Journal homepage: **https://medicinskiglasnik.ba**

Med Glas (Zenica) 2026;23(2)
https://doi.org/10.17392/medglas-2193-23-2

Med Glas (Zenica)

ORIGINAL ARTICLE

Analysis of the effects of heat-not-burn tobacco product use on cardiorespiratory symptoms in adults

Aida Mujaković[1,2,3*], Mihana Hasak Hassan[2], Besim Prnjavorac[3,4], Nejra Mlaco-Vrazalic[5], Akif Mlačo[6,7]

[1]Clinic for Pulmonary Diseases and Tuberculosis "Podhrastovi", Clinical Centre University of Sarajevo, Sarajevo, Bosnia and Herzegovina; [2]Department of Internal Medicine, School of Medicine, Sarajevo School of Science and Technology, Sarajevo, Bosnia and Herzegovina; [3]Department of Pathophysiology, School of Medicine, Sarajevo School of Science and Technology, Sarajevo, Bosnia and Herzegovina; [4]Department of Pulmonology, General Hospital Tešanj, Tešanj,Tešanj, Bosnia and Herzegovina; [5]Internal Medicine Department, General Hospital "Prim. dr. Abdulah Nakaš", Sarajevo, Bosnia and Herzegovina; [6]Clinic for Heart, Blood Vessel and Rheumatic Diseases, Clinical Centre University of Sarajevo, Sarajevo, Bosnia and Herzegovina; [7]School of Medicine, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

ABSTRACT

Aim To determine if heat-not-burn (HNB) tobacco products are a safe alternative to cigarette smoking by inducing decreased decline of cardiorespiratory function.

Methods A clinical observational, cross-sectional study was conducted in the period between February and June 2025. It analysed and identified the effects of HNB tobacco products on cardiorespiratory symptoms in 60 adults below 55 years of age with confirmed arterial hypertension, 30 in the HNB users group (≥ 6 months of HNB use and no history of conventional cigarette use (CCU)), and 30 in the non-HNB user group (no history of HNB or CCU).

Results The gender distribution among the groups was similar. HNB tobacco product users reported significantly more respiratory (daily and nighttime shortness of breath, coughing) and cardiologic symptoms (choking, shortness of breath during physical activity). The following parameters were significantly reduced in the HNB tobacco product users: forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), and forced expiratory flow at 75% (FEF75) ($p = 0.01$), SO_2 ($p < 0.001$), pO_2 ($p = 0.001$), HCO_3^- ($p < 0.001$), total cholesterol ($p = 0.001$), and basophils ($p < 0.001$), while the following parameters were significantly increased in the same group: right ventricular systolic pressure (RVSP) ($p = 0.002$), hsCRP ($p < 0.001$), monocytes ($p < 0.001$), eosinophils ($p < 0.001$), D-dimer ($p < 0.001$), and platelet count ($p = 0.003$).

Conclusion HNB tobacco product use in adults with arterial hypertension was associated with worse cardiorespiratory symptoms, impaired pulmonary function, signs of early right ventricular dysfunction, and systemic inflammation.

Keywords: cardio-respiratory symptoms, heat-not-burn products

INTRODUCTION

Tobacco use remains one of the leading causes of preventable morbidity and mortality worldwide, accounting for over eight million deaths annually, including 1.3 million attributed to second-hand smoke exposure, according to a WHO report from 2020 (1). Long-term exposure to toxic substances released during the combustion of tobacco leaves is primarily responsible for smoking-related diseases, rather than nicotine itself (2). Despite global tobacco control measures, smoking prevalence remains high, particularly in low- and middle-income countries, where the health and economic burden is greatest (1).

