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Effect of Substance Use on Platelet Count and Mean Platelet Volume among Healthy Population of Assam, India

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ABSTRACT

The baseline information on prevalence of substance use viz.; cigarette smoking, tobacco chewing and alcohol consumption among the population of Assam, India is available. However, data pertinent to their impact on platelet count and Mean Platelet Volume (MPV) was lacking. Herein, a cross-sectional study was carried out to evaluate the potential effect of substance use on these haematological indices. Healthy volunteers were included in the study and interviewed for the assessment of substance use and frequency of consumption. For determination of haematological indices, Complete blood count was performed. Out of 510 study subjects, 26.1% (n = 133) were substance abuse and grouped under consumers category. Individuals with combined or multiple substance uses were also recorded. A significantly lower mean platelet count was observed among consumers as compared to the non-consumers ($p < 0.001$), whereas no significant differences were seen for the values of MPV between the groups. Females of the smokers group were observed with significantly lower mean platelet count as compared to the male smokers ($p < 0.05$). A relatively lower mean value for platelet count was observed among regular substance users as compared to the occasional and significantly reported only for the smokers group. Low platelet count was more significantly observed among the group of individuals who were combined or multiple substance users as compared to the non-consumers group ($p < 0.001$). The study concluded that the habit of substance use is one of the potential markers to be considered for quantitative variation of platelets. Besides, combined or multiple substance addictions could be much more deleterious.

Key words: *Complete blood count, Mean Platelet Volume, Oral cancer, Platelet, Substance abuse*

INTRODUCTION

Studies have evidenced various pathophysiological changes and risk continuum associated with the habit of substance use particularly, cigarette smoking, tobacco chewing/smoking, and alcohol consumption.

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Cigarette smoking influences many haematological indices including platelet count and its associated parameters. The risk of arterial thrombosis is relatively higher in cigarette smokers[1]. Besides, hematopoietic dysfunctions and chronic obstructive pulmonary diseases are also seen in chronic smokers and it is believed that higher platelet activity and aggregation seems to play a crucial role in occurrence of these pathological conditions[2, 3]. In a healthy individual, platelet count ranges from 1, 50,000−4, 00,000 or 1, 50,000−4, 50,000 /µl of blood[4, 5]. However, different reference ranges for platelet count were also documented as per the geographical location and ethnic affiliation of the population[6, 7]. Generally, higher platelet count is observed among smokers as compared to the non-smokers but the smoking effect on quantitative property of platelet is still controversial due to its rapid return towards normal on withdrawal or cessation[8, 9]. Other than cigarette smoking, tobacco chewing is the most widely recognized addictive substance. The habit of tobacco chewing is more prevalent in South Asian countries and extensively consumed by the Indians belonging to lower socio-economic groups. A range of oral diseases predominantly, oral cancer, leukoplakia, leukoderma and subcutaneous fibrosis are associated with tobacco consumption. Moreover, addiction of this substance enhances the risk severity of cardiovascular diseases, peripheral vascular diseases, hypertension, diabetes, hypercholesterolemia and peptic ulcers[10]. Few studies have confirmed that tobacco chewing diminishes the average platelet count in blood and also affects other haematological parameters[11]. Another most common and frequently used beverage is the intake of Alcohol. Alcohol consumption profoundly influences the blood-coagulation system by affecting both quantitative and qualitative properties of platelet[12]. Low platelet count is the commonly encountered figure in chronic alcoholics. Earlier information indicated that alcohol-related thrombocytopenia affects approximately 3−43% of healthy well-nourished people and near about 14–81% of acutely ill hospitalized alcoholics[13]. Alcohol-related thrombocytopenia in combination with increased platelet destruction might be life-threatening to the individuals as it prolongs the bleeding time[14]. Other risks related to alcohol consumption are cancer, diabetes, neuropsychiatric diseases, cardiovascular disease, liver cirrhosis and pancreatic disorders[15]. Mean Platelet Volume (MPV) represents the average size distribution of platelet in blood (7.0 - 11.0 femtoliter, fl) and considered as one of the most significant marker as per prognostic and therapeutic aspects[16, 17]. With reference to MPV, there are very few proven explanations available regarding the impact of substance use on platelet volume.

