Prevalence, Characteristics, and Effect of Smokeless Tobacco Use on Blood Pressure Control Among Hypertensive Patients

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Abstract

Background

Smokeless tobacco (ST) use is highly prevalent in South Asia, particularly in Pakistan, Bangladesh, and India, with increasing consumption among young adults. While ST use has been associated with cardiovascular risks, its direct effect on blood pressure control among hypertensive patients remains unclear.

Aim

To assess the prevalence, characteristics, and effects of ST use on blood pressure control in hypertensive patients using antihypertensive medications.

Methods

A cross-sectional observational cohort was conducted at Creek General Hospital, Karachi, from November 2024 to March 2025. Hypertensive patients aged 18 or older, using both ST and antihypertensive medications for at least 12 months, were included. Patients with certain comorbidities and medication histories were excluded. Blood pressure readings were recorded, and data were analyzed using SPSS version 27, with statistical significance set at $p<0.05$.

Results

Among 1097 hypertensive patients, 108 (9.8%) were ST users. The mean age was 51.33±12.01 years, and most patients were male. Compliance with antihypertensive medications was low (44.4%). Mean blood pressure readings were elevated (154.84±20.18 mmHg systolic, 92.76±15.54 mmHg diastolic). There was no statistically significant association between blood pressure control and ST use duration, compliance, age, gender, or comorbidities.

Conclusion

ST use among hypertensive patients is nearly equal to the general population and negatively impacts blood pressure control regardless of medication compliance or other patient characteristics. Complete abstinence from ST is recommended for better cardiovascular health.

Keywords: Smokeless Tobacco, Hypertension**,** Blood Pressure Control**,** Cardiovascular Risk**,** Medication Compliance

Introduction

Smokeless tobacco (ST) consumption is rampant in South Asia, where a large proportion of the population in countries of Bangladesh, Pakistan, and India use it either recreationally or habitually. More and more young adults are now taking up this practice; the estimated prevalence of ST use in Pakistan is 17% (25.4 million) of the general population [1-2]. ST use confers not only a massive financial burden on the economies of these nations but also adversely affects health outcomes over a long time. Policies and measures to curb its spread and usage have only been partially successful; as of writing, ST remains a major clinical and cultural enigma in these regions [3-4].

ST use can have acute and chronic effects on blood pressure control. Smokeless tobacco can cause a significant acute increase in both systolic and diastolic blood pressure, as well as heart rate, shortly after use; This effect can last up to 90 minutes post-consumption [5-12]. The increase in blood pressure is linked to the rise in plasma nicotine levels and catecholamine release, particularly epinephrine, which stimulates the cardiovascular system [13-15]. Chronically, there is weak evidence that suggests that in the long term, ST can cause significant elevation of blood pressure and lead to adverse associated events [16-17]; however, the evidence for this has recently been increasing.

Intuitively, ST is compared to smoking, and the results are surprising. Compared to smoking, the effects of ST are limited, as severe cardiovascular pathologies such as intima-media thickening

and atherosclerosis have not been demonstrated to the same degree; while the overall risk of adverse events is lower in exclusive ST users, it is substantially higher in individuals using both, perhaps pointing towards a synergistic pathological mechanism [16-17].

Similarly, a correlation between oral tobacco use and blood pressure control while on medications also has not been authentically established as of writing; Similar to other substance abuse compounds, ST use should lead to altered/elevated blood pressures among patients, but recorded data on this issue, at least for the local population, is inconclusive [18-19]. But, caution must be taken as the debate is only on the degree to which ST affects cardiovascular outcomes, not its detrimental potential. One would expect that with ST reaching epidemic proportions, data on such topics locally would be ample; unfortunately, this is not the case. With this cohort, we explore just a few variables of this deleterious relationship with the best tools available to us and hope to find a correlation of blood pressure control (or lack thereof) with respect to ST use (and its prevalence).

