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Prevalence of Tobacco use and Nicotine Dependence in Patients with Diabetes and Hypertension

Ibrahim Shah[1]✉, Saif Ullah[2], Samiullah Khan[3], Umer Ibrahim Paracha[1], Akhtar Sher[4], Matiullah Khan[4]

[1]Department of Cardiology, Bacha Khan Medical Complex/Gajju Khan Medical College, Swabi – Pakistan [2]Department of Cardiology, Pak Medical Center and Hospital, Peshawar – Pakistan [3]Department of Cardiology, District Headquarter Hospital/Bannu Medical College, Bannu – Pakistan [4]District of Cardiology, District Health Quarter Hospital/Gajju Khan Medical College, Swabi - Pakistan

Corresponding Author:
Ibrahim Shah
Department of Cardiology,
Bacha Khan Medical Complex/Gajju Khan Medical College,
Swabi - Pakistan
Email: ibrahimshahcpsp@gmail.com

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A B S T R A C T

Background: Tobacco use is a significant risk factor for numerous chronic diseases, including diabetes and hypertension, which are already associated with high morbidity and mortality rates. Understanding the patterns of tobacco use and nicotine dependence in patients with diabetes and hypertension is crucial for developing effective interventions to improve health outcomes.

Objective: To estimate the prevalence of tobacco, use and nicotine dependence among adult diabetic and/or hypertensive patients.

Methodology: A cross-sectional study was conducted at Bacha Khan Medical Complex from February 2022 to October 2022. This study included patients with Diabetes and hypertension. For study purpose, Fagerstrom Test for Nicotine Dependence (FTND) to assess nicotine dependence and pre-test for tobacco use was used.

Results: The study of 250 patients with diabetes and hypertension found a higher tobacco use among males (36%) compared to females (11%). Tobacco use was more common in patients with secondary education (27.1%) and in earners. Moderate nicotine dependence was most prevalent among both smokers and smokeless tobacco users. Longer tobacco use duration and starting at 24 years or older were linked to higher dependence.

Conclusion: In conclusion, tobacco use is more prevalent among male patients with diabetes and hypertension, with moderate nicotine dependence being common in both smokers and smokeless tobacco users. Socio-demographic factors such as education level, marital status, and earning status influence tobacco use, while age and duration of tobacco use are significant predictors of nicotine dependence. Despite these associations, income and education levels did not show a direct link to higher dependence.

Keywords: Smokers; Diabetes Mellitus; Hypertension; Swabi

Introduction

Tobacco use is one of the most preventable causes of morbidity and mortality worldwide, contributing significantly to various non-communicable diseases, including cardiovascular diseases, chronic respiratory conditions, and cancers.[1] Among individuals with diabetes and hypertension, tobacco use poses an even greater health risk, accelerating complications associated with these chronic conditions.[2] The primary addictive component of tobacco, nicotine, is a potent stimulant that promotes dependence by interacting with the central nervous system and altering dopamine release. Nicotine dependence remains a substantial barrier to smoking cessation, as physiological and psychological dependencies reinforce long-term use. Understanding the implications of tobacco use and nicotine dependence in populations with pre-existing health conditions, such as diabetes and hypertension, is essential to developing effective interventions that minimize health risks and improve quality of life.

Diabetes mellitus and hypertension are two of the most common chronic diseases affecting millions globally.[3] Both conditions require consistent management to prevent life-threatening complications, including cardiovascular disease, stroke, and kidney failure. Smoking in individuals with diabetes worsens blood sugar control and amplifies the risk of diabetic complications, such as retinopathy, nephropathy, and neuropathy. Similarly, in hypertensive patients, tobacco use exacerbates blood pressure variability, reduces endothelial function, and accelerates atherosclerosis, increasing the likelihood of adverse cardiovascular events.[4] Despite these risks, a significant proportion of individuals with diabetes and hypertension continue to use tobacco products, underscoring the challenges of nicotine dependence and the need for targeted smoking cessation strategies within these patient groups.