In recent years, heat-not-burn (HNB) tobacco products have been introduced as alternatives to conventional cigarettes. These devices heat tobacco at lower temperatures than combustion, generating aerosols containing nicotine and other harmful chemicals (3). Marketed as modified-risk tobacco products (MRTP) by the U.S. Food and Drug Administration (FDA), HNB products are promoted as a reduced-risk alternative to smoking because they emit fewer toxicants compared with conventional cigarettes (4). However, evidence suggests that they are not risk-free. HNB products produce environmental pollutants, lead to nicotine dependence, and contain chemicals in concentrations that may still pose significant health risks (5). Although chemical analyses have identified toxicants in HNB aerosols, there are limited population-based studies regarding their impact on health. HNB

*Corresponding author:
Aida Mujaković
Clinic for Pulmonary Diseases and Tuberculosis "Podhrastovi", Clinical Centre University of Sarajevo, Sarajevo, Bosnia and Herzegovina
E-mail: mujakovic.aida@gmail.com
ORCID ID: 0000-0002-0022-1482

Submitted: 29 November 2025; **Revised:** 22 January 2026; **Accepted:** 12 February 2026

products in adults induce adverse cardiovascular and pulmonary responses, such as oxidative stress, airway resistance, vascular dysfunction, increased exhaled CO, increased airway resistance, decreased peripheral oxygen saturation (spO_2), forced expiratory flow at 25% (FEF25%) and 50% (FEF50%) of vital capacity (VC), peak expiratory flow (PEF), and diffusion lung capacity for CO (DLCO) (6).

The lack of evidence regarding benefits vs. harms of HNB tobacco products is especially evident in low and middle-income countries and therefore their long-term effects are still under observation.

The aim of this study was to analyse and identify the effects of HNB tobacco product use on the cardiorespiratory system in adults, providing insight into the potential long-term health consequences of these emerging tobacco products.

PATIENTS AND METHODS

Patients and study design

This clinical observational cross-sectional study was conducted at the General Hospital "Prim. Dr. Abdulah Nakaš", Sarajevo, Bosnia and Herzegovina (B&H), between February and June 2025. A total of 60 patients with a history of arterial hypertension were included in the study and divided into two groups: HNB users (N=30) consisted of adults aged 18–55 years with a history of exclusive HNB tobacco product use for at least the past six months, and no prior history of conventional cigarette smoking and non-HNB users (N=30) included adults with no history of HNB or conventional cigarette use.

All participants provided written informed consent. The study was approved by the hospital's Ethics Committee and conducted in accordance with the Declaration of Helsinki.

Methods

Patients aged 18–55 years, diagnosed with arterial hypertension and users of HNB tobacco products for at least 6 months, were included in the study. Exclusion criteria included: history of chronic lung disease, Modified Medical Research Council (mMRC) dyspnea scale 3 and 4 (7), significant cardiac dysfunction defined as New York Heart Association (NYHA) class III–IV and left ventricular ejection fraction (LVEF < 50%) (8), chronic pulmonary diseases, chronic systemic disease (diabetes, connective tissue disease, rheumatologic disease), recent myocardial infarction, pulmonary embolism, cerebrovascular incident, or SARS-CoV-2 infection within the past two months. Patients with a history of newly or recently diagnosed pulmonary malignancy or abnormal spirometry in the past six months were also excluded.

Each participant completed a structured questionnaire addressing demographic characteristics, history and duration of HNB use, conventional smoking history, frequency of consumption, self-reported respiratory symptoms (daily shortness of breath, shortness of breath during night, coughing, appetite, fatigue, and sport activity habit), presence of cardiologic symptoms (shortness of breath during physical activity, choking, sport activity habit).

Dyspnoea was graded using the mMRC scale (7). Echocardiographic findings (mitral/tricuspid regurgitation, right ventricular size) were also recorded.

Spirometry, including forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), FEV1/FVC ratio, forced expiratory flow at 75% (FEF75), mean expiratory flow at 25% (MEF25), mean expiratory flow at 50% (MEF50) was performed using a calibrated BTL-08 Spiro device (BTL Industries, UK, 2016). Arterial blood gas (ABG) parameters (pH, pO_2, pCO_2, HCO_3^-, SO_2) were measured with COBAS equipment (Roche, Germany). Echocardiography was performed using the EPIQ CVx (Philips, USA, 2024) to evaluate LVEF, right ventricular systolic pressure, right ventricular size, and valvular regurgitation.