Materials and Methods

This was a prospective cross-sectional study held at Creek General Hospital Karachi, from 23 January 2025 to 23 April 2025. 108 patients age >18, of either gender, who were diagnosed cases of hypertension, who were also using anti-hypertensive medications while simultaneously using ST products, were included in the study using a convenience sampling technique. Sample size was calculated using the OpenEpi sample size calculator using 9.8% prevalence and 5% as margin of error [7]. They had to have been using the oral tobacco for at least 12 months. Patient confidentiality was ensured at all times, and consent was taken each time data was recorded. This study was approved by the ethical board review of United Medical and Dental College, Karachi (Reference no: UMDC/Ethics/2025/01/23/379). Patients with end-stage renal disease, alcoholics, decompensated liver disease, malignancy (of any stage), significant history of systemic disorders, and those with a history of use of quack medication were excluded from the disease. Patients with significant history of use (consumption for >2 weeks in the last year) of the following drugs: antidepressants, corticosteroids and mineral corticoids, herbals products, erythropoietin, estrogens (including birth control pills), immune-suppressants, migraine medicines, nicotine, phentermine (a weight loss medicine), testosterone and other anabolic

steroids and performance-enhancing drugs and thyroid medications were also ineligible for inclusion. Patients with any history of narcotic use at all were excluded. Patients with a history of use of Non-steroidal anti-inflammatory drugs (NSAIDs) were included after taking verbal informed consent.

All data was collected using printed pro forma (s). Patients fulfilling the inclusion criteria were questioned in the presence of doctors at the aforementioned institute. Their bio data and various factors of ST were recorded. Then, three separate readings of blood pressure were recorded by the patients or the duty staff/researcher at said intervals/timings, and these were entered into the overall cohort data. A non-probability convenience sampling technique was used.

Data were analyzed using the SPSS software version 27. For qualitative variables, frequency and percentages were calculated, including gender, type of oral tobacco used, and number of patients using oral tobacco versus non-users. For association analysis, the chi-squared test was used. For the quantitative variables of duration of tobacco use, number of anti-hypertensive medications in use, and blood pressure levels, mean, median, and standard deviation were calculated. Skewness and kurtosis were plotted, checking for normal distribution, and if found (normal), a paired t test was to be used, and a p value of <0.05 was considered significant.

Results

In the three months this study was conducted, 1097 diagnosed hypertensive patients were inquired about ST use, of which 108 responded positively, corresponding to a prevalence of 9.8%. Cohorts were predominantly male with a mean age of 51.33±12.01 years. The vast majority of the patients were not educated at all, and even among those who had received formal education, only 18.6% had managed to pass 12th grade/ intermediate level education; the most common profession among men was personal work (shop keeping, washing, tailoring, etc.), and for women it was being a housewife. All data recorded were from residents of the Karachi urban area. The patient profiles are demonstrated in Table 1.

Table 1. Patient profiles and overall prevalence

Variables	Frequency (Percentage)
Age (mean)	51.33±12.01 years
Gender	
Male	80 (83.3%)
Female	18 (16.7%)
Education level	
Primary level	8 (7.4%)
Secondary level	22 (20.3%)
Intermediate/College	14 (13.0%)
Graduate	6 (5.6%)
None	58 (53.7%)
Occupation	
Self employed	48 (44.4%)
Driver	22 (20.37%)
Labor	14 (13.0%)
House wife	10 (9.25%)
None	14 (13.0%)
Residence	
Urban Karachi	108 (100%)
Prevalence	
Over all questioned	1097
Admission of smokeless tobacco use (as per inclusion criteria)	108
Prevalence rate	9.8%

Clinically, most of the inductees did not have any other comorbidities save hypertension; among the 18.5% with other known comorbidities, Diabetes was recorded most often. The mean duration of ST use was 27.64±15.94 years, and the mean duration since the diagnosis of hypertension was 5.64±6.63 years. All varieties of ST were used with near equal frequency. Throughout the study, ST was used all day and every day with 63% of the patients 'chewing' ST 5 or more times in 24 hours. This adversely affected compliance with medications; only 44.4% of the patients were compliant with regard to their anti-hypertensive drugs. The most commonly prescribed medications were Amlodipine and combination drugs. Blood pressure control was poor among all patients using ST. Three readings were recorded for the purposes of the study, which showed a median blood pressure of 160/90 mmHg, 150/95 mmHg &150/90 mmHg with an overall systolic mean of 154.84±20.18 mmHg and a diastolic mean of 92.76±15.54 mmHg; the overall median BP was 150/90 mmHg. These characteristics are summarized in Table 2.