Tobacco use has a unique and multifaceted effect on individuals with diabetes and hypertension due to the metabolic and vascular changes induced by nicotine and other harmful substances in tobacco products.[5] In diabetic patients, nicotine exposure impairs insulin sensitivity and disrupts glucose homeostasis by stimulating catecholamine release and inducing lipolysis. This results in increased free fatty acid levels, which antagonize insulin action, leading to poor glycemic control and heightened insulin resistance. Furthermore, tobacco use promotes oxidative stress and inflammation, both of which are pivotal in the pathogenesis of diabetes complications. Studies have shown that smokers with diabetes exhibit higher levels of oxidative stress markers and inflammatory cytokines than non-smokers, suggesting a synergistic interaction that accelerates the progression of diabetic complications.[6,7]

In patients with hypertension, tobacco use causes transient and sustained elevations in blood pressure due to nicotine's stimulatory effect on the sympathetic nervous system. Nicotine triggers the release of catecholamines, such as adrenaline and noradrenaline, which constrict blood vessels and increase heart rate and cardiac output.[6] This vasoconstrictive response contributes to the pathophysiology of hypertension and worsens blood pressure control in hypertensive patients. Long-term exposure to tobacco smoke also promotes endothelial dysfunction and vascular stiffness, further elevating blood pressure and enhancing atherosclerosis development. These mechanisms illustrate how tobacco use exacerbates the pathophysiological processes underlying diabetes and hypertension, highlighting the need for effective management strategies for these high-risk populations.

Nicotine dependence is a significant challenge among individuals with diabetes and hypertension due to the highly addictive nature of nicotine and the habitual nature of smoking.[8] According to studies, smokers with chronic diseases are more likely to face difficulties with cessation due to the physiological and psychological dependence on nicotine. This dependence is fueled by complex neurobiological mechanisms where nicotine acts on nicotinic acetylcholine receptors in the brain, releasing dopamine and reinforcing rewarding behavior. The addictive properties of nicotine, combined with the habitual patterns associated with smoking, make it particularly challenging for patients to quit, even when they are aware of the health risks associated with continued use.

Moreover, nicotine dependence is often exacerbated by psychological factors, including stress, anxiety, and depression, which are prevalent among patients managing chronic illnesses. For individuals with diabetes and hypertension, these psychological factors may be compounded by the stress of disease management, the fear of complications, and socioeconomic constraints. Consequently, nicotine dependence in these patients can be persistent and resistant to standard smoking cessation interventions, requiring more personalized and integrated approaches to promote successful cessation outcomes.

Given the heightened risks associated with tobacco use and nicotine dependence in diabetic and hypertensive populations, there is an urgent need for targeted interventions that address both the physiological and psychological aspects of smoking cessation.[8] Conventional cessation strategies, such as counseling, pharmacotherapy, and nicotine replacement therapies, may be less effective in this group due to the complexity of managing nicotine dependence alongside chronic disease management. Therefore, integrated approaches that incorporate behavioral support, pharmacological aids, and close monitoring of metabolic and cardiovascular health may offer greater efficacy. Tailored

Table 1. Baseline Socio-demographic characteristics of the study cases

Variable	Frequency (%)
Age group (in years)	
18 – 45	74 (29.6)
46–60	75 (30)
≥ 61	101 (40.4)
Earning status	
Not earning	196 (78.4)
Earning	54 (21.6)
Education status	
No education	75 (30)
Less than primary	50 (20)
Primary education	44 (17.6)
Secondary and above	81 (32.4)
Monthly family income	
0 – 20,000	55 (22)
20,001 – 50,000	115 (46)
>50,000	80 (32)

interventions, which consider the specific challenges faced by diabetic and hypertensive patients, are essential to mitigating the detrimental effects of tobacco use and improving long-term health outcomes.

