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Original Research Article

Maternal Smokeless Tobacco Consumption and Its Association with Spontaneous Abortion: A Study in a Bangladeshi Tertiary Hospital

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Abstract: ***Background*:** Smokeless tobacco use among women of reproductive age is a significant public health issue, particularly in low- and middle-income countries where it is culturally ingrained and underreported. This study explores the association between prolonged maternal smokeless tobacco use and adverse pregnancy outcomes, focusing on spontaneous abortion, preterm birth, low birth weight (LBW), and intrauterine growth restriction (IUGR). ***Methods:*** A retrospective cohort study was conducted at Dhaka Medical College Hospital from January 2009 to December 2010, including 340 mother-newborn pairs: 170 smokeless tobacco users (cases) and 170 non-users (controls), matched for age, BMI, socioeconomic status, paternal smoking, and educational level. Data on maternal characteristics, smokeless tobacco use, and pregnancy outcomes were collected and analyzed using Chi-square, Z-test, and odds ratio calculations, with a p-value <0.05 considered significant. ***Results:*** Baseline maternal characteristics, including age, BMI, and hemoglobin levels, were comparable between cases and controls ($p > 0.10$). Among cases, preterm births (38.24% vs. 16.47%, $p < 0.001$), LBW (58.82% vs. 27.65%, $p < 0.001$), and IUGR (26.47% vs. 11.65%, $p < 0.001$) were significantly more frequent. Spontaneous abortion was more prevalent among cases (34.1% vs. 18.8%, $p < 0.01$), with a 2.2-fold increased risk for mothers who used smokeless tobacco for >5 years (OR = 2.2, 95% CI: 1.3–3.6). The most common product used was Jorda (61.2%), with a mean usage duration of 7.4 ± 1.8 years. ***Conclusion:*** Prolonged maternal smokeless tobacco use is significantly associated with adverse pregnancy outcomes like spontaneous abortion, highlighting the urgent need for public health interventions, routine screening and support in antenatal care.

Keywords: Smokeless Tobacco, Pregnancy Outcomes, Spontaneous Abortion, Low Birth Weight, Preterm Birth, Intrauterine Growth Restriction.

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Introduction

Smokeless tobacco (ST) use is a significant public health issue globally, particularly in low- and middle-income countries (LMICs), where cultural, socioeconomic, and lifestyle factors drive its prevalence. Unlike combustible tobacco, smokeless forms are often perceived as less harmful, despite evidence of severe health risks. According to global data, South Asia is a hotspot for ST use, with countries like Bangladesh, India, and Nepal