Table 2. Smokeless tobacco patterns and clinical profiles.

Variables	**Frequency (Percentage)**
Duration of Smokeless tobacco use (mean)	27.64±15.94 years
Duration of since diagnosis of Hypertension (mean)	5.64±6.63 years
Comorbid (other than hypertension)	
Diabetes Mellitus	12 (11.1%)
Other	8 (7.4%)
None	88 (81.4%)
Types of Medications used by patients for HTN	
Amlodipine 5/10 mg	42 (38.9%)
Combination	28 (25.9%)
Multiple	28 (25.9%)
Other	10 (9.25%)
Compliance	
Yes	48 (44.4%)
No	60 (55.6%)

Types of Smokeless tobacco used	
'Mawa'	28 (25.9%)
'Ghuttka'	22 (20.4%)
'Pan'	20 (18.5%)
Chewable tobacco	20 (18.5%)
Combination/Multiple	18 (16.7%)
"Chews" per day of Smokeless tobacco	
3-5	40 (37.0%)
6-10	20 (18.5%)
>10	48 (44.4%)
Time of day smokeless tobacco is used	
Throughout the day	108 (100.0%)
At night	Nil
Other Specific times	Nil
Blood pressure levels	
Overall systolic blood pressure (mean)	154.84±20.18 mmHg
Overall systolic blood pressure (median)	150.00 mmHg
Overall diastolic blood pressure (mean)	92.76±15.54 mmHg
Overall diastolic blood pressure (median)	90.00 mmHg

There was no statistical significance with respect to blood pressure control with the variables of time since ST use, compliance with medication, gender, age of the patients, daily chews of ST, comorbidities, and time since diagnosis of hypertension. These values are summarized in Table 3.

Table 3. Association between various parameters and blood pressure control with respect to smokeless tobacco use.

Parameter	N	Systolic blood pressure (mean)	P-value	Diastolic blood pressure (mean)	P-value
Age					
>45 years	64	156.45±20.92	0.4722	91.25±17.72	0.4451
≤45 years	44	152.42±18.81		94.54±11.25	
Hypertension duration					
>5 years	24	157.00±23.34	0.5657	90.55±17.55	0.5069
≤5 years	84	154.04±19.14		93.17±14.84	
Smokeless tobacco usage duration					
≤10 years	16	153.75±22.61	0.8196	97.91±13.50	0.1359
≥10 years	92	155.00±19.75		91.66±15.64	
Chews per day					
>5	68	154.90±20.76	0.9698	92.54±16.02	0.9525
≤5	40	159.66±19.17		92.66±14.59	
Comorbidities					
Present	20	156.00±24.71	0.7707	88.66±18.14	0.2089
Absent	88	154.54±19.03		93.48±14.72	
Compliance to medication					
Yes	48	152.36±22.04	0.2589	89.56±16.22	0.0686
No	60	156.77±18.34		95.0±14.47	
Gender					
Male	90	153.25±19.34	0.0715	92.88±14.70	0.6589

Female	18	162.59±22.46		91.11±19.08	

Discussion

The prevalence of ST use in the Pakistani population is approximately 8% [2], while the prevalence of hypertensive patients is about 19% [20]. Separately, these two groups represent a massive proportion of the population and an even greater health care challenge; how much these two groups overlap is a very concerning question. The prevalence of ST use among hypertensives in our cohort was 9.8%, just slightly over the national average. Other characteristics of ST use, such as a higher incidence among men, acquisition of ST use in adolescence or young adulthood, variety of ST and time since usage with (inverse) correlation to education levels, were concordant with previous national reports [21-24]. This suggests that ST use among hypertensive patients has a similar substance abuse pattern as those not affected by the presence of cardiovascular diseases (or other comorbidities for that fact).