Data on nicotine dependence among smokers with diabetes and hypertension is sparse. The information on tobacco use and nicotine dependence will help in planning and implementation of the tobacco cessation or control strategy effectively among tobacco users with hypertension and diabetes. Therefore, we conducted this study to estimate the prevalence of tobacco use and nicotine dependence among diabetic and hypertension patients in Swabi, Khyber Pakhtunkhwa.

Objective

To estimate the prevalence of tobacco use and nicotine dependence among adult diabetic and/or hypertensive patients.

Methodology

This cross-sectional study was conducted at a district-level hospital in Swabi, Pakistan from February 2022 to October 2022. Study cases were selected according to inclusion criteria of the study. For study purposes, special questionnaire was created from where data were entered into Microsoft Excell and SPSS for analysis purposes.

As smokers play key role in this study and in this study all those cases, which either smoking or the use of smokeless tobacco within the past seven days are added to tobacco user group. Thes cases were also further assessed for different types of data, like which type of tobacco they used, in which frequency, in which age, from how many years and any attempts to quit within the previous month. Participants who used both smoked and smokeless tobacco were categorized based on which type they used more frequently. This was determined by the amount and length of time they used each form.

To assess nicotine dependence among current tobacco users, we employed the revised Fagerström Test for Nicotine Dependence (FTND) for smokers and smokeless tobacco users.[9] The FTND includes multiple items, with a total score ranging from 0 to 10. Nicotine dependence was categorized as low (0–3), moderate (4–6), or high (7–10) based on these scores.[10]

Descriptive analyses were performed to assess the prevalence and patterns of tobacco use. The prevalence of tobacco use was presented as a proportion with a 95% confidence interval. Nicotine dependence among current users was categorized based on the Fagerström Test for Nicotine Dependence (FTND) score. Bivariable and multivariable logistic regression analyses were utilized to identify factors associated with tobacco use and moderate to high nicotine dependence (defined as an FTND score of ≥4). Variables with a p-value <0.2 in the bivariable analysis were considered for inclusion in the multivariable logistic regression model. For individuals who used both smoked and smokeless forms of tobacco, the predominant form was selected for analysis.

Results

The present study included 250 patients diagnosed with diabetes and hypertension, of whom 109 (43.6%) were male and 141 (56.4%) were female, indicating a higher prevalence of these conditions among females (Figure 1).

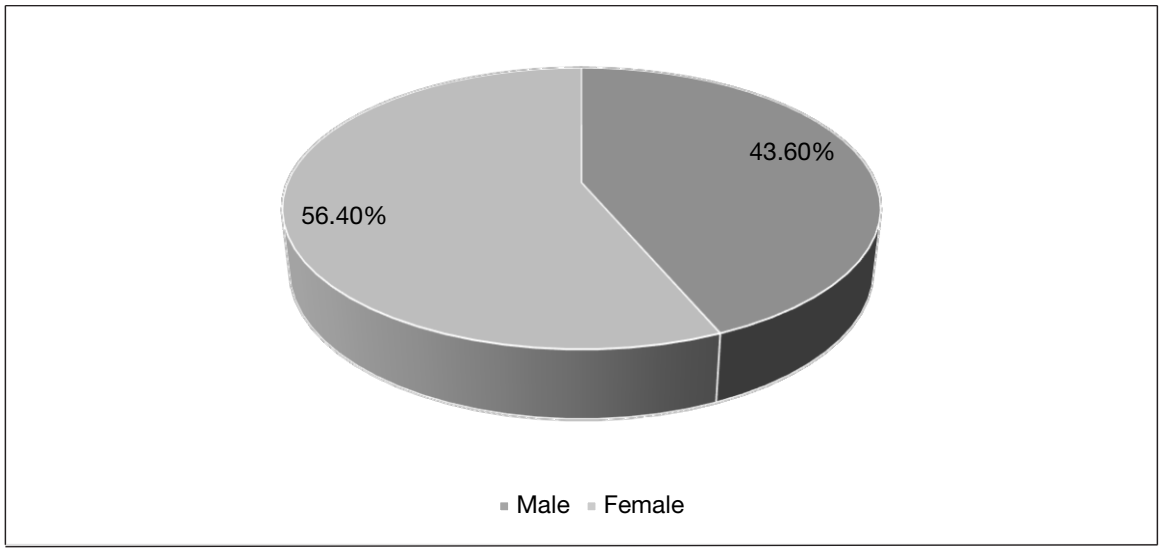

Figure 1. Gender base distribution of study cases

Regarding marital status, a significant majority, 196 (78.4%), were currently married, while 54 (21.6%) were either unmarried (Figure 2).

