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COAGULATION SCREENING TEST DIFFERENCES BETWEEN SMOKERS AND NON-SMOKERS IN DHAKA CITY

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ABSTRACT

Background: Smoking is a significant risk factor for cardiovascular and hematological conditions, yet its effects on blood coagulation remain inconclusive. Coagulation screening tests are essential for assessing blood clotting function and potential thrombotic risks. This study investigates the differences in coagulation parameters between smokers and non-smokers in Dhaka city to better understand the impact of smoking on haemostatic balance. **Methods:** A case-control study was conducted in the Department of Laboratory Medicine, BSMMU, Dhaka, from January 2022 to June 2022. A total of 200 adult male participants (100 smokers and 100 non-smokers) were enrolled using purposive sampling. Prothrombin time (PT), Activated partial thromboplastin time (APTT), and INR (International Normalized Ratio) were measured and analysed using IBM SPSS version 26. Statistical significance was determined at $p<0.05$. **Results:** The mean PT was slightly prolonged in smokers (14.12±3.87 sec) compared to non-smokers (13.53±2.93 sec), but the difference was not statistically significant. Similarly, APTT was 32.12±9.44 sec in smokers and 30.76±6.51 sec in non-smokers, while INR was 1.15±0.34 in smokers and 1.11±0.23 in non-smokers. Weak correlations were found between smoking duration and coagulation parameters, indicating minimal impact of prolonged smoking on coagulation function. Subgroup analysis based on smoking severity also showed no significant differences. **Conclusion:** This study found no statistically significant effect of smoking on coagulation parameters. Although smokers showed a slight tendency towards prolonged coagulation times, the impact was minimal. Further research with larger sample sizes and a more extensive assessment of coagulation markers is recommended to clarify the relationship between smoking and coagulation abnormalities.

KEYWORDS: *Coagulation, Prothrombin time, Activated partial thromboplastin time, INR.*

INTRODUCTION

The global burden of smoking-related health issues has consistently drawn attention from the medical and scientific community due to its widespread prevalence and its impact on nearly every physiological system (CDC, 2018; WHO, 2017). Smoking, a significant modifiable risk factor for numerous diseases, has well-documented effects on cardiovascular health, respiratory function, and systemic inflammation (U.S. Department of Health and Human Services, 2014). One of the lesser-explored areas of concern is its influence on the coagulation system, a critical component of haemostasis that maintains the delicate balance between clot formation and dissolution. Abnormalities in coagulation are strongly associated with conditions such as thrombosis, stroke, and myocardial infarction, making this an area of great importance for public health (Rahman & Alam, 2015; WHO, 2019).

In Dhaka, the densely populated capital city of Bangladesh, smoking is highly prevalent among adults, with both active smoking and passive exposure contributing to adverse health outcomes (Bangladesh Bureau of Statistics, 2015; WHO, 2021). Despite global

efforts to reduce tobacco consumption, cultural, social, and economic factors sustain its prevalence in this region (Rahman & Mahmood, 2019). The interplay between smoking and its impact on coagulation parameters remains an under-researched domain in Bangladesh, leaving significant gaps in understanding the local population's susceptibility to clotting disorders (Uddin & Rahman, 2016).

This study aims to explore and compare the differences in coagulation test results between smokers and non-smokers residing in Dhaka. Specifically, it will examine key coagulation markers such as prothrombin time (PT), activated partial thromboplastin time (APTT), and INR(International Normalized Ratio). These parameters provide critical insights into the coagulation cascade's functionality and potential hypercoagulable states associated with smoking (Rahman & Alam, 2015; WHO, 2020).

Previous research from various global contexts has identified smoking as a pro-thrombotic factor, influencing platelet activation, fibrinogen concentration, and clotting factor activity (Islam & Johnson, 2005; WHO, 2018). However, these studies often reflect populations with different genetic, dietary, and environmental backgrounds. Dhaka's unique urban dynamics, including high levels of air pollution and dietary habits, may compound or modify the effects of smoking on coagulation, warranting a localized investigation (Rahman & Fukui, 2000; BBS, 2019). By understanding the specific variations in coagulation profiles between smokers and non-smokers in this demographic, this study seeks to contribute to the growing body of evidence necessary for public health interventions and targeted medical strategies.