The pattern of ST usage is quite similar in Bangladesh, India, and Pakistan; the disparities are nominal [25]. In all three countries, all varieties of ST are used with high frequency. The usage is mostly habitual rather than recreational, i.e., multiple chews are made throughout the day; almost without exception, ST use is a daily based phenomenon, whereby users indulge in its consumption at work, home, or otherwise at any given time of the day [2-3]. All of our patients used ST daily, with multiple chews per day, and all varieties of ST were consumed with near even distribution; our results are in line with preceding data.

Adherence to anti-hypertensive medications is adversely affected by low socioeconomic status and low education levels [7]. These two factors are quite common among ST users. Likewise, compliance with tobacco cessation or medications for other purposes among ST users is also hampered [15]. Combine these variables, and you have a major health problem. Just over 55% of our patients were non-compliant/adherent to the anti-hypertensive medications prescribed to them. This non-compliance in most cases was long-term, as patients would go weeks to months without taking proper drugs, only using them if they 'felt' like having symptoms of hypertension. We cannot state with certainty whether this non-adherence was solely due to ST use or if it represented a deeper cultural problem. What we can objectively declare is that the rates of non-compliance are much higher among ST users with hypertension than either of the two groups alone.

The evidence of the negative impact of ST on overall cardiovascular health and blood pressure control has been mounting for the better part of the last half a century [11]. Our results mirror most of the findings from these reports. The median systolic and diastolic blood pressures were 150mmHg and 90mmHg, respectively. The mean pressures were quite similar as well. The most striking finding of our study was that these elevated pressures among ST users were not significantly (therefore clinically as well) affected by age, gender, duration of ST use, time since diagnosis of hypertension, presence of comorbidities, consumption of ST per day, and compliance to medications. This essentially establishes ST use as an independent risk factor for adverse cardiovascular outcomes and poor blood pressure control, even with proper medication.
Nutritional status of the patients was not evaluated, nor was a blood workup done to evaluate any other biochemical abnormalities that may affect blood pressure control. Concomitant use of other medications was not evaluated; however, it was ensured that no patient was using quack medications at all. Adherence to an anti-hypertensive diet, such as minimal use of salt, processed food, junking, etc., was neither asked about nor analyzed.

Conclusions

The overall prevalence of ST use among hypertensive patients is nearly equal to the general population; ST use adversely affects blood pressure control irrespective of compliance to medications, age of the patients, presence of comorbidities, duration of ST use, and 'chews' of ST per day. As such, complete abstinence from ST is recommended in these patients.

Ethical approval: Ethical approval was taken from United Medical & Dental College (Reference no: UMDC/Ethics/2025/01/23/379. The research was conducted in compliance with ethical standards, adhering to the Declaration of Helsinki (1975, revised in 2013) and relevant national regulations. All authors confirm that this study did not involve animal subjects or tissue.
Informed consent: Verbal consent was obtained from the subjects.
Human and animal rights: Consent was obtained or waived by all participants in this study.
Data availability: Data sharing does not apply to this article, as no new data were created or analyzed in this study.
Authors contribution:

1. Conceptualization and methodology: Syed Jibran Ashraf, Muhammad Ali Khan

2. Statistical analysis: Syed Jibran Ashraf, Muhammad Ali Khan
3. Data curation: Rahmat Ali, Qaiser Iqbal, Mehmooda Wasim, Farhan Haleem
4. Write-up, review, and editing: Syed Jibran Ashraf, Muhammad Ali Khan, Rahmat Ali, Qaiser Iqbal, Mehmooda Wasim, Farhan Haleem

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References:

1. Siddiqui F, Croucher R, Ahmad F, Ahmed Z, Babu R, Bauld L, Fieroze F, Huque R, Kellar I, Kumar A, Lina S, Mubashir M, Nethan ST, Rizvi N, Siddiqi K, Kumar Singh P, Thomson H, Jackson C. Smokeless Tobacco Initiation, Use, and Cessation in South Asia: A Qualitative Assessment. Nicotine Tob Res. 2021 Aug 29;23(10):1801-1804. Doi: 10.1093/ntr/ntab065.
2. Coyle K, Singh PK, Kaushik R, Huque R, Khan Z, Mehrotra R, Siddiqi K, Pokhrel S. The Lifetime Health and Economic Burden of Smokeless Tobacco use in Bangladesh, India, and Pakistan: Results From ASTRAMOD. Nicotine Tob Res. 2024 May 8067. Doi: 10.1093/ntr/ntae067.
3. Chatterjee S, Gawde NC, Gupta PC. Prevalence, Reach of Anti-smokeless Tobacco Messages and Quit Attempts by Product Type: A Secondary Data Analysis from the Global Adult Tobacco Survey (GATS - 2016-17). Asian Pac J Cancer Prev. 2024 Apr 1;25(4):1277-1283. Doi: 10.31557/APJCP.2024.25.4.1277.
4. Benowitz NL, Liakoni E. Tobacco use disorder and cardiovascular health. Addiction. 2022 Apr;117(4):1128-1138. Doi: 10.1111/add.15703
5. Oguanobi NI, Chijioke CP, Ghasi SI, Nubila NI, Nwoke OC, Okolo CC. Impact of Smokeless Tobacco on Cardiovascular Disease Risk in a Nigerian Metropolitan City. CardiovascToxicol. 2024 May 6. Doi: 10.1007/s12012-024-09862-5

6. Gupta R, Gupta N, Khedar RS. Smokeless tobacco and cardiovascular disease in low- and middle-income countries. Indian Heart J. 2013 Jul-Aug;65(4):369-77. Doi: 10.1016/j.ihj.2013.06.005.
7. Sajid F, Bano S. Effects of smokeless dipping tobacco (Naswar) consumption on antioxidant enzymes and lipid profile in its users. Pak J Pharm Sci. 2015 Sep;28(5 Suppl):1829-33
8. Rao Ch S, Subash Y E. The effect of chronic tobacco smoking and chewing on the lipid profile. J Clin Diagn Res. 2013 Jan;7(1):31-4. Doi: 10.7860/JCDR/2012/5086.2663.
9. Khurana M, Sharma D, Khandelwal PD. Lipid profile in smokers and tobacco chewers--a comparative study. J Assoc Physicians India. 2000 Sep;48(9):895-7.
10. Swislocki, A., Tsuzuki, A., Tait, M., Khuu, D., & Fann, K. (1997). Smokeless nicotine administration is associated with hypertension but not with a deterioration in glucose tolerance in rats. Metabolism: clinical and experimental, 46 9, 1008-12. Doi:10.1016/S0026-0495(97)90270-5
11. Wolk, R., Shamsuzzaman, A., Svatikova, A., Huyber, C., Huck, C., Narkiewicz, K., & Somers, V. (2005). Hemodynamic and autonomic effects of smokeless tobacco in healthy young men. Journal of the American College of Cardiology, 45 6, 910-4. Doi: 10.1016/J.JACC.2004.11.056
12. Squires, W., Squires, W., Brandon, T., Zinkgraf, S., Bonds, D., Bonds, D., Hartung, G., Murray, T., Jackson, A., & Miller, R. (1984). Hemodynamic effects of oral smokeless tobacco in dogs and young adults. Preventive medicine, 13 2, 195-206. Doi: 10.1016/0091-7435(84)90051-3
13. Lee, P. (2007). Circulatory disease and smokeless tobacco in Western populations: a review of the evidence. International journal of epidemiology, 36 4, 789-804. Doi:10.1093/IJE/DYM039
14. Mushtaq N, Sarwar Z, Kouplen K, Ahmed R, Beebe LA. Association of Cardiovascular Disease Risk Factors with Exclusive Smokeless Tobacco Use among US Males: Cross-Sectional Analysis of NHANES Data 2003-2018. Am J Health Promot. 2023 Jun;37(5):614-624. Doi: 10.1177/08901171221141980.
15. Ali R, Loney T, Al-Houqani M, Blair I, Aziz F, Al Dhaheri S, El Barazi I, Soteriades ES, Shah SM. Cigarette smoking and smokeless tobacco use among male south Asian