The age distribution showed that 29.6% of the patients were aged between 18 and 45 years, 30% were between 46 and 60 years, and the largest group, 40.4%, were aged 61 years or older. Most of the patients (78.4%) were not earning, reflecting potential economic dependency, with only 21.6% of the cohort being earners. Education levels varied, with 30% having no formal education, 20% having less than primary education, 17.6% completing primary education, and 32.4% achieving secondary education or higher. Economic status, as measured by monthly family income, showed that 22% of the patients earned up to Rs. 20,000 and 32% of the study cases earned more than Rs. 50,000 (Table 1).

Nicotine dependence was assessed among 64 current tobacco users, including 40 predominant smokers and 24 smokeless tobacco users. Among smokers, 30% exhibited low nicotine dependence, while 50% had moderate dependence, and 20% were classified with high dependence. In the group of smokeless tobacco users, 33.3% showed low dependence, 50% had moderate dependence, and 16.6% were categorized as highly dependent. These findings highlight a significant prevalence of moderate nicotine dependence among both smoker categories, with a slightly higher rate of high dependence in smokers compared to smokeless tobacco users (Table 2).

Bivariable and multivariable analyses explored the relationship between socio-demographic factors and tobacco use among the patients. Male patients were significantly more likely to use tobacco, with 36% of males using tobacco compared to 11% of females. The adjusted odds ratio (aOR) of 5.7 indicates a strong association between male gender and tobacco use. Education level also influenced tobacco use; patients with secondary education and above had a higher usage rate (27.1%), although this association was not significant after adjustment (aOR 0.8). Marital status showed that