Standard laboratory analyses included complete blood count (CBC), differential blood cell count (DBC), inflammatory markers including highly sensitive C-reactive protein (hs-CRP), erythrocyte sedimentation rate (ESR), fibrinogen, D-dimer, and lipid profile including total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides. The laboratory testing for CBC and DBC was performed on a calibrated machine, model SYSMEX XN 550 (Sysmex Corporation, Japan), and the biochemistry and immunochemistry on model DIMENSION EXL 200 (Siemens, Germany).

Statistical analysis

Normality was tested with the Shapiro–Wilk test. Parametric variables were compared using the independent samples t-test, while non-parametric variables were analysed with the Mann–Whitney U test. Categorical variables were assessed using the χ^2 test or Fisher's exact test. Effect sizes were calculated with Cohen's d. A $p < 0.05$ was considered statistically significant. All quantitative variables were evaluated for distributional characteristics before selecting the appropriate statistical tests. Qualitative variables were summarized using frequencies and percentages to ensure consistent comparison between the groups.

RESULTS

A total of 60 participants were involved, 30 HNB tobacco product users with arterial hypertension (HNB users) and 30 non-users with arterial hypertension (non-HNB users). Gender distribution was comparable between groups ($p = 0.604$). Among the HNB users, there were 12 females and 18 males, while the non-HNB users consisted of 15 females and 15 males. The non-HNB group was significantly older ($p = 0.026$) with a mean age of 45.1±7.1 years.

HNB users had significantly higher severity of choking episodes ($p < 0.0001$) and shortness of breath during physical activity ($p < 0.001$). Significantly higher severity of the respiratory symptoms including daily shortness of breath ($p < 0.001$), shortness of breath at night ($p < 0.001$), and coughing ($p < 0.001$) was reported in HNB tobacco users.

Spirometry parameters: FEV1 (87.9 ± 3.9%; $p < 0.001$), FVC ($p = 0.008$), and FEF75 (86.0 ± 12.1%; $p = 0.006$) were significantly lower in HNB users. The FEV1/FVC ratio showed a nonsignificant trend toward reduction ($p = 0.061$) (Figure 1).

FEF75 was significantly lower in HNB users, indicating reduced small airway function ($p = 0.006$). FEV1/FVC did not reach statistical significance between the two groups ($p = 0.061$) (Figure 2).

No significant differences were observed in LVEF or systemic blood pressure between the groups. However, right ventricular systolic pressure (RVSP) was significantly elevated in HNB users ($p = 0.002$), indicating increased pulmonary arterial pressure (Figure 3). Statistically significant difference was observed between HNB users and non-HNB users for RVSP ($p<0.05$).