Assam is the highest populated state of North-eastern region of India and rich in ethnic diversity. The baseline information on substance abuse revealed a high prevalence of cigarette smoking, tobacco chewing, and alcohol consumption among the inhabitants of Assam[18, 19]. Consequently, the present study was designed to assess the frequency of substance uses among healthy volunteers of upper Assam and their potential effect on basal platelet count and MPV.

MATERIAL AND METHODS

Study design and subject recruitment criteria

Based upon operational and logistic feasibility, four contiguous districts of upper Assam *viz*., Tinsukia, Dibrugarh, Sivasagar, and Jorhat were included in the study. A total 510 healthy volunteers were included in the study comprising both male (46%, n = 235) and female (54%, n = 275) with mean age 29.9 ± 12.6 ranging from 14−68 years. The study was conducted during the year 2014−2016. Signed informed consents were obtained and social-demographic features (age, gender, locality, and ethnicity) of each individual were recorded on a pre-designed proforma. Apparently healthy individuals with no history of malaria, jaundice, thyroid disorder, anaemia or any other acute infections diagnosed in

previous 6 months were included. Further, individuals on medication due to hypertension, diabetes mellitus, stroke, heart attack, asthma, epilepsy, kidney diseases, arthritis or any other chronic diseases were exempted from the study. Individuals were interviewed for their personal habits *viz*.; cigarette smoking, tobacco chewing, and alcohol consumption. Data obtained were further categorized based upon their frequency of substance consumption, i.e. regular and occasional. Individuals who were non-consumers for these habits were also grouped separately. The study protocol was approved by Institutional Ethics Committee (IEC), ICMR-Regional Medical Research Centre, Northeast Region, Dibrugarh, Assam, India.

Collection of blood sample and determination of CBC profile

Intravenous blood samples were drawn aseptically in K_3EDTA vacutainer tubes. Complete blood count (CBC) profile of each individual was determined by Automated Haematology Analyser (Celltac α, MEK-6420K, Nihon Kohden, Japan) within 4-6 hours of sample collection. The values of platelet count and MPV were recorded and computed for further analysis.

Statistical analysis

Quantitative data were presented as Mean ± Standard Deviation. Statistical tests, namely, Independent t-test and One-way Analysis of Variance (ANOVA) were performed to compare the mean differences between and within the study groups. For multiple comparisons, Tukey's post-hoc test was conducted and a probability value, $p < 0.05$ considered as statistically significant. The analyses were done by using Statistical Package for Social Science (SPSS) version 17 software (SPSS Inc, Chicago, USA).

RESULTS

Out of 510 study subjects, 26.1% (n = 133) were consumers for substance abuse including cigarette smokers, tobacco chewers, and alcohol consumers. Our study reported a significantly lower mean value for platelet count among consumers (130.6 ± 59 × 10^3/µl of blood) as compared to the non-consumers (212.2 ± 80.6 × 10^3/µl of blood) ($p < 0.000$). Besides, no statistical differences were observed for the values of MPV between the two groups. The individuals under consumers group were further categorized based on single and combined/multiple substance uses and evaluated for their impact on platelet count and MPV. Gender-wise variation in platelet count was also observed in the smokers group where females were observed with significantly lower mean platelet count (123.8 ± 9.2 × 10^3/µl of blood) as compared to the male smokers (150.5 ± 18.6 × 10^3/µl of blood) ($p < 0.05$). The analysis also revealed that individuals with regular habit of cigarette smoking had significantly lower platelet count as compared to the occasional ($p < 0.05$). However, no significant differences were observed for both the haematological parameters in case of tobacco chewing and alcohol consumption on regular and occasional basis (Table 1). Furthermore, a decreased mean platelet count was observed in regular consumers as compared to the occasional for each habit of substance uses.