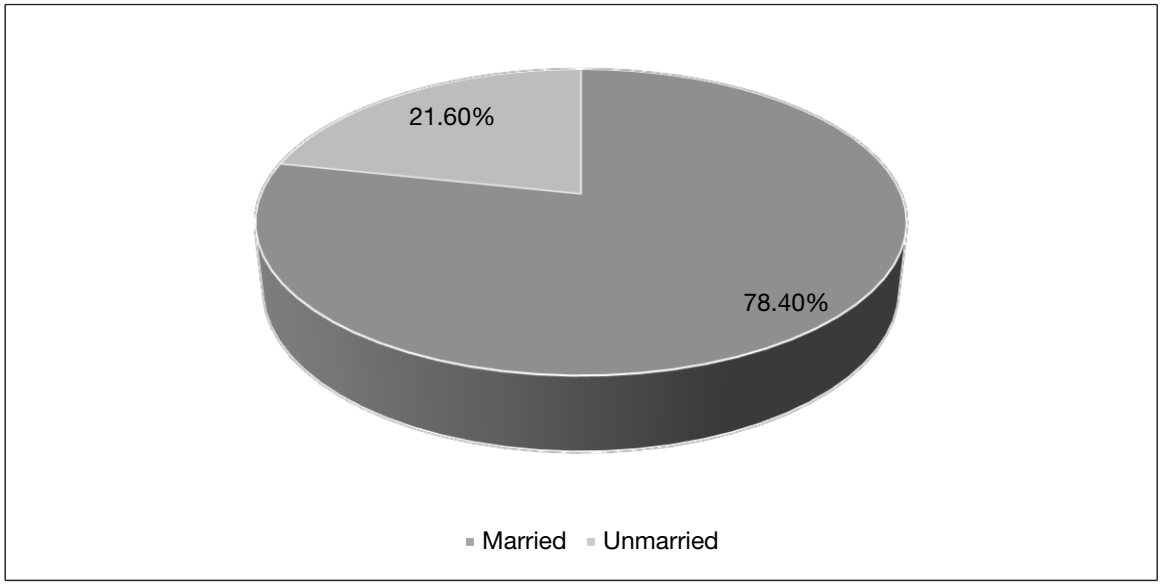

Figure 2. Marital status of study cases

those currently married were less likely to use tobacco (24.4%) compared to those not married (14.8%). Earning status indicated a notable association, where non-earning patients were less likely to use tobacco compared to earners (aOR 0.77). Age group and family income did not show significant associations with tobacco use (Table 3).

Among 64 tobacco users, moderate to high nicotine dependence (FTND score ≥4) was examined concerning various socio-demographic and behavioral factors. Predominantly smokeless tobacco users displayed slightly higher rates of moderate to high nicotine dependence (71.4%) compared to smokers (58.3%), though this was not statistically significant. The age at which tobacco use began also influenced dependence levels; patients who started using tobacco at 24 years or older had higher dependence (64.5%) compared to those who started earlier (54.5%). The duration of tobacco use showed that longer use (≥23 years) correlated with higher dependence (62.8%). Younger patients (16-58 years) demonstrated a higher likelihood of nicotine dependence (66.6%) compared to older patients (≥59 years), with a significant crude odds ratio (cOR) of 2.5. Income and education levels did not show a significant association with higher nicotine dependence (Table 4).

Discussion

The present study provides comprehensive insights into the socio-demographic characteristics and tobacco use behaviors among patients with diabetes and hypertension. The findings underscore significant patterns, which merit detailed discussion and comparison with other literature.

Our study revealed a notable gender disparity in tobacco use, with males being significantly more likely to consume tobacco than females (36% vs. 11%). This aligns with findings from a study by Gupta et al. (2019), which reported higher tobacco use among males in South Asian populations due to cultural and social norms that discourage female tobacco consumption.[11] Similarly, a study by Mishra et al. (2018) observed a male predominance in tobacco use, suggesting that gender roles and accessibility contribute to this disparity. However, our

Table 2. Level of nicotine dependence among smokers and smokeless users

Level of Nicotine Dependence	Current Predominant Smokers, n (%)	Current Predominant Smokeless Tobacco Users, n (%)
Low (0 - 3)	12 (30.0)	8 (33.3)
Moderate (4 - 6)	20 (50.0)	12 (50.0)
High (7 - 10)	8 (20.0)	4 (16.6)

Table 3. Factors associated with tobacco users among study cases

Variables	Tobacco Users (%)	p-value	Bivariable Analysis cOR (95% CI)	Multivariable Analysis	p-value
Gender					
Male (109)	12 (11%)	<0.001	1	1	<0.001
Female (141)	52 (36%)		5.0 (3.0–8.5)	5.7 (2–11.8)	
Age group (in years)					
18-45 (4)	16 (21.6%)		1		
46-60 (75)	14 (18.6%)	0.789	0.7 (0.6–1.5)		
≥61 (101)	23 (22.7%)	0.768	1.3 (0.8–2.0)		
Education Status					
No education (75)	11 (14.6%)		1	1	
Less than primary (50)	9 (18%)	0.651	1.3 (0.4–2.7)	0.8 (0.5–1.3)	0.12
Primary education (44)	11 (25%)	0.201	1.9 (0.6–3.3)	0.9 (0.5–1.5)	0.4
Secondary and above (81)	22 (27.1%)	0.030	1.7 (1.07–3.4)	0.8 (0.5–1.5)	0.21
Marital Status					
Currently married (196)	48 (24.4%)	0.045	2.3 (1.2 – 4.0)	1.4 (0.6–3.4)	0.101
Currently not married (54)	8 (14.8%)		1	1	
Family Income					
0 - 20000 (55)	12 (21.8%)		1		
20001 - 50000 (115)	22 (19.1%)	0.349	0.6 (0.7–1.3)		
>5000 (80)	19 (23.7%)	0.876	1.06 (0.7–1.5)		
Earning Status					
Not earning (196)	37 (18.8%)		1	1	
Earning (54)	18 (33.3%)	0.002	2.4 (1.5–3.6)	0.77 (0.4–1.5)	0.876