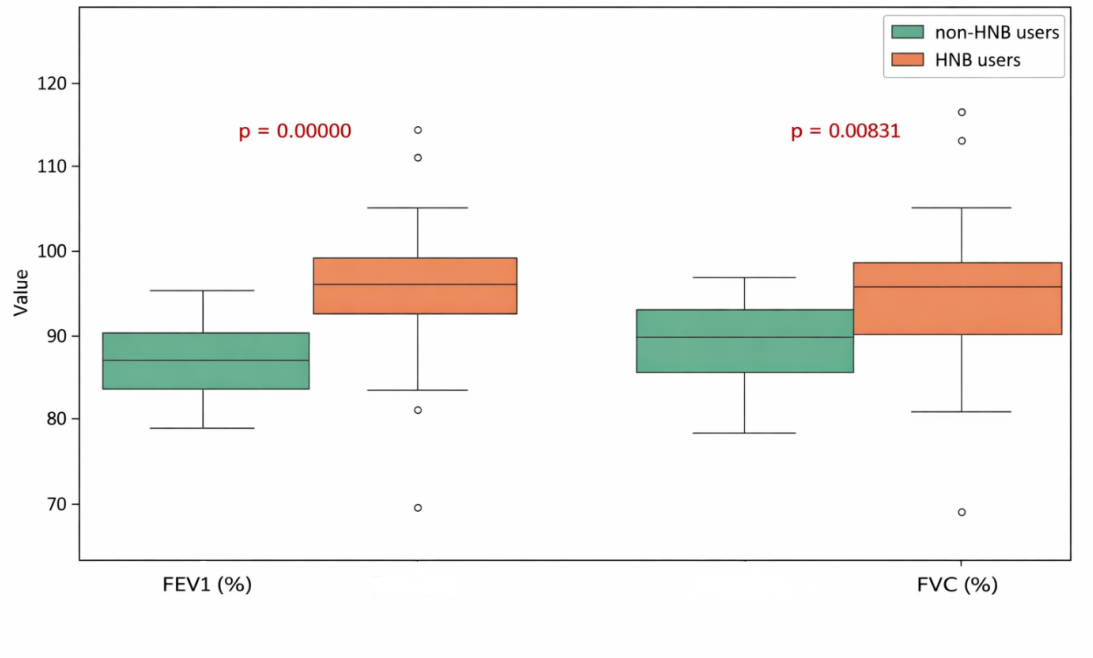

Figure 1. Spirometry parameters by heat- not-burn (HNB) consumer status

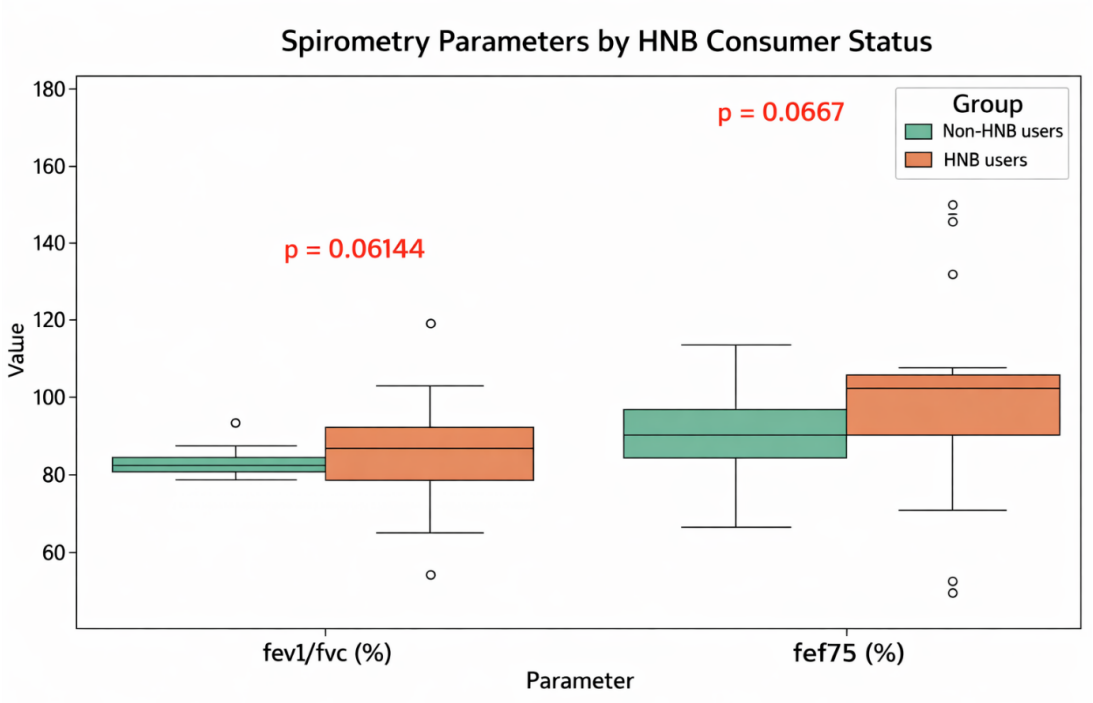

Figure 2. Spirometry parameters by heat- not-burn (HNB) consumer status

RVSP was significantly higher in HNB users, indicating elevated pulmonary pressure.

There were no significant differences observed between the groups for heart rate, systolic or diastolic blood pressure ($p = 1.000$; Cohen's $d = 0.00$ for all).

Peripheral oxygen saturation (SO_2) was lower in HNB users (96.0 vs 97.6; $p < 0.001$). There were no significant differences in pH or pCO_2 between the groups. However, HNB users had significantly lower pO_2 ($p = 0.001$) and HCO_3^- ($p < 0.001$) (Table 1).

