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Comparative Effects of Chronic Hookah and Cigarette Smoking on Cardiopulmonary Function and Perceived Stress in College Students

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Abstract: ***Hookah (waterpipe) smoking has gained significant popularity among college students in India, often perceived as a safer alternative to cigarette smoking. This observational comparative cross-sectional study aimed to compare the chronic effects of hookah and cigarette smoking on cardiopulmonary function and perceived stress among college students aged 18–30 years. Fifty male participants (25 exclusive hookah smokers and 25 exclusive cigarette smokers) were recruited from Malegaon, Nashik. Cardiopulmonary parameters including resting Heart Rate (HR), Respiratory Rate (RR), Oxygen Saturation (SpO_2), and Peak Expiratory Flow Rate (PEFR) were measured using a pulse oximeter and calibrated peak flow meter. Perceived stress was assessed using the validated Perceived Stress Scale (PSS-10). Independent t-test analysis revealed no statistically significant difference between the two groups in any measured variable ($p > 0.05$). However, Pearson correlation analysis demonstrated a significant negative correlation between PEFR and PSS scores in the overall sample ($r = -0.298$, $p = 0.035$) and specifically within the hookah group ($r = -0.428$, $p = 0.033$), indicating that reduced pulmonary function is associated with higher perceived stress. These findings suggest that hookah smoking carries comparable cardiopulmonary and psychological burden to cigarette smoking, contradicting the widespread misconception of its relative safety.***

Keywords: Hookah Smoking, Cardiopulmonary Function, Perceived Stress Scale (PSS-10), Peak Expiratory Flow Rate (PEFR), College Students

1. Introduction

Smoking is a growing public health concern among young adults globally. While cigarette smoking has been extensively studied and recognized as a major risk factor for respiratory, cardiovascular, and oncological diseases, hookah (waterpipe) smoking has emerged as an increasingly popular alternative- particularly among college-going youth [1]. Social acceptability, flavored tobacco, and communal use in cafés and lounges have contributed to its rapid rise.

A central misconception drives hookah's popularity: the belief that water filtration during smoke passage makes it safer than cigarettes. Nimma et al. (2022) found that a majority of young Indian adults perceive hookah as less harmful, creating a significant barrier to health awareness [2]. Scientific evidence unequivocally contradicts this belief. Hookah smoke contains the same harmful constituents as cigarette smoke- including nicotine, carbon monoxide, heavy metals, and other toxic compounds at levels comparable to or exceeding cigarette smoke [3]. The longer session duration (30–60 minutes) and deeper inhalation patterns significantly amplify toxic exposure.

Both forms of smoking exert direct harm on the cardiopulmonary system. Nicotine increases heart rate and cardiac workload, elevating risk of hypertension and coronary artery disease. Carbon monoxide binds hemoglobin with ~200× greater affinity than oxygen, reducing oxygen-carrying capacity. Chronic smoke inhalation causes progressive airway narrowing measurable via Peak Expiratory Flow Rate (PEFR)- a precursor to COPD [4].

Beyond physiology, smoking has a complex bidirectional relationship with psychological stress. Young adults frequently initiate smoking as a coping mechanism, yet nicotine dependence worsens baseline stress over time. Karki (2024) confirmed a significant positive correlation between perceived stress and tobacco dependence in Indian male college students [5].

Despite growing prevalence of hookah smoking, comparative research between exclusive hookah and exclusive cigarette smokers at early stages- incorporating both physiological and psychological parameters- remains limited. This study aims to fill that gap.

2. Literature Survey

Haroon et al. (2024) reviewed cardiovascular effects of hookah and vaping, finding that chronic hookah use is associated with hypertension, endothelial dysfunction, and atherosclerotic plaque buildup [1].

Karki (2024) demonstrated a significant positive correlation between nicotine dependence and PSS scores in male college students in Bangalore, confirming tobacco use as both a stress coping mechanism and a stress amplifier [5].