adjusted odds ratio (aOR) of 5.7 indicates an even stronger association than the aforementioned studies, emphasizing the urgent need for gender-specific tobacco cessation interventions.[12] The stark gender disparity observed in our study, where males were significantly more likely to consume tobacco than females, underscores the deeply entrenched cultural and societal influences on smoking behavior in this population. The aOR of 5.7 highlights a stronger association compared to prior studies, suggesting that the factors influencing tobacco use may be more pronounced or complex in our study setting. This could be attributed to greater social

Table 4. Factors associated with level of nicotine dependence among study cases

Variables	Patients with high nicotine dependence	Bivariable analysis cOR (95%CI)	p-value	Multi analysis aOR (95%CI)	p-value
Predominant tobacco type					
Smoke (n=36)	21 (58.3%)	1		1	
Smokeless (n=28)	20 (71.4%)	1.7 (0.5–5.4)	0.201	1.6 (0.5–4.5)	0.189
Age of starting tobacco use					
≤ 23 yrs (n=33)	18 (54.5%)	1			
≥ 24 yrs (n=31)	20 (64.5%)	1.3 (0.7–2.9)	0.564		
Duration of tobacco use					
≤ 22 yrs (n=29)	15 (51.7%)	1			
≥ 23 yrs (n=35)	22 (62.8%)	1.5 (0.5–3.7)	0.189		
Gender					
Female (n=22)	13 (59.09%)	1			
Male (n=42)	25 (59.5%)	1.7 (0.7–3.4)	0.434		
Age group (in years)					
16-58 (n=27)	18 (66.6%)	2.5 (1.3–6.5)		1.9 (0.09–5.9)	
≥ 59 (n=37)	21 (56.7%)	1	0.021	1	0.039
Education status					
≤ 4th standard (n=30)	19 (63.3%)	1			
≥ 5th standard (n=34)	20 (58.8%)	0.7 (0.3–2.4)	0.879		
Income status					
Not earning (n=40)	23 (57.5%)	1			
Earning (n=24)	16 (66.6%)	2.5 (0.4–2.6)	0.657		
Monthly family income					
≤ 11000 (n= 28)	17 (60.7%)	1			
≥ 11001 (n=36)	22 (611%	1 (0.6–2.5)	0.876		

acceptability of tobacco use among men, higher exposure to tobacco marketing targeted at males, or differing stress-coping mechanisms between genders. Conversely, restrictive cultural norms, limited accessibility, and fear of social stigma likely deter women from engaging in tobacco use. These findings not only align with but also amplify the conclusions of Gupta et al. (2019) and Mishra et al. (2018), reinforcing the necessity for targeted interventions. The data advocate for culturally sensitive and gender-specific tobacco cessation programs, alongside broader public health strategies aimed at reducing the overall prevalence of tobacco use.

Education emerged as a significant factor, with patients having secondary education or higher demonstrating a higher prevalence of tobacco use (27.1%), though the association was not significant after adjustment. This contrasts with findings by Venkatesh et al. (2020), who reported an inverse relationship between education level and tobacco use, highlighting that higher education typically correlates with greater health awareness and reduced tobacco consumption.[13] However, our results suggest that even educated individuals might not always translate knowledge into healthier behaviors, underscoring the need for targeted educational campaigns regardless of education levels. These findings highlighted that limited education often correlates with reduced awareness of the health risks associated with tobacco use and lower access to cessation resources. Individuals with higher education levels may possess better health literacy, enabling them to understand and act upon public health messages discouraging tobacco use. Furthermore, lower educational attainment is often associated with socioeconomic disadvantages, which can increase stress and make tobacco use a coping mechanism. Findings of theses studies indicates that education plays a critical role in shaping tobacco use behaviors, underscoring the need for targeted educational campaigns and policies to bridge this knowledge gap and promote healthier choices among less-educated populations.