Table 1: Distribution of Platelet count and MPV based upon the frequency of intake for substance use among consumers

Hematological parameters	Personal habits								
	Cigarette smoking		*P* value	Tobacco chewing		*P* value	Alcohol Consumption		*P* value
	Regular (n = 4)	Occasional (n = 4)		Regular (n = 4)	Occasional (n = 5)		Regular (n = 7)	Occasional (n = 59)	
Platelet Count, mean ± (SD) × 10^3/µl	123.8 ± 9.2	150.5 ± 18.6	< 0.05	165 ± 66.7	184.8 ± 28.9	0.299	85.7 ± 71.1	137.5 ± 39.9	0.130
MPV, mean ± (SD) fl	11.2 ± 1.8	12 ± 0.9	0.055	11.3 ± 1.9	11.9 ± 1.9	0.894	9.8 ± 1.9	11.5 ± 2.1	0.995

Individuals with more than one habit of substance addictions were categorized as cigarette smokers & alcohol consumers, tobacco chewers & alcohol consumers and cigarette smokers, tobacco chewers & alcohol consumers. The overall analysis reported a significantly lower mean value for platelet count among the individuals who were only alcoholics ($p < 0.001$). On the other hand, no significant differences were emphasized for both cigarette smokers and tobacco chewers taking non-consumers group as the comparator. As per the evaluation of MPV, no significant differences were noticed among the various categories of consumers groups studied in comparison with the non-consumers group (Table 2).

Table 2: Distribution of Platelet count and MPV among non-consumers and consumers under various categories

Hematological parameters	* Non-consumer (n = 377)	Cigarette smokers (n = 8)	Tobacco chewers (n = 9)	Alcohol consumers (n = 66)	Cigarette smokers & Alcohol consumers (n = 22)	Tobacco chewers & Alcohol consumers (n = 17)	Cigarette smokers, Tobacco chewers & Alcohol consumers (n = 11)
Platelet Count, mean ± (SD)×10^3/µl	212.2 ± 80.6	137.1 ± 19.7	176 ± 46.9	132 ± 46.4	118.6 ± 72.5	123.1 ± 62.8	93.3 ± 56.5
P value	-	0.075	0.782	<0.001	<0.001	<0.001	<0.001
MPV, mean ± (SD) fl	10.8 ± 1.8	11.6 ± 1.4	11.6 ± 1.9	11.3 ± 2.1	11.6 ± 1.5	11.3 ± 1.6	11.6 ± 1.4
P value	-	0.899	0.837	0.500	0.544	0.939	0.772

* Comparison group; Non-consumers

DISCUSSION

The addiction of substance uses known to vary globally and therefore must be evaluated for their potential hazards on individual's physiological and metabolic processes. The study primarily based on the screening of substance uses among healthy population and their impact on basal platelet count and its volume. The present study indicated more than one-fourth of the study population (26.1%, n = 133/510) with substance abuse, particularly cigarette smoking, tobacco chewing and alcohol consumption. Since each of these habits has its own aspects in developing pathophysiological conditions, therefore, has been investigated individually as well as in its combined pattern. Our findings reported 6% (n = 8/133) of the consumers' group with the habit of cigarette smoking. It has been deduced that gender-wise platelet count varies in smokers. Green et al., in their study reported that mean platelet count in male smokers was higher as compared to the female smokers[20]. Another study carried out on adolescents with age range 14-16 years likewise evidenced the similar outcome for regular habit of cigarette smoking[21]. In consistence with their findings, the present study also reported a significantly higher mean platelet count among males as compared to female smokers ($p < 0.05$). It has been speculated that in chronic smokers, platelet count usually elevated inferring increased reactivity and aggregation[2,3]. The present study reported contradicting results of smoking consequences, where a decreased mean platelet count observed among smokers but was not statistically significant as compared to the non-smokers. Moreover, a significantly decreased mean platelet count was observed among the regular smokers as compared to the occasional ($p < 0.05$).