The findings of this research will not only provide a clearer picture of impact of smoking on coagulation profile but may also serve as a foundation for health advocacy programs aimed at reducing smoking prevalence in Dhaka. By bridging the gap in regional data, this study hopes to enhance awareness and guide policies to mitigate the health risks associated with smoking (WHO, 2022).

MATERIALS AND METHODOLOGY

This study employed a case-control design to compare coagulation test differences between smokers and non-smokers. It was conducted in the Department of Laboratory Medicine at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. The study population consisted of male patients aged 18 to 70 years who visited the department during the study period. Participants were selected based on specific criteria. Inclusion criteria required participants to be male, aged 18–70 years, with a history of smoking (for smokers) and residing in Dhaka city. Exclusion criteria included a history of alcoholism and betel nut chewing, the presence of diseases significantly affecting coagulation, and patients undergoing long-term medication or therapies influencing platelet counts.

A total of 200 participants were enrolled in the study, divided into 100 smokers and 100 non-smokers. The sampling method was purposive, with participants selected based on the inclusion criteria. Verbal and written informed consent were obtained from each participant after a thorough explanation of the study's purpose and procedures. The study was conducted over six months, from January 2022 to June 2022.

Data collection involved the use of a pre-designed data collection sheet and laboratory reports. Participant information was obtained through face-to-face interviews conducted by the researcher. Each interview was conducted with care to ensure accuracy, and data collection involved 3–5 participants per day. Blood samples were collected from each participant, with 2.0 ml of whole blood drawn for coagulation screening tests, including prothrombin time (PT), activated partial thromboplastin time (APTT), and INR. Laboratory testing was performed daily in the Department of Laboratory Medicine at BSMMU, and results were systematically recorded in the data collection sheet.

The collected data were entered into a computer database, checked for inconsistencies, and analysed using IBM SPSS version 26. Descriptive statistics were used to summarize the data, expressed as mean ± standard deviation. Comparative analyses were conducted using Student's t-test and ANOVA for continuous variables, and the chi-square test for categorical variables. Pearson’s correlation analysis was employed to assess the relationship between smoking duration and coagulation parameters. Statistical significance was set at $p < 0.05$, with $p < 0.001$ considered highly significant.

Results were presented in tables, figures, and diagrams for clarity and ease of interpretation. Ethical approval for the study was obtained from the SST (School of Science & Technology) at Bangladesh Open University. Participants were assured that their confidentiality and privacy would be maintained, and all collected data were coded and securely stored. Each participant was assigned a unique ID number to ensure anonymity. Universal precautions were observed during the collection of biological samples, and participants were not subjected to additional costs or experimental procedures. This methodology ensured rigorous data collection and ethical compliance, providing a robust foundation for analysing coagulation differences between smokers and non-smokers in Dhaka.

RESULT

This case-control study was conducted in the Department of Laboratory Medicine, BSMMU, Dhaka, from January 2022 to June 2022, to assess the effects of smoking on coagulation screening tests in the adult male population.

A total of 200 participants were included, comprising 100 smokers and 100 non-smokers. Participants were categorized based on their smoking history, and data were collected using a pre-designed data collection sheet.

Demographic Characteristics

The age distribution of participants showed that 11% of smokers and 17% of non-smokers were aged <20 years. In the 21–30 years age group, 24% were smokers, and 32% were non-smokers, making it the most prevalent age group in the study. Among those aged 31–40 years, 22% were smokers and 17% were non-smokers, while in the 41–50 years age group, 12% were smokers and 19% were non-smokers. In the 51–60 years category, 14% were smokers, and 10% were non-smokers. The mean age of smokers was found to be 40.24±16.9 years, whereas for non-smokers, it was 34.89±14.24 years. A statistically significant difference was observed in the mean age between smokers and non-smokers ($p > 0.05$) **(Table 01).**

Regarding residence, 65% of smokers and 62% of non-smokers were from Dhaka, while 35% of smokers and 38% of non-smokers were from outside Dhaka. The BMI of both smoker and non-smoker groups was found to be within the normal range for most respondents. Within the smoker group, 29% were classified as mild smokers, 44% as moderate smokers (highest proportion), and 27% as heavy smokers **(Table 02).**