The study found that married individuals were less likely to use tobacco (24.4%) compared to unmarried counterparts (14.8%). This is consistent with the work of Lee et al. (2017), who found that marriage often acts as a protective factor against tobacco use, potentially due to increased familial responsibilities and support.[14] Another study by Singh et al. (2016) similarly highlighted the role of marital status in reducing risk behaviors, including smoking.[15] Our findings reaffirm the importance of considering social support systems in designing tobacco cessation programs. Our study identified a notable association between marital status and tobacco use, with unmarried individuals showing higher rates of consumption. This aligns with research suggesting that married individuals often experience greater social support and accountability, which may discourage tobacco use. Conversely, unmarried individuals may face higher stress levels, loneliness, or fewer social constraints, leading to increased tobacco consumption as a coping mechanism.

Economic status appeared to influence tobacco use, with non-earning patients less likely to use tobacco than earners. This is comparable to findings by Patel et al. (2019), which suggested that economic dependency could reduce tobacco use due to financial constraints.[16] However, our study's aOR of 0.77 indicates a nuanced interaction, suggesting that earning individuals might have more disposable income to spend on tobacco. Similarly, a study by Choi et al. (2018) reported that financial independence often correlates with higher tobacco consumption, emphasizing the need for economic considerations in tobacco control policies.[17]

Nicotine dependence was predominantly moderate to high among both smokers (70%) and smokeless tobacco users (71.4%). This aligns with findings from Sinha et al. (2021), who reported similar dependence patterns in Indian populations.[18] Additionally, Ghosh et al. (2020) observed comparable dependence rates, indicating that both forms of tobacco present substantial addiction risks.[19] Our study's findings support the need for robust intervention strategies targeting both smokers and smokeless tobacco users to mitigate nicotine dependence effectively.

The age at initiation and duration of tobacco use significantly influenced nicotine dependence. Those who began tobacco use at 24 years or older showed higher dependence rates (64.5%), similar to the results of Sharma et al. (2020), who found that later initiation correlates with greater addiction severity.[20] Prolonged use (≥23 years) was also associated with higher dependence, mirroring findings by Kumar et al. (2017) that longer duration of tobacco use exacerbates dependence.[21] These insights highlight the critical need for early preventive measures to curb tobacco initiation and reduce long-term dependency.

Interestingly, younger patients (16-58 years) exhibited higher nicotine dependence (66.6%) than older patients (≥59 years), with a significant crude odds ratio (cOR) of 2.5. This finding contrasts with previous research by Jha et al. (2020), which reported lower dependence among younger individuals, potentially due to shorter use duration.[22] However, our study suggests that younger patients may have more intense usage patterns, necessitating targeted cessation interventions for this age group.

This study elucidates the intricate dynamics of tobacco use and nicotine dependence among patients with diabetes and hypertension. Our findings underscore the multifaceted influences of gender, education, marital status, economic status, and age on tobacco behaviors, echoing and occasionally diverging from the broader literature. These insights pave the way for tailored intervention strategies to address tobacco use and its associated dependencies effectively.

Conclusion

In conclusion, our study provides critical insights into the multifaceted factors influencing tobacco use among patients with diabetes and hypertension, emphasizing the interplay between socio-demographic variables and nicotine dependence. The findings underscore the urgent need for tailored, culturally sensitive tobacco cessation strategies that address gender, education, marital status, and economic factors. Additionally, the observed patterns of nicotine dependence, particularly among younger individuals and those with prolonged tobacco use, highlight the importance of early intervention and sustained support to prevent initiation and reduce dependency. These findings not only align with existing literature but also reveal context-specific nuances, reinforcing the necessity for holistic public health approaches to mitigate the burden of tobacco-related health risks in vulnerable populations. Future research should explore longitudinal impacts and intervention outcomes to build on these insights and inform effective policy implementation.

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