HNB users demonstrated significantly elevated markers of inflammation and coagulation, including hsCRP ($p < 0.001$), D-dimer ($p < 0.001$), platelet count ($p = 0.003$), monocytes ($p < 0.001$), and eosinophils ($p < 0.001$). Basophils ($p < 0.001$) and total cholesterol ($p = 0.001$) were significantly lower. No differences were observed in leukocytes, haemoglobin, neutrophils, lymphocytes, LDL cholesterol, or triglycerides (Table 2).

DISCUSSION

This study analysed the effects of HNB tobacco products on cardiorespiratory symptoms in 60 adults with arterial hypertension, comparing 30 HNB users and 30 non-HNB users. Results of

Table 1. Comparison of arterial blood gas analysis parameters between heat-not-burn (HNB) users (case group) and non-HNB users (control group)

Variable	HNB users	Non-HNB users	p^*	$p^\dagger$
pH (median; IQR)	7.40 (7.40–7.40)	7.40 (7.39–7.42)	0.673	0.768
pO_2 (median; IQR) (kPa)	10.20 (9.87–11.15)	11.00 (10.57–11.30)	<0.001	0.001
$pCO_2 \pm$ SD (kPa)	5.25 ± 0.29	5.16 ± 0.24	0.335	0.371
HCO_3^- (median; IQR) (mmol/L)	24.00 (24.00–24.00)	24.65 (24.17–25.10)	<0.001	<0.001
SO_2 (median; IQR) (%)	96.00 (96.00–97.00)	97.60 (96.80–97.92)	<0.001	<0.001

Data are presented as median (IQR) for non-normally distributed variables and mean ± SD for normally distributed variables.
* t-test was used to determine the difference between the means (averages) of two groups.
† U-test (Mann–Whitney U test) a non-parametric statistical test as used to determine the presence of a significant difference between the distribution of two independent samples.
HNB, heat-not-burn; SD, standard deviation; IQR, interquartile range; pO_2, partial pressure of oxygen; pCO_2, partial pressure of carbon dioxide; HCO_3^-, bicarbonate; SO_2, oxygen saturation.

Table 2. Comparison of laboratory blood analysis parameters between heat-not-burn (HNB) users (case group) and non-HNB users (control group)

Parameter	HNB Users	Non-HNB Users	p^*	$p^\dagger$
WBC ±SD ($\times 10^{*9}$/L)	6.44±1.28	6.19±1.11	0.415	0.482
RBC ±SD ($\times 10^{*12}$)	4.95±0.32	5.07±0.25	0.116	0.135
Plt ±SD ($\times 10^9$/L)	266.00±14.18	254.50±14.88	0.003	0.004
Hb (median; IQR) (g/L)	141.37 (139.00–170.00)	139.80 (138.00–152.00)	0.310	0.994
Neu ±SD (%)	56.23±2.82	57.16±1.60	0.124	0.119
Lym ±SD (%)	34.87±2.65	34.53±1.38	0.543	0.393
Mono ±SD (%)	6.13 ± 0.67	5.31 ± 0.23	<0.001	<0.001
Eos (median; IQR) (%)	2.05 (2.00–2.08)	1.16 (1.15–1.20)	<0.001	<0.001
Baso (median; IQR) (%)	0.35 (0.30–0.40)	0.61 (0.60–0.61)	<0.001	<0.001
Chol. total (median; IQR) (mmol/L)	4.84 (4.55–5.06)	5.47 (5.25–6.26)	<0.001	0.001
HDL (median; IQR) (mmol/L)	1.22 (1.13–1.30)	1.14 (1.10–1.20)	0.007	0.010
LDL ±SD (mmol/L)	2.85±0.40	3.00±0.58	0.247	0.317
Triglycerides (median; IQR) (mmol/L)	1.68 (0.25–2.30)	1.53 (0.80–1.80)	0.093	0.110
hsCRP (median; IQR) (mg/L)	4.74 (1.08–11.23)	1.75 (0.91–1.90)	<0.001	<0.001
D-dimer (median; IQR) (μg/L)	484.00 (427.50–570.00)	320.00 (307.50–362.50)	<0.001	<0.001