Coagulation Parameters

The mean (±SD) prothrombin time in smokers was 14.12±3.87 seconds, compared to 13.53±2.93 seconds in non-smokers. For activated partial thromboplastin time (APTT), the mean (±SD) was 32.12±9.44 seconds in smokers and 30.76±6.51 seconds in non-smokers. The international normalized ratio (INR) had a mean (±SD) of 1.15±0.34 in smokers and 1.11±0.23 in non-smokers **(Table 03).**

A subgroup analysis based on smoking severity showed that the mean prothrombin time was 13.86±4.25 seconds in mild smokers, 13.95±2.50 seconds in moderate smokers, and 14.67±5.18 seconds in severe smokers. However, the difference among these groups was not statistically significant ($F=0.379$, $p=0.686$). Similarly, for APTT, the mean values were 34.49±14.18 seconds in mild smokers, 31.51±7.68 seconds in moderate smokers, and 30.56±3.94 seconds in severe smokers. Again, this difference was not statistically significant ($F=1.388$, $p=0.254$). The INR values were 1.13±0.31 in mild smokers, 1.13±0.18 in moderate smokers, and 1.22±0.52 in severe smokers, with no statistically significant difference among the groups ($F=0.711$, $p=0.494$) **(Table 04).**

Correlation Between Smoking Duration and Coagulation Parameters

The scatter plots illustrate the relationship between smoking duration and coagulation parameters among smokers. A weak positive correlation was observed between smoking duration and prothrombin time, with an R^2 value of 0.009, indicating a minimal impact of prolonged smoking on prothrombin time. Similarly, APTT showed a weak negative correlation with smoking duration, with an R^2 value of 0.019, suggesting a slight decrease in APTT with increasing smoking duration. INR also exhibited a weak positive correlation with smoking duration ($R^2=0.009$), indicating a minimal increase in INR values with prolonged smoking **(Figure I, II, III).**

Overall, the findings suggest that while smokers demonstrated slightly prolonged prothrombin time, APTT, and INR compared to non-smokers, the differences were not statistically significant. Additionally, smoking severity did not significantly affect coagulation parameters. The weak correlation between smoking duration and coagulation markers suggests that smoking alone may not have a strong direct impact on coagulation function in this study population.

Table 01: Sociodemographic Characteristics of Respondents (N=200).

Variables	Smoker (n=100)	Non-Smoker (n=100)	*p*- value
Age Group (years)			
<20	11%	17%	
21-30	24%	32%	
31-40	22%	17%	0.016*
41-50	12%	19%	
51-60	14%	10%	
61-70	17%	5%	
Living Area			
Dhaka	65%	62%	0.659
Outside of Dhaka	35%	38%	
BMI Category			
Underweight (<18.5)	7%	8%	
Normal (18.5-24.9)	76%	64%	0.104
Overweight (25.0-29.9)	12%	25%	
Obese (>30.0)	5%	3%	

Table 02: Distribution of the respondents by smoking history (N=100).

Variables	Frequency	Percentage (%)
Mild (1-2 packs/day)	29	29.0%
Moderate (2-5 packs/day)	44	44.0%
Heavy (>5 packs/day)	27	27.0%
Total	100	100.0%

Table 03: Comparison of coagulation screening tests between two groups (N=200).

Variables	Smoker (n=100)	Non-Smoker (n=100)	*p*- value
Prothrombin time (sec)	**Mean±SD**:14.12±3.87 **Range:** (12.0–38.0)	**Mean±SD:** 13.53±2.93 **Range:** (10.0–38.0)	0.226
Activated partial thromboplastin time (sec)	**Mean±SD:** 32.12±9.44 **Range:** (20.0–87.9)	**Mean±SD:** 30.76±6.51 **Range:** (26.0–84.0)	0.237
INR	**Mean±SD:** 1.15±0.34 **Range:** (1.0–3.6)	**Mean±SD:** 1.11±0.23 **Range:** (0.8 –3.1)	0.265

Table 04: Comparison of coagulation screening tests with smoking severity (N=100).