Nimma et al. (2022) documented widespread belief that hookah is safer than cigarettes due to water filtration, highlighting critical knowledge gaps among young Indian adults [2].

Qasim et al. (2019) demonstrated that hookah smoke contains nicotine, carbon monoxide, and heavy metals at levels

comparable to or exceeding cigarettes, with evidence of oxidative stress and vascular inflammation in regular users [3].

Kadhum et al. (2014) measured acute cardiovascular effects after a single hookah session, finding significant increases in heart rate, blood pressure, and exhaled carbon monoxide levels [6].

Koubaa et al. (2013) compared hookah and cigarette smokers on pulmonary function, finding both groups had significantly reduced lung function and antioxidant levels compared to non-smokers, confirming comparable physiological harm [7].

3. Problem Definition

Hookah smoking is increasingly prevalent among college students in India, yet widely perceived as harmless. Most existing research focuses on cigarette smoking's long-term effects; comparative data specifically contrasting exclusive hookah versus cigarette users at early smoking stages is sparse. Furthermore, the psychological dimension- perceived stress- is frequently omitted from smoking research. This study addresses these gaps by comparing cardiopulmonary parameters (HR, RR, SpO_2, PEFR) and perceived stress (PSS-10) between exclusive hookah and cigarette smokers aged 18–30 years.

4. Methodology / Approach

4.1 Study Design & Participants

An observational comparative cross-sectional study was conducted over 4 months in Malegaon, Nashik. Fifty male college students (25 exclusive hookah smokers, 25 exclusive cigarette smokers) aged 18–30 years were recruited. Participants were required to have used their respective smoking type for a minimum of 3 months at ≥2 sessions/week. Dual users, those with pre-existing cardiorespiratory disease, and those with recent illness were excluded.

4.2 Sample Size

Sample size was calculated for medium effect size ($d = 0.5$; $\alpha = 0.05$; power = 0.80) using the formula $n = 2(Z\alpha/2 + Z\beta)^2/\Delta^2$, yielding $n \approx 24.5$ per group, rounded to 25 per group (N = 50 total).

4.3 Outcome Measures & Instruments

- PEFR (L/min): Calibrated peak flow meter, best of 3 trials.
- Heart Rate (bpm) & SpO_2 (%): Fingertip pulse oximeter.
- Respiratory Rate (breaths/min): Manual count via stopwatch (60 seconds).
- Perceived Stress: PSS-10 questionnaire (Cronbach's α: 0.78–0.91).

4.4 Procedure

Participants abstained from smoking for 8–12 hours prior to assessment. After 5 minutes of seated rest, HR, SpO_2, RR, and PEFR were recorded. PSS-10 was administered via Google Form. Data were entered into a master spreadsheet and PSS items 4, 5, 7, and 8 were reverse-scored before calculating total scores.

4.5 Statistical Analysis

Independent samples t-test was used for primary group comparison. Pearson correlation assessed the PEFR–PSS relationship. Chi-square tests examined categorical associations. Level of significance: $p < 0.05$. All analyses were performed on raw participant-level data (N = 50).

5. Results & Discussion

5.1 Descriptive Statistics

Variable	Hookah Mean±SD	Cigarette Mean ±SD
Heart Rate (bpm)	92.60 ± 8.25	89.72 ± 9.86
Resp. Rate (br/min)	15.56 ± 2.84	14.96 ± 2.15
SpO_2 (%)	96.08 ± 1.53	96.72 ± 1.97
PEFR (L/min)	407.16 ± 35.44	421.20 ± 47.11
PSS Score	21.88 ± 3.07	22.08 ± 1.89

5.2 Independent t-Test

Variable	t-value	p-value	Result
Heart Rate	1.12	0.268	NS
Resp. Rate	0.841	0.404	NS
SpO_2	-1.285	0.205	NS
PEFR	-1.191	0.24	NS
PSS Score	-0.277	0.783	NS