reporting alarmingly high prevalence rates among both men and women.[1] Among women, particularly those of reproductive age, ST use poses unique challenges, as it is often intertwined with cultural practices and social norms (Hossain et al., 2014). For instance, ST products like *jarda* and *gul* are widely consumed in rural areas of Bangladesh, where traditional beliefs and limited awareness perpetuate the habit.[2] In Bangladesh, the burden of ST use is particularly concerning, with studies indicating that nearly 25% of married rural women consume smokeless tobacco, often beginning usage after the age of 30.[3] Despite high awareness of the health risks, many women perceive ST as culturally acceptable or even beneficial during pregnancy. The availability and affordability of ST products exacerbate this problem, with rural areas seeing higher rates of consumption compared to urban centers.[2] The underreporting of ST use among pregnant women further complicates public health efforts to address its adverse effects.[4] This underreporting is linked to stigma, social desirability bias, and limited health interventions targeting smokeless forms of tobacco, unlike more established efforts to reduce cigarette smoking.[5] The health implications of smokeless tobacco use during pregnancy are profound, with established associations to adverse maternal and neonatal outcomes. Prolonged ST use significantly increases the risks of spontaneous abortion, stillbirth, preterm delivery, and low birth weight.[3,5] For example, a retrospective cohort study in Sylhet, Bangladesh, revealed that mothers who used ST for more than five years were 2.2 times more likely to experience spontaneous abortions and 3.1 times more likely to have preterm deliveries compared to non-users.[5] These findings emphasize the need for targeted interventions to mitigate the adverse impacts of ST use during pregnancy, particularly in LMICs like Bangladesh, where maternal and child health outcomes remain suboptimal. Spontaneous abortion, defined as the loss of pregnancy before 20 weeks of gestation, is one of the most common adverse pregnancy outcomes, with significant psychological and physical consequences for affected women. Identifying modifiable risk factors, such as lifestyle behaviors, is critical to reducing its incidence.[6] While the link between cigarette smoking and spontaneous abortion is well-documented, the role of smokeless tobacco remains underexplored, particularly in LMICs where its use is prevalent.[7] A study conducted in rural Bangladesh found that ST use during pregnancy nearly tripled the risk of stillbirth, with a dose-response relationship observed for higher frequencies of use.[4] This gap in research underscores the importance of examining the relationship between maternal smokeless tobacco use and spontaneous abortion, especially in low-resource settings where public health data are limited. Tertiary-level hospitals serve as critical research sites for studying maternal health in Bangladesh. These hospitals cater to a diverse and often high-risk patient population, providing a unique opportunity to capture a comprehensive picture of the impact of smokeless tobacco use. For instance, studies conducted at Dhaka Medical College Hospital and Sylhet MAG Osmani Medical College Hospital have been instrumental in highlighting the association between prolonged ST use and adverse pregnancy outcomes.[3,5] By focusing on a tertiary-level hospital, this study aims to contribute robust evidence to the existing literature, enabling the development of targeted interventions and policies to address maternal smokeless tobacco use. This study seeks to bridge the gap in research on the association between prolonged maternal smokeless tobacco use and the incidence of spontaneous abortion in Bangladesh. Given the underreporting of ST use and its poorly understood implications compared to cigarette smoking, this research aims to provide critical insights into the risks posed by this culturally ingrained behavior. By focusing on a tertiary hospital setting, the study will capture a diverse patient population, enabling an in-depth analysis of the relationship between maternal ST use and spontaneous abortion. The findings will not only contribute to the limited body of evidence in this area but also inform public health interventions and policies aimed at improving maternal and neonatal outcomes in Bangladesh.

Methods

This retrospective cohort study was conducted in the Department of Paediatrics and Department of Gynecology and Obstetrics, Dhaka Medical College Hospital, Dhaka, from January 2009 to December 2010. The study population comprised mothers who had been exposed to smokeless tobacco (ST) for more than 5 years and had delivered a newborn infant within the past 24 hours. A total of 340

mother-newborn pairs were enrolled, with 170 pairs assigned as cases and 170 as suitably matched controls. Cases were enrolled using purposive sampling. Cases included mothers who met the following inclusion criteria: age between 20 and 40 years, BMI greater than 18.5, hemoglobin levels of more than 10 gm/dl, and newborn infants aged less than 24 hours. Mothers with hypertension, pre-eclampsia, diabetes mellitus, chronic renal disease, multiple gestations, smoking habits, or alcohol use were excluded. Controls consisted of mothers who neither smoked nor used smokeless tobacco and had delivered a newborn within the past 24 hours. Matching between cases and controls was performed based on age, BMI, socioeconomic status, paternal smoking status, and educational background. A detailed history of each mother was meticulously collected, including demographic details, parity, socioeconomic status, passive smoking exposure, educational attainment, frequency and duration of ST use, and previous pregnancy outcomes. Outcomes of interest included spontaneous abortion, stillbirth, low birth weight (LBW) infants, preterm delivery, and term delivery within the past five years. For mothers unable to recall specific birth weights of previous infants, visual validation using photographs of LBW and normal-weight babies was employed. Physical examinations of the mothers were conducted, including assessments of weight, height, BMI, blood pressure, and signs of systemic diseases or infections. Hypertension was defined as a systolic blood pressure >140 mm Hg or a diastolic blood pressure >90 mm Hg. BMI was calculated using the formula weight (kg) / height² (m^2). Hemoglobin levels were measured for all participants, and additional laboratory investigations, such as serum creatinine and random blood sugar levels, were conducted when indicated. Newborn assessments included birth weight, occipital-frontal circumference (OFC), supine length, and examination for congenital infections. Birth weight was measured in grams using a baby scale, supine length in centimeters with an infantometer, and OFC with a measuring tape. Gestational age was determined using the last reported menstrual period (LRMP) method and validated by the New Ballard Scoring System. In cases where a discrepancy of more than two weeks occurred, the latter method was accepted. Data were collected using a structured, pretested questionnaire and processed with statistical software. Statistical analyses included the Chi-square test, Student's t-test, and Z-test, where applicable, with a p-value of <0.05 considered statistically significant. Odds ratios were calculated to evaluate the strength of associations between ST use and pregnancy outcomes. Ethical approval was obtained from the Ethical Committee of Dhaka Medical College, Dhaka. Informed written consent was obtained from all participants prior to enrollment in the study. Participants were assured of the confidentiality and anonymity of their data, and all procedures adhered to ethical research standards.