In the present study, the effect of tobacco chewing on platelet count and MPV were also studied. Since the habit of tobacco chewing and smoking is more prevalent in India and subsequently reported from the North-eastern region of the country too[10]. In a cross-sectional study carried out on youths of tea garden workers of Dibrugarh district of Assam, Medhi et al., have reported a very high (58%) percentage of substance uses, out of which 52.5% of the study population were

tobacco chewers and 32.2% were alcoholics comprising both male and female participants[19]. Another pilot study conducted in Meghalaya and upper Assam revealed 29.4% of the study participants with the habit of tobacco consumption, out of which 20.5% were chewers and 12.7% were smokers and the percentage prevalence for alcoholics was 12.5% [22]. Screening studies have suggested that tobacco chewing causes decrease in platelet count and also affect other haematological parameters of blood[18, 11]. In agreement with their findings, the present study also observed decreased mean platelet count among tobacco chewers as compared to the non-consumers but the difference in their mean was not found statistically significant ($p > 0.05$). Similarly, the present study also investigated the frequency of alcohol consumption and its consequences on quantitative variation of platelet. Many studies demonstrated that excessive alcohol consumption is a common cause of modest thrombocytopenia where platelet count usually ranges from 75 − 100 $\times 10^3$ µl of blood[23, 12]. Consumption of alcohol also affects platelet indices i.e. MPV. A study carried out on Korean population reported low platelet count with high MPV in individuals who were chronic alcohol consumers[24]. Alcohol consumption is also associated with verities of metabolic syndromes and causes cancer of liver, cardiovascular diseases and increased risk of cerebral haemorrhage where decreased platelet count act as a significant marker in disease severity[25, 26]. Studies also suggested that in case of chronic alcohol ingestion, an evidently inhibitory effect on platelet function was observed together with reduced platelet count and thus, contributes increased incidence and recurrence of gastrointestinal haemorrhage[13]. Some information also indicated that primary hemostasis is impaired in man after ingestion of moderate amount of alcohol but might have favorable effect on ischemic heart disease[27]. The present study indicated a highest percentage of consumers group with the habit of alcohol consumption (49.6 %; n = 66/133). In concordance with the earlier findings, the present study also reported a lower mean value for platelet count in alcoholics as compared to the non-consumers ($p < 0.000$). Low platelet count was more significantly observed in each category of combined or multiple substance users ($p < 0.001$) and thus, are quite conceivable that more than one habit of substance addiction is a threat to platelet numeration. Considering MPV as a pivotal element in platelet activation, the present study has not conferred any significant difference for the variation in MPV between consumers and non-consumers group.

CONCLUSION

This happens to be the first description for elucidating the impact of substance uses on quantitative variation of platelet among healthy population of Assam, India, where substance addiction is associated with low platelet count. Therefore, individual's personal habits for substance abuse likely to be considered as one of the contributing determinants for low platelet count condition despite being healthy.

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CONFLICT OF INTEREST

None

REFERENCES

1. Campbell, R.A., Machlus, K.R. and Wolberg, A.S., Smoking Out of the Cause of Thrombosis, *Arterioscler. Thromb. Vasc. Biol*. **30:** 7-8 (2010).
2. Ngozi, S.C. and Ernest, N.E., Long-term smoking results in haemostatic

dysfunction in chronic smokers, *Niger. Med. J*. **55:** 121-125 (2014).