No statistically significant difference was found between hookah and cigarette smokers for any of the five variables (all $p > 0.05$). Hookah smokers showed slightly higher HR (92.60 vs 89.72 bpm) and RR (15.56 vs 14.96 breaths/min), likely reflecting nicotine-mediated sympathetic stimulation and compensatory breathing respectively. Cigarette smokers showed marginally higher SpO_2 (96.72% vs 96.08%), possibly due to greater carbon monoxide exposure from hookah charcoal combustion reducing functional oxygen saturation. The lower PEFR in hookah smokers (407.16 vs 421.20 L/min) may suggest early airway remodeling consistent with Koubaa et al. (2013) [7]. The absence of statistical significance reflects the young age and compensatory capacity of the cohort at this early smoking stage.

5.3 Pearson Correlation (PEFR vs PSS)

Group	r-value	p-value	Significance
Overall (N=50)	-0.298	0.035*	Significant
Hookah (n=25)	-0.428	0.033*	Significant
Cigarette (n=25)	-0.216	0.299	NS
Age vs PSS	-0.013	0.927	NS

** $p < 0.05$ — statistically significant*

A significant negative correlation was found between PEFR and PSS in the overall sample ($r = -0.298$, $p = 0.035$) and specifically within the hookah group ($r = -0.428$, $p = 0.033$). This indicates that participants with lower pulmonary function experienced higher perceived stress — a psycho-physiological link particularly pronounced in hookah users.

This may reflect anxiety associated with breathing difficulty, or alternatively, that higher stress drives heavier smoking and accelerates PEFR decline. The stronger correlation in hookah smokers may be attributable to the greater acute respiratory burden per session from larger smoke volumes and charcoal-generated CO.

5.4 Chi-Square Analysis

Association	χ^2	p-value
Smoking × PSS category	1.418	0.234 NS
Smoking × PEFR category	0.893	0.345 NS
Smoking × Age group	2.895	0.235 NS

No significant categorical associations were found between smoking type and PSS category, PEFR category, or age group. However, a notable trend was observed: 3 hookah smokers (12%) scored in the high-stress range vs none in the cigarette group, and a greater proportion of hookah smokers had PEFR below the sample median (36% vs 20%), suggesting trends that a larger sample may render significant.

6. Conclusion

This study found no statistically significant difference between hookah and cigarette smokers in cardiopulmonary parameters (HR, RR, SpO_2, PEFR) or perceived stress (PSS-10). Both groups demonstrated comparable physiological and psychological burden- directly contradicting the widespread misconception that hookah is a safer alternative to cigarettes.

The key finding was a significant negative correlation between PEFR and PSS, particularly in hookah smokers ($r = -0.428$, $p = 0.033$), indicating that poorer lung function is associated with greater perceived stress. This psycho-physiological link highlights that smoking's harm extends beyond the physical to the psychological domain.

PEFR and PSS-10 screening represent a practical, non-invasive model for early detection of smoking-related decline in young adults- directly applicable by physiotherapists in community and college health settings.

7. Future Scope

Future research should: (1) employ longitudinal designs to track progressive cardiopulmonary decline; (2) include non-smoker control groups; (3) use advanced tools- spirometry (FEV_1, FVC), exhaled CO, echocardiography, and inflammatory markers; (4) include female smokers for gender-stratified analysis; (5) expand to larger, multi-centre samples; (6) quantify smoking intensity; and (7) develop and evaluate physiotherapy-based smoking cessation, stress management programs.

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Author Profile

Arshaan Ansari is a graduate in Bachelor of Physiotherapy (B.P.Th) with research interests in cardiopulmonary physiotherapy and preventive healthcare. His research focuses on comparing the chronic effects of hookah and cigarette smoking on cardiopulmonary function and perceived stress among college students, contributing to tobacco-related health awareness in young adults. He aspires to contribute to evidence-based clinical practice and public health promotion.