Results

Table 1: Baseline maternal characteristics distribution among the participants (N=340)

Characteristic	Cases (n=170)	Controls (n=170)	Statistical Value	P-value
Age (years, Mean ± SD)	27.64 ± 4.62	26.99 ± 4.78	Z = 0.90	> 0.10
BMI (Mean ± SD)	20.23 ± 0.80	20.09 ± 0.85	Z = 1.10	> 0.10
Hemoglobin (gm/dl, Mean ± SD)	10.99 ± 0.35	10.90 ± 0.37	Z = 1.63	> 0.10
Educational Status				
No institutional education	35 (20.59%)	40 (23.53%)	$\chi^2 = 1.08$	> 0.10
Class I-V	35 (20.59%)	30 (17.65%)		
Class VI-X	90 (52.94%)	85 (50.00%)		
SSC and above	10 (5.88%)	15 (8.82%)		
Socioeconomic Status				
Poor	116 (68.24%)	111 (65.29%)	$\chi^2 = 0.34$	> 0.50
Middle class	54 (31.76%)	59 (34.71%)		
Husband's Smoking				
Yes	118 (69.41%)	113 (66.47%)	$\chi^2 = 0.32$	> 0.50
No	52 (30.59%)	57 (33.53%)		

Baseline maternal characteristics were comparable between cases and controls, with no statistically significant differences observed across key variables. The mean age of mothers in the case group was 27.64 ± 4.62 years, while in the control group it was 26.99 ± 4.78 years (Z = 0.90, p > 0.10). Similarly, the mean BMI of cases (20.23 ± 0.80) and controls (20.09 ± 0.85) showed no significant

difference (Z = 1.10, p > 0.10). Hemoglobin levels were also comparable, with cases having a mean of 10.99 ± 0.35 gm/dl and controls 10.90 ± 0.37 gm/dl (Z = 1.63, p > 0.10). Educational status distribution revealed that 20.59% of cases and 23.53% of controls had no institutional education, while the majority in both groups (52.94% cases vs. 50.00% controls) had completed education from Class VI to X (χ^2 = 1.08, p > 0.10). Socioeconomic status was predominantly poor in both groups, with 68.24% of cases and 65.29% of controls categorized as such (χ^2 = 0.34, p > 0.50). Additionally, a high proportion of husbands were smokers in both groups (69.41% cases vs. 66.47% controls), with no significant difference observed (χ^2 = 0.32, p > 0.50).