migrants in the United Arab Emirates: a cross-sectional study. BMC Public Health. 2020 May 30;20(1):815. Doi: 10.1186/s12889-020-08942-9

16. Elahi A, Ali AA, Khan AH, Samad Z, Shahab H, Aziz N, Almas A. Challenges of managing hypertension in Pakistan - a review. Clin Hypertens. 2023 Jun 15;29(1):17. Doi: 10.1186/s40885-023-00245-6.
17. Karim AA, Inam S, Zaidi AB. Inadequate checks on smokeless tobacco usage in Pakistan: cultural heritage or policy neglect? J Pak Med Assoc. 2020 Jan;70(1):134-138. Doi: 10.5455/JPMA.6459
18. Khan Z, Suliankatchi RA, Heise TL, Dreger S. Naswar (Smokeless Tobacco) Use and the Risk of Oral Cancer in Pakistan: A Systematic Review with Meta-Analysis. Nicotine Tob Res. 2019 Jan 1;21(1):32-40. Doi: 10.1093/ntr/ntx281.
19. Ochani S, Ochani A, Ochani K. Naswar, a Smokeless Tobacco: Awareness and Regulation in Pakistan. Asia Pac J Public Health. 2022 Sep;34(6-7):741-742. Doi: 10.1177/10105395221109520
20. Zhao L, Mbulo L, Twentyman E, Palipudi K, King BA. Disparities in smokeless tobacco use in Bangladesh, India, and Pakistan: Findings from the Global Adult Tobacco Survey, 2014-2017. PLoS One. 2021 Apr 22;16(4): e0250144. Doi: 10.1371/journal.pone.0250144
21. Singh L, Jain P, Kumar C, Singh A, Lal P, Yadav A, Singh PK, Singh S. Trends in age of tobacco use initiation over time in Bangladesh, India and Pakistan: analysis of cross-sectional nationally representative surveys. BMJ Open. 2023 Dec 9;13(12): e067875. Doi: 10.1136/bmjopen-2022-067875.
22. Mamaghani EA, Hasanpoor E, Maghsoodi E, Soleimani F. Barriers to Medication Adherence among Hypertensive Patients in Deprived Rural Areas. Ethiop J Health Sci. 2020 Jan;30(1):85-94. Doi: 10.4314/ejhs. v30i1.11.
23. Lor M, Koleck TA, Bakken S, Yoon S, Dunn Navarra AM. Association Between Health Literacy and Medication Adherence Among Hispanics with Hypertension. J Racial Ethn Health Disparities. 2019 Jun;6(3):517-524. doi: 10.1007/s40615-018-00550-z. Epub 2019 Jan 3. Erratum in: J Racial Ethn Health Disparities. 2019 Oct;6(5):1052. Doi: 10.1007/s40615-019-00588-7.

24. Singh PK, Dubey R, Singh L, Singh N, Kumar C, Kashyap S, Subramanian SV, Singh S. Mixed Effect of Alcohol, Smoking, and Smokeless Tobacco Use on Hypertension among Adult Population in India: A Nationally Representative Cross-Sectional Study. Int J Environ Res Public Health. 2022 Mar 9;19(6):3239. Doi: 10.3390/ijerph19063239
25. Oguanobi NI, Chijioke CP, Ghasi SI, Nubila NI, Nwoke OC, Okolo CC. Impact of Smokeless Tobacco on Cardiovascular Disease Risk in a Nigerian Metropolitan City. Cardiovasc Toxicol. 2024 Aug;24(8):727-736. Doi: 10.1007/s12012-024-09862-5.