Variables	Smoking category			F-value	*p*- value
	Mild (n=29) Mean±SD	Moderate (n=44) Mean±SD	Severe (n=27) Mean±SD		
Prothrombin time (sec)	13.86±4.25	13.95±2.50	14.67±5.18	0.379	0.686
APTT (sec)	34.49±14.18	31.51±7.68	30.56±3.94	1.388	0.254
INR	1.13±0.31	1.13±0.18	1.22±0.52	0.711	0.494

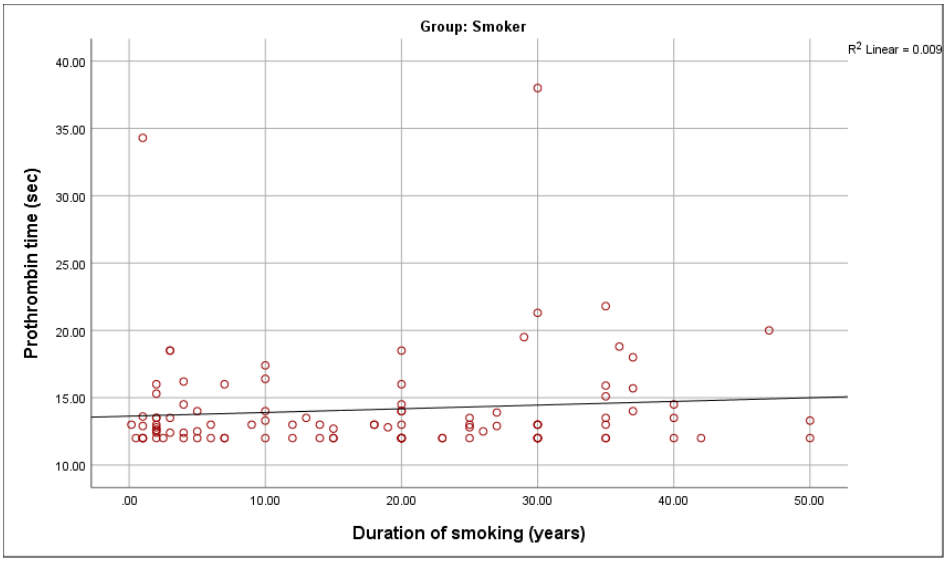

Figure 1: Correlation of prothrombin time with duration of smoking shows weak but positive correlation (r= +0.097, p=0.335).

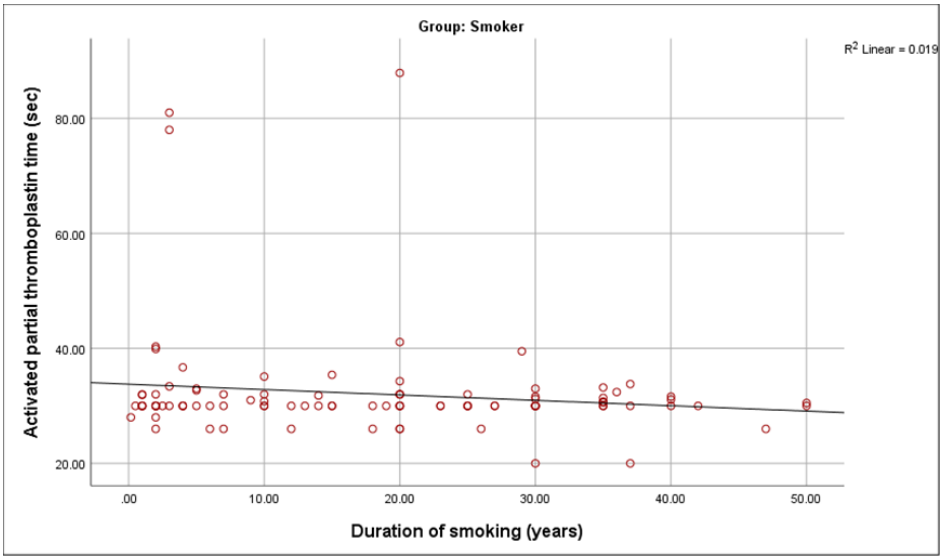

Figure 2: Correlation of activated partial thromboplastin time with duration of smoking shows weak negative correlation (r= - 0.137, p=0.174).