Table 2: Baseline Neonatal Characteristics among the participants

Characteristic	Cases (n=170)	Controls (n=170)	Statistical Value	P-value
Term Births	105 (61.76%)	142 (83.53%)	χ^2 = 20.26	< 0.001
Preterm Births	65 (38.24%)	28 (16.47%)	χ^2 = 20.26	< 0.001
Low Birth Weight	100 (58.82%)	47 (27.65%)	χ^2 = 11.90	< 0.001
IUGR	45 (26.47%)	20 (11.65%)	χ^2 = 33.66	< 0.001

Neonatal characteristics showed significant differences between cases and controls. The proportion of term births was significantly lower in the case group (61.76%) compared to the control group (83.53%) (χ^2 = 20.26, p < 0.001). Conversely, preterm births were significantly higher among cases (38.24%) compared to controls (16.47%) (χ^2 = 20.26, p < 0.001). Low birth weight (LBW) was notably more prevalent in the case group, affecting 58.82% of neonates compared to 27.65% in the control group (χ^2 = 11.90, p < 0.001). Similarly, intrauterine growth restriction (IUGR) was significantly more common among cases (26.47%) than controls (11.65%) (χ^2 = 33.66, p < 0.001).

Table 3: Smoking related characteristics among the case participants (n=170)

Category	Number of Mothers (n)	Percentage (%)
Type of Smokeless Tobacco		
Jorda	104	61.2
Shada	63	37.1
Gul	3	1.7
Duration of Smokeless Tobacco Use		
5–7 years	102	60.0
8–10 years	51	30.0
>10 years	17	10.0
Mean Duration (± SD)	7.4 (± 1.8) years	

Among the case participants (n=170), the majority of mothers (61.2%) reported using *Jorda* as their primary form of smokeless tobacco, followed by *Shada* (37.1%) and *Gul* (1.7%). The duration of smokeless tobacco use varied, with 60.0% of mothers reporting usage between 5–7 years, 30.0% reporting 8–10 years, and 10.0% using smokeless tobacco for more than 10 years. The mean duration of smokeless tobacco use was 7.4 ± 1.8 years.

Table 4: Spontaneous Abortion Among Mothers Who Used Smokeless Tobacco (ST) for >5 Years (N=340)

Group	Spontaneous Abortion Present	Spontaneous Abortion Absent	χ^2 Value	P-value	Odds Ratio	95% Confidence Interval
Case Group (n=170)	58 (34.1%)	112 (65.9%)	10.2	< 0.01	2.2	1.3–3.6
Control Group (n=170)	32 (18.8%)	138 (81.2%)				

The prevalence of spontaneous abortion was significantly higher among mothers in the case group (34.1%) compared to the control group (18.8%) (χ^2 = 10.2, p < 0.01). Mothers who used smokeless tobacco for more than 5 years had 2.2 times higher odds of experiencing spontaneous abortion compared to non-users (OR = 2.2, 95% CI: 1.3–3.6).

