneity of participants (all male, age 20–40) restricts the generalizability of findings. It is also important to acknowledge that BMI alone may not capture more nuanced changes in body composition, such as shifts in fat mass or lean tissue. Inclusion of broader health indicators such as waist circumference, visceral adiposity, or body fat percentage could enrich future research.

Moreover, the study did not assess sex-specific responses to nicotine exposure, despite literature suggesting potential hormonal and metabolic differences in nicotine's effects between males and females (Yang et al., 2021). Future studies should include both genders to allow sex-stratified analysis.

From a public health perspective, the findings underscore the importance of addressing common misconceptions about vaping and weight control. While e-cigarettes may reduce harm compared to combustible tobacco, their role in weight regulation remains uncertain. Health education should clarify that e-cigarettes are not validated tools for weight management, particularly among youth and image-conscious populations.

In conclusion, this study contributes preliminary evidence that short-term switching to e-cigarettes does not significantly alter BMI in young adult males. However, limitations in sample size, duration, and behavioral data collection constrain the interpretation. Future research should be longitudinal, gender-inclusive, and integrate multiple metabolic markers to yield a more comprehensive understanding of nicotine's health implications.

This study has several limitations. First, the small sample size, particularly in the conventional group, may have reduced statistical power. Second, participants were limited to young adult males, which restricts the generalizability of findings across genders and age groups. Third, BMI alone may not reflect subtle changes in body composition. Fourth, the short duration of follow-up (three months) may not capture long-term metabolic effects. Lastly, the lack of objective data on dietary intake and physical activity limits interpretation of behavioral influences on weight changes.

5. CONCLUSION

This study provides preliminary evidence that short-term transition from conventional cigarettes to electronic cigarettes does not result in significant changes in BMI among young adult male smokers. While the findings suggest metabolic neutrality over a three-month period, the short duration and modest sample size limit the generalizability and statistical power of the results.

These insights underscore the need for future longitudinal research that incorporates broader metabolic assessments such as insulin resistance markers, lipid profiles, and systemic inflammatory indicators. Such metrics can offer a more comprehensive understanding of the physiological impact of e-cigarette use beyond anthropometric changes.

Furthermore, the results hold translational relevance for public health interventions. Behavioral counseling within smoking cessation programs should explicitly address weight-related concerns and clarify that switching to e-cigarettes is not a clinically supported strategy for weight control. This can help dispel prevalent misconceptions and support more informed decision-making among individuals attempting to quit smoking.

In summary, while short-term use of e-cigarettes does not appear to affect BMI significantly, its metabolic implications remain insufficiently understood. Integrating behavioral, biochemical, and longitudinal data will be essential in developing evidence-based cessation strategies that address both nicotine dependence and concerns about body weight.

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7. CONFLICT OF INTEREST

The authors declare no conflict of interest related to the conduct, analysis, or reporting of this study. No commercial or financial relationships that could be construed as a potential conflict were present during the research process.

8. REFERENCES

Chen, H., Chan, Y. L., Thorpe, A. E., Pollock, C. A., Saad, S., & Oliver, B. G. (2022). Inhaled or Ingested, Which Is Worse, E-Vaping or High-Fat Diet? *Frontiers in Immunology*, *13*. https://doi.org/10.3389/fimmu.2022.913044.

Easwaran, M., Maria, C. S., Martinez, J. D., Hung, B., Yu, X., Soo, J., Kimura, A., Gross, E. R., & Erickson-DiRenzo, E. (2024). Effects of Short-term Electronic(e)-Cigarette Aerosol Exposure in the Mouse Larynx. *Laryngoscope*, *134*(3), 1316–1326. https://doi.org/10.1002/lary.31043.

Farsalinos, K., Poulas, K., & Voudris, V. (2018). Changes in puffing topography and nicotine consumption depending on the power setting of electronic cigarettes. *Nicotine and Tobacco Research*, *20*(8), 993–997. https://doi.org/10.1093/ntr/ntx219.

Jackson, S. E., Brown, J., Aveyard, P., Dobbie, F., Uny, I., West, R., & Bauld, L. (2019). Vaping for weight control: A cross-sectional population study in England. *Addictive Behaviors*, *95*, 211–219. https://doi.org/10.1016/j.addbeh.2019.04.007.

Lamota, L., Bermudez-Silva, F. J., Marco, E.-M., Llorente, R., Gallego, A., Rodríguez de Fonseca, F., & Viveros, M.-P. (2008). Effects of adolescent nicotine and SR 147778 (Surinabant) administration on food intake, somatic growth and metabolic parameters in rats. *Neuropharmacology*, *54*(1), 194–205. https://doi.org/10.1016/j.neuropharm.2007.07.004.