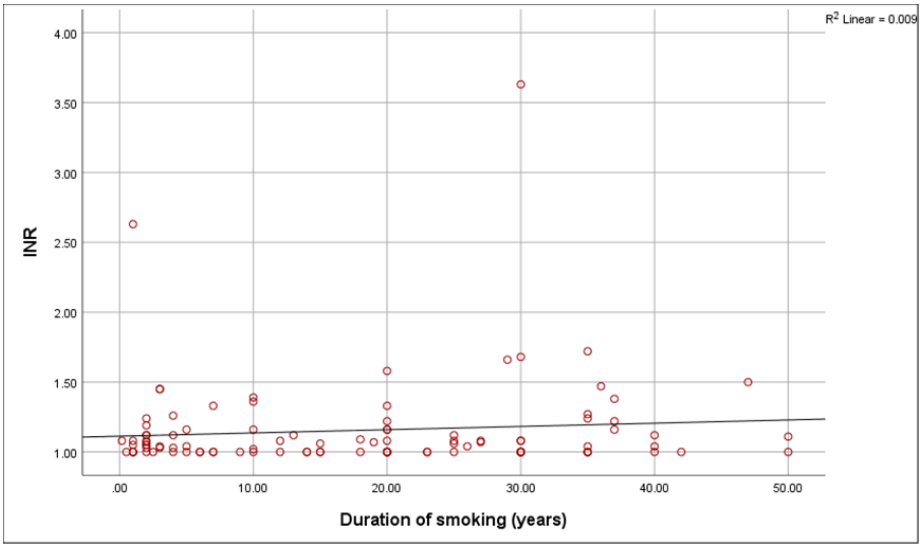

Figure 3: Correlation of INR with duration of smoking shows weak negative correlation (r= - 0.347, p=0.095).

DISCUSSION

This study aimed to assess the impact of smoking on coagulation parameters among adult males in Dhaka. The findings revealed that smokers exhibited slightly prolonged prothrombin time (PT), activated partial thromboplastin time (APTT), and INR compared to non-smokers; however, these differences were not statistically significant.

The observed non-significant prolongation of PT and APTT in smokers aligns with some studies that have reported no substantial differences in these parameters between smokers and non-smokers. For instance, a study by Das *et al.* (2024) found no significant changes in PT and APTT among smokers compared to non-smokers, suggesting that smoking may not markedly affect these coagulation pathways.

Conversely, other research has indicated that smoking can lead to a hypercoagulable state. Okeke and Ekeanumba (2017) reported significant prolongation of PT and APTT in smokers, along with decreased platelet counts and fibrinogen levels, suggesting that smoking induces coagulation abnormalities that may increase the risk of thromboembolic events.

The weak correlations observed between smoking duration and coagulation parameters in this study imply that the length of smoking history may not have a strong direct impact on coagulation function. This finding is consistent with the conclusions of Das *et al.* (2024), who also reported no significant correlation between the duration of smoking and changes in coagulation markers.

It is important to note that the literature presents mixed findings regarding the effects of smoking on coagulation. Some studies have demonstrated that smoking contributes to a hypercoagulable state by increasing platelet activation and altering fibrinogen levels, thereby elevating the risk of thromboembolic events.

These discrepancies may be attributed to variations in study populations, methodologies, and the specific coagulation parameters assessed.

In summary, while this study did not find statistically significant differences in coagulation parameters between smokers and non-smokers, the potential for smoking to influence coagulation function cannot be entirely ruled out. Further research with larger sample sizes and more comprehensive assessments of coagulation markers is warranted to elucidate the relationship between smoking and coagulation.

CONCLUSION

This study examined the impact of smoking on coagulation screening tests in adult males in Dhaka. While smokers showed slightly prolonged PT, APTT, and INR compared to non-smokers, these differences were not statistically significant. Additionally, the correlation between smoking duration and coagulation parameters was weak, indicating that smoking history alone may not strongly influence coagulation function. Although some studies suggest a hypercoagulable state in smokers, our findings do not support smoking as a definitive factor in altering coagulation status. Further large-scale research with comprehensive coagulation markers is recommended to clarify the potential effects of smoking on haemostatic balance.

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study. This research was conducted independently without any financial, institutional, or personal conflicts that could have influenced the findings.

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