Data are presented as median (IQR) for non-normally distributed variables and mean ± SD for normally distributed variables. †U-test (Mann–Whitney U test) a non-parametric statistical test as used to determine the presence of a significant difference between the distribution of two independent samples.
SD, standard deviation; IQR, interquartile range; WBC, white blood cells; RBC, red blood cells; Plt, platelets; Hb, haemoglobin; Neu, neutrophils; Lym, lymphocytes; Mono, monocytes; Eos, eosinophils; Baso, basophils; Chol. Total, total cholesterol; HDL, high density lipoprotein; LDL, low density lipoprotein; hsCRP, high sensitive C-reactive protein.

our study showed that HNB users had more symptoms and physiological changes, especially in pulmonary function, echocardiographic measures, arterial blood gas parameters, and laboratory markers. Previous studies also reported rising HNB use among younger population, with adverse effects such as oxidative stress, inflammation, airway remodelling, and cardiovascular changes (4). Although gender distribution was not significant, in our study HNB users were younger, which may partly influence differences. Prior studies confirmed rising HNB popularity among younger adults, both smokers and non-smokers (9,10).

HNB users reported more frequent and severe respiratory symptoms (dyspnoea, cough) and cardiologic symptoms (choking, exertional dyspnoea), with reduced physical activity. Fatigue and appetite changes were not significant. Similar findings were noted in other studies where users reported throat irritation and other systemic symptoms, as well as effects such as increased oxidative stress, inflammation, and airway remodelling (11,12).

HNB users in our study had reduced FEV1, FVC, and FEF75 values, with a nonsignificant FEV1/FVC decline. Prior studies showed acute decreases in oxygen saturation, airflow parameters, and diffusion capacity, suggesting that chronic use may accelerate pulmonary decline (13). In vitro studies confirm airway inflammation and remodelling similar to conventional cigarettes (14).

RVSP was significantly higher in HNB users, indicating pulmonary vascular involvement, while LVEF and blood pressure remained unchanged. SO levels were lower in HNB users, suggesting a ventilation-perfusion mismatch. Previous research showed a link of HNB use with increased arterial stiffness, elevated blood pressure, and nicotine-induced sympathomimetic effects (5,15). Most existing studies focus on switching from cigarettes to HNB, with limited direct echocardiographic data (16).

HNB users had significantly lower pO , HCO , and SO , suggesting impaired gas exchange and early compensation (17, 18). In a research regarding lung injury caused by HNB tobacco products, it is stated that four out of the ten patients demonstrated an increase in oxygen demands, due to significant hypoxia, but hypercapnia was not present (17).

HNB users showed higher platelets, monocytes, eosinophils, hs-CRP, and D-dimer, with lower basophils and total cholesterol. These findings indicate inflammation, endothelial activation, and prothrombotic states (19,20). Previous research confirms

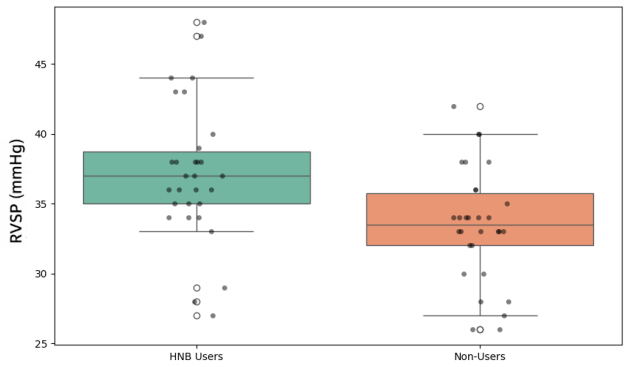

Figure 3. Right ventricular systolic pressure (RVSP) comparison between heat- not-burn (HNB) users and non-HNB users

elevations in inflammatory and coagulation markers (19). The high hs-CRP and D-dimer level observed here raise concern for increased cardiovascular risk (19).

Taken together, the findings suggest HNB products are not safe alternatives for patients with hypertension. Increased inflammatory, hemodynamic, and pulmonary changes may worsen hypertension and raise cardiovascular event risk (21). Despite being marketed as reduced-risk, WHO and international studies highlight persistent harms, including oxidative stress and endothelial dysfunction (22).