Li, Y., Mao, J., Chai, G., Zheng, R., Liu, X., & Xie, J. (2025). Neurobiological mechanisms of nicotine's effects on feeding and body weight. *Neuroscience and Biobehavioral Reviews*, *169*. https://doi.org/10.1016/j.neubiorev.2025.106021.

Mason, T. B., & Leventhal, A. M. (2021). Relations among sweet taste preference, body mass index, and use of E-cigarettes for weight control motives in young adults. *Eating Behaviors*, *41*. https://doi.org/10.1016/j.eatbeh.2021.101497.

Mohtadji, A. (2019). Smoking and weight gain, myth or reality? *Pratiques En Nutrition*, *15*(58), 30–33. https://doi.org/10.1016/j.pranut.2019.03.008.

Piliguian, M., Zhu, A. Z. X., Zhou, Q., Benowitz, N. L., Ahluwalia, J. S., Sanderson Cox, L., & Tyndale, R. F. (2014). Novel CYP2A6 variants identified in African Americans are associated with slow nicotine metabolism in vitro and in vivo. *Pharmacogenetics and Genomics*, *24*(2), 118–128. https://doi.org/10.1097/FPC.0000000000000026.

Radwan, H., Hasan, H. A., Najm, L., Zaurub, S., Jami, F., Javadi, F., Deeb, L. A., & Iskandarani, A. (2018). Eating disorders and body image concerns as influenced by family and media among university students in Sharjah, UAE. *Asia Pacific Journal of Clinical Nutrition*, *27*(3), 695–700. https://doi.org/10.6133/apjcn.062017.10.

Shi, H., Fan, X., Horton, A., Haller, S. T., Kennedy, D. J., Schiefer, I. T., Dworkin, L., Cooper, C. J., & Tian, J. (2019). The Effect of Electronic-Cigarette Vaping on Cardiac Function and Angiogenesis in Mice. *Scientific Reports*, *9*(1). https://doi.org/10.1038/s41598-019-40847-5.

Sobkowiak, R., & Lesicki, A. (2013). [Absorption, metabolism and excretion of nicotine in humans]. *Postepy Biochemii*, *59*(1), 33–44. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84881223307&partnerID=40&md5=3b8c239a4ce02f6d11dac27dc8f52cb0.

Wagener, T. L., Floyd, E. L., Stepanov, I., Driskill, L. M., Frank, S. G., Meier, E., Leavens, E. L., Tackett, A. P., Molina, N., & Queimado, L. (2017). Have combustible cigarettes met their match? The nicotine delivery profiles and harmful constituent exposures of second-generation and third-generation electronic cigarette users. *Tobacco Control*, *26*(e1), e23–e28. https://doi.org/10.1136/tobaccocontrol-2016-053041.

Weiss, A. L., Miller, J. N., & Chermak, R. (2023). Adolescent Diet Culture: Where Does it Originate? In *Fad Diets and Adolescents: a Guide for Clinicians, Educators, Coaches and Trainers* (pp. 17–24). https://doi.org/10.1007/978-3-031-10565-4_3.

Yang, Y.-D., Xie, M., Zeng, Y., Yuan, S., Tang, H., Dong, Y., Zou, Z., Dong, B., Wang, Z., Ye, X., Hong, X., Xiao, Q., & Ma, J. (2021). Impact of short-term change of adiposity on risk of high blood pressure in children: Results from a follow-up study in China. *PLoS ONE*, *16*(9 September). https://doi.org/10.1371/journal.pone.0257144.

Yingst, J. M., Foulds, J., Veldheer, S., Hrabovsky, S., Trushin, N., Eissenberg, T. T., Williams, J., Richie, J. P., Nichols, T. T., Wilson, S. J., & Hobkirk, A. L. (2019). Nicotine absorption during electronic cigarette use among regular users. *PLoS ONE*, *14*(7). https://doi.org/10.1371/journal.pone.0220300.

Zuo, Y., Solingapuram Sai, K. K., Jazic, A., Bansode, A. H., Rose, J. E., & Mukhin, A. G. (2024). Comparison of brain nicotine accumulation from traditional combustible cigarettes and electronic cigarettes with different formulations. *Neuropsychopharmacology*, *49*(4), 740–746. https://doi.org/10.1038/s41386-024-01800-x.

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Abbreviations

BMI, Body Mass Index; CO, Carbon Monoxide; ppm, Parts Per Million; SPSS, Statistical Package for the Social Sciences; WHO, World Health Organization; CYP2A6, Cytochrome P450 2A6 enzyme; nAChRs, Nicotinic Acetylcholine Receptors.