3. Biljak, V.R., Pancirov, D., Cepelak, I., Popovic-Grle, S., Stjepanovic, G. and Grubisic, T.Z., Platelet count, mean platelet volume and smoking status in stable chronic obstructive pulmonary disease, *Platelets*. **22:** 466-470 (2011).
4. Giles, C., The platelet count and mean platelet volume, *Br. J. Haematol*. **48:** 31-37 (1981).
5. Martina, E.D., Determinants of platelet count in humans, *Haematologica*. **96:** 10-13 (2011).
6. Sairam, S., Domalapalli. S. and Muthu, S., *et al*., Hematological and Biochemical Parameters in Apparently Healthy Indian Population: Defining Reference Intervals, *Ind. J. Clin. Biochem*. **29:** 290-297 (2014).
7. Lozano, M., Narvaez, J. and Faundez, A., *et al*., Platelet count and mean platelet volume in the Spanish population, *Med. Clin*. **110:** 774-777 (1988).
8. Bain, B.J., Rothwell, M., Feher, M.D., Robinson, R., Brown, J. and Sever, P.S., Acute changes in haematological parameters on cessation of smoking, *J. R. Soc. Med*. **85:** 80-82 (1992).
9. Erikssen, J., Hellem, A. and Stormorken, H., Chronic effect of smoking on platelet count and" platelet adhesiveness" in presumably healthy middle-aged men, *Thromb. Haemost*. **38:** 606-611 (1977).
10. Biswas, S., Manna, K. and Das, U., *et al*., Smokeless tobacco consumption impedes metabolic, cellular, apoptotic and systemic stress pattern: A study on Government employees in Kolkata, *India. Sci. Rep*. **5:** 1-12 (2015).
11. Kumar, D., Binawara, D.R., Beniwal, M.P. and Sharma, M.P., Effect of Chewing Tobacco on Hematological Parameters in Bikaner City Population, *J. Med. Sci. Clin. Res*. **5:** 17721-17727 (2017).
12. Ballard, H.S., The hematological complications of alcoholism, Alcohol. *Health. Res. World*. **21:** 42-52 (1997).
13. Mikhailidis, D.P., Jenkins, W.J., Barradas, M.A., Jeremy, J.Y. and Dandona, P., Platelet function defects in chronic alcoholism, *Brit. Med. J*. **293:** 715-718 (1986).
14. Cowan, D.H., Effect of alcoholism on hemostasis, *Sem. Hematol*. **17:** 137-147 (1980).
15. Rehm, J., The Risks Associated With Alcohol Use and Alcoholism, *Alcohol. Res. Health*. **34:** 135-143 (2011).
16. Koc, S., Eyibilen, A. and Erdogan, A.S., Mean Platelet Volume as an Inflammatory Marker in Chronic Sinusitis, *Eur. J. Gen. Med*. **8:** 314-317 (2011).
17. Gasparyan, A.Y., Ayvazyan, L., Mikhailidis, D.P. and Kitas, G.D., Mean Platelet Volume: A Link Between Thrombosis and Inflammation?, *Curr. Pharm. Des*. **17:** 47-58 (2011).
18. Hazarika, N.C., Biswas, D., Phukan, R.K., Hazarika, D. and Mahanta, J., Prevalence and pattern of substance abuse at Bandardewa, a border area of Assam and Arunachal Pradesh, *Indian J. Psychiatry*. **42:** 262-266 (2000).
19. Medhi, G.K., Hazarika, N.C. and Mahanta, J., Tobacco and alcohol use among the youth of the agricultural tea industry in Assam, India, *Southeast Asian J. Trop. Med. Public Health*. **37:** 581-586 (2006).
20. Green, M.S., Peled, I. and Najenson, T., Gender differences in platelet count and its association with cigarette smoking in a large cohort in Israel, *J. Clin. Epidemiol*. **45:** 77-84 (1992).
21. Tell, G.S., Grimm, R.H. Jr., Vellar, O.D. and Theodorsen, L., The relationship of white cell count, platelet count, and hematocrit to cigarette smoking in adolescents: the Oslo Youth Study, *Circulation*. **72:** 971-974 (1985).
22. Chaturvedi, H.K., Phukan, R.K. and Mahanta, J., The association of selected sociodemographic factors and differences in patterns of substance use: a pilot study in selected areas of Northeast India, *Subst. Use Misuse*. **38:** 1305-1322 (2003).

23. Bradbury, C. and Murray, J., Investigating an incidental finding of thrombocytopenia, *Brit. Med. J*. **346:** 1-6 (2013).
24. Cho, S.Y., Lee, H.J., Kim, J.W. and Park, T.S., Mean platelet volume and mean platelet volume/platelet count ratio in patients with chronic alcohol consumption, *Platelets*. **26:** 371-379 (2015).
25. Kotani, K., Sakane, N., Saiga, K., Mu, H. and Kurozawa, Y., Clustered components of the metabolic syndrome and platelet counts in Japanese females, *Clin. Chem. Lab. Med*. **45:** 376-379 (2007).
26. Peng, G.S., Yin, S.J. and Cheng, C.A., *et al*., Increased risk of cerebral hemorrhage in Chinese male heavy drinkers with mild liver disorder, *Cerebrovasc. Dis*. **23:** 309-314 (2007).
27. Elmer, O., Goransson, G. and Zoucas, E., Impairment of primary hemostasis and platelet function after alcohol ingestion in man, *Haemostasis*. **14:** 223-228 (1984).