HNB use caused measurable cardiorespiratory effects. Although some studies suggest reduced oxidative stress and vascular damage compared to cigarettes (23), pulmonary function decline and airway resistance remain concerns (10,13). The lack of long-term data warrants caution, and HNB should be seen as a potential threat, not a safe alternative.

The study's small sample size, cross-sectional design, reliance on self-reported data, strict exclusion criteria, single-centre equipment, and the lack of follow-up limitations were noted.

Evidence of existing studies conducted in low- and middle-income countries indicating HNB tobacco use impact on cardiorespiratory symptoms is not available. According to our study, HNB tobacco products showed a statistically significant influence on cardiorespiratory symptoms in adults; however, the long-term consequences of chronic HNB tobacco product use still remain unanswered.

FUNDING

No specific funding was received for this study.

CONFLICT OF INTERESTS

None to declare.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request and with permission of the institution. The data are not publicly available due to ethical and privacy restrictions.

ETHICS STATEMENT

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Institutional Ethics Committee of the General Hospital “Prim. dr. Abdulah Nakas”.

AUTHOR CONTRIBUTIONS (CRediT)

Conceptualization: A.M.; **Data curation:** M.H.H., N.M.-V.; **Formal analysis:** N.M.-V.; **Investigation:** A.M., M.H.H.; **Methodology:** A.M., M.H.H., B.P., A.M.; **Supervision:** B.P., A.M.; **Writing – original draft:** A.M., N.M.-V.; **Writing – review & editing:** A.M., M.H.H., B.P., N.M.-V., A.M. All authors have read and agreed to the published version of the manuscript.

REFERENCES

1. WHO Team-Study group on tobacco regulation. 2023 July 26th. Heated tobacco products: summary of research and evidence of health impacts. Switzerland, Geneva: 2023 (accessed: June 20, 2025) https://www.who.int/publications/i/item/9789240042490
2. Sakaguchi C, Nagata Y, Kikuchi A, Takeshige Y, Minami N. Differences in Levels of Biomarkers of Potential Harm Among Users of a Heat-Not-Burn Tobacco Product, Cigarette Smokers, and Never-Smokers in Japan: A Post-Marketing Observational Study. Nicotine Tob Res 2021; 23:1143-52. doi:10.1093/ntr/ntab014
3. Fried ND, Gardner JD. Heat-not-burn tobacco products: an emerging threat to cardiovascular health. Am J Physiol Heart Circ Physiol 2020; 319:H1234-39. doi:10.1152/ajpheart.00708.2020
4. Pokhrel P, Herzog TA, Kawamoto CT, Fagan P. Heat-not-burn Tobacco Products and the Increased Risk for Poly-tobacco Use. Am J Health Behav 2021; 45:195-204. doi:10.5993/AJHB.45.1.16
5. Kim SC, Friedman TC. A New Ingenious Enemy: Heat-Not-Burn Products. Tob Use Insights 2022;15:1179173X221076419. doi:10.1177/1179173X221076419
6. Upadhyay S, Rahman M, Johanson G, Palmberg L, Ganguly K. Heated Tobacco Products: Insights into Composition and Toxicity. Toxics 2023; 11:667. doi:10.3390/toxics11080667
7. Sunjaya A, Poulos L, Reddel H, Jenkins C. Qualitative validation of the modified Medical Research Council (mMRC) dyspnoea scale as a patient-reported measure of breathlessness severity. Respir Med 2022; 203:106984. doi:10.1016/j.rmed.2022.106984
8. Nieminen MS, Böhm M, Cowie MR, Drexler H, Filippatos GS, Jondeau G, et al. ESC Committee for Practice Guideline (CPG). Executive summary of the guidelines on the diagnosis and treatment of acute heart failure: the Task Force on Acute Heart Failure of the European Society of Cardiology. Eur Heart J 2005; 26:384-416. doi:10.1093/eurheartj/ehi044
9. Igarashi A, Aida J, Kusama T, Tabuchi T, Tsuboya T, Sugiyama K, et al. Heated Tobacco Products Have Reached Younger or More Affluent People in Japan. J Epidemiol 2021; 31:187-93. doi:10.2188/jea.JE20190260
10. Czoli CD, White CM, Reid JL, OConnor RJ, Hammond D. Awareness and interest in IQOS heated tobacco products among youth in Canada, England and the USA. Tob Control 2020; 29:89-95. doi:10.1136/tobaccocontrol-2018-054654
11. Wang L, Chen J, Leung LT, Mai ZM, Ho SY, Lam TH, Wang MP. Characterization of Respiratory Symptoms Among Youth Using Heated Tobacco Products in Hong Kong. JAMA Netw Open 2021; 4:e2117055. doi:10.1001/jamanetworkopen.2021.17055.
12. Queloz S, Etter JF. An online survey of users of tobacco vaporizers, reasons and modes of utilization, perceived advantages and perceived risks. BMC Public Health 2019; 19:642. doi:10.1186/s12889-019-6957-0
13. Pataka A, Kotoulas S, Chatzopoulos E, Grigoriou I, Sapalidis K, Kosmidis C, Vagionas A, Perdikouri EI, Drevelegas K, Zarogoulidis P, Argyropoulou P. Acute Effects of a Heat-Not-Burn