Discussion

This study highlights the significant association between prolonged maternal smokeless tobacco (ST) use and adverse pregnancy outcomes, with particular emphasis on spontaneous abortion, preterm births, low birth weight (LBW), and intrauterine growth restriction (IUGR). The findings align with previous studies, which collectively underscore the harmful effects of smokeless tobacco on maternal and neonatal health. Notably, this study revealed that mothers who used smokeless tobacco for more than five years had a significantly higher prevalence of spontaneous abortion (34.1% in cases vs. 18.8% in controls, OR = 2.2, 95% CI: 1.3–3.6), supporting earlier findings from Bangladesh and India that linked prolonged ST use to increased risks of pregnancy loss and adverse outcomes.[3,5] The prevalence of preterm births among ST users was significantly higher in this study (38.24% in cases vs. 16.47% in controls), reflecting similar findings reported in Dhaka, where smokeless tobacco use was associated with a 2.9-fold increase in the risk of preterm deliveries.[8] Comparable studies in India have also documented elevated risks of preterm births among smokeless tobacco users, with strong dose-response relationships observed.[9] These findings collectively highlight the need for targeted public health interventions to address the risks associated with smokeless tobacco use during pregnancy, particularly in regions where its consumption is culturally ingrained. The significantly higher prevalence of LBW neonates in the case group (58.82%) compared to controls (27.65%) is consistent with prior studies from Bangladesh and India, where smokeless tobacco use was associated with a 3.7-fold increased risk of delivering LBW babies.[3,8] Similarly, a large cohort study in Mumbai demonstrated that smokeless tobacco users delivered babies with an average reduction in birth weight of 105 grams, further emphasizing the adverse impacts of nicotine and other tobacco components on fetal growth.[9] These findings underscore the teratogenic potential of smokeless tobacco and its capacity to impair placental function, leading to compromised fetal nutrition and growth. Intrauterine growth restriction (IUGR) was also significantly more common among ST users in this study (26.47% in cases vs. 11.65% in controls). This aligns with previous research highlighting the association between smokeless tobacco use and impaired fetal growth.[10,11] Studies from both Bangladesh and India have reported elevated odds of IUGR among mothers using smokeless tobacco, often attributing these outcomes to nicotine-induced placental insufficiency and fetal hypoxia.[3,12] The comparative findings from these studies and the current research collectively emphasize the detrimental effects of smokeless tobacco use on fetal health, with significant implications for maternal and child health programs. In terms of baseline maternal characteristics, no statistically significant differences were observed between cases and controls in this study concerning maternal age, BMI, hemoglobin levels, educational attainment, and socioeconomic status. This finding aligns with prior research that has demonstrated that the harmful effects of smokeless tobacco are largely independent of maternal demographic and socioeconomic factors, thereby underscoring its direct biological impact on pregnancy outcomes.[3,5] However, cultural and social factors influencing smokeless tobacco use, such as peer acceptance and affordability, remain critical considerations for public health interventions.[2] The patterns of smokeless tobacco use observed in this study are consistent with those reported in similar settings. The majority of mothers in the case group consumed *Jorda* (61.2%) and *Shada* (37.1%), with an average duration of use of 7.4 years. Comparable findings from Bangladesh highlight *Jorda* and *Shada* as the predominant smokeless tobacco products used by women, reflecting cultural preferences and accessibility.[5] The prolonged use of smokeless tobacco further underscores the addictive nature of these products and the urgent need for cessation programs targeted at women of reproductive age. The findings of this study align closely with the broader literature on the health risks of smokeless tobacco use, yet they also highlight critical gaps in public health efforts to address this issue in low- and middle-income countries. While significant progress has been made in reducing cigarette smoking globally, the harmful effects of smokeless tobacco remain underappreciated and underreported, particularly in LMICs like Bangladesh.[4] The findings of this study add to the growing body of evidence supporting the inclusion of smokeless tobacco cessation in maternal health programs and the enforcement of stricter regulations on the production and sale of smokeless

tobacco products. In conclusion, this study provides robust evidence linking prolonged smokeless tobacco use with adverse pregnancy outcomes, including spontaneous abortion, preterm births, LBW, and IUGR. These findings reinforce the urgent need for public health interventions targeting smokeless tobacco cessation among women of reproductive age, particularly in regions where its use is culturally ingrained and socially accepted. Future research should aim to further elucidate the biological mechanisms underlying these associations and evaluate the effectiveness of targeted cessation programs in improving maternal and neonatal health outcomes. The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

This study demonstrates a significant association between prolonged maternal smokeless tobacco use and adverse pregnancy outcomes, including spontaneous abortion, preterm birth, low birth weight, and intrauterine growth restriction. The findings underscore the detrimental impact of smokeless tobacco use on maternal and neonatal health, highlighting the urgent need for public health interventions targeted at reducing its prevalence among women of reproductive age. The strong dose-response relationships observed in this study emphasize the importance of addressing this culturally ingrained habit through education, awareness campaigns, and regulatory measures. Additionally, healthcare providers should incorporate smokeless tobacco screening and cessation support into antenatal care practices. Future research should explore the long-term health consequences of smokeless tobacco use on both mothers and their offspring to further inform public health strategies and policies.

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Ethical approval

The study was approved by the Institutional Ethics Committee

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