Tobacco Product on Pulmonary Function. Medicina 2020; 56:292. doi:10.3390/medicina56060292

14. Sohal SS, Eapen MS, Naidu VGM, Sharma P. IQOS exposure impairs human airway cell homeostasis: direct comparison with traditional cigarette and e-cigarette. ERJ Open Res 2019; 5:00159-2018. doi:10.1183/23120541.00159-2018
15. Münzel T, Crea F, Rajagopalan S, Lüscher T. Nicotine and the cardiovascular system: unmasking a global public health threat. Eur Heart J 2025; ehaf1010. doi:10.1093/eurheartj/ehaf1010
16. Fried ND, Oakes JM, Whitehead AK, Lazartigues E, Yue X, Gardner JD. Nicotine and novel tobacco products drive adverse cardiac remodeling and dysfunction in preclinical studies. Front Cardiovasc Med 2022; 9:993617. doi:10.3389/fcvm.2022.993617
17. Doukas SG, Kavali L, Menon RS, Izotov BN, Bukhari A. E-cigarette or vaping induced lung injury: A case series and literature review. Toxicol Rep 2020; 7:1381-1386. doi:10.1016/j.toxrep.2020.09.010
18. Andreozzi P, Gussoni G, Sesti G, Montano N, Pietrangelo A, Basili S, et al. Impact of electronic cigarettes (e-cigs) and heat-not-burn/heated tobacco products (HnB/HTP) on asthma and chronic obstructive pulmonary disease: a viewpoint of the Italian Society of Internal Medicine. Intern Emerg Med 2024; 19:1829-37. doi:10.1007/s11739-024-03648-x
19. Znyk M, Jurewicz J, Kaleta D. Exposure to Heated Tobacco Products and Adverse Health Effects, a Systematic Review. Int J Environ Res Public Health 2021; 18:6651. doi:10.3390/ijerph18126651
20. Świątkowska B, Jankowski M, Kaleta D. Effects of Heated Tobacco Use on Blood Parameters and Cardiovascular Risk in Healthy Men. Med Sci Monit 2025; 31:e948556. doi:10.12659/MSM.948556
21. Zhang Z, Zhao L, Zhou X, Meng X, Zhou X. Role of inflammation, immunity, and oxidative stress in hypertension: New insights and potential therapeutic targets. Front Immunol 2023; 13:1098725. doi:10.3389/fimmu.2022.1098725
22. WHO. Heated tobacco products: information sheet. WHO/Hep/Hpr/2020. March 2020. (accessed: June 20, 2025) https://www.who.int/publications/i/item/WHO-NMH-PND-17.6
23. Rahman M, Alatiqi M, Al Jarallah M, Hussain MY, Monayem A, Panduranga P, Rajan R. Cardiovascular Effects of Smoking and Smoking Cessation: A 2024 Update. Glob Heart 2025; 20:15. doi:10.5334/gh.1399