Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Physiology

Differential Study of Haematological Parameters in Between the Workers Working in Filling Station and Control Population

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DOI: https://doi.org/10.36347/sjams.2026.v14i07.005 | **Received:** 23.05.2026 | **Accepted:** 07.07.2026 | **Published:** 10.07.2026

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Abstract **Original Research Article**

Background: Exposure to high quantities of benzene and its metabolites can cause hematotoxicity. However, the effects of exposure to low amounts remain unknown. Furthermore, the impacts on haemopoietic components may cause injury in other sections of the body later in life. ***Aim of the study:*** The purpose of this study is to use hemograms to analyze the effect of fuel exposure on the hematological parameters of filling station workers. ***Methods:*** A cross-sectional study was done from January 2022 to December 2022 in the Department of Physiology, Dhaka Medical College, Dhaka. A total number of 80 participants comprising 40 in study group and 40 in control group were recruited by purposive sampling technique after fulfilling the ethical aspect. The study group was again divided into group A1 (duration of exposure to fuel < 5 years), group A2 (duration of exposure to fuel 5 to 10 years) and group A3 (duration of exposure to fuel > 10 years). The study parameters were total and differential count of white blood cell (WBC), platelet count and mean platelet volume (MPV). Statistical analysis was done by a computer based statistical program SPSS windows version 26.0 as applicable. ***Results:*** In this study, total count of platelet ($p< 0.001$) was lower in study group compared with control group which was statistically significant. TC of WBC ($p=0.363$), neutrophil ($p=0.266$), lymphocyte ($p=0.152$), monocyte ($p=0.640$), eosinophil ($p=0.332$) and MPV ($p=0.536$) were not statistically significant. Furthermore, TC of WBC ($p=0.337$), total count of WBC and platelet count showed negative correlation with duration of exposure while neutrophil showed positive correlation. ***Conclusion:*** Long time exposure to fuel impacts haematological parameters.

Keywords: Filling station, mean platelet volume (MPV), filling station workers, hematological parameters.

INTRODUCTION

Our society's economic prosperity is progressing towards a more meaningful life. To achieve this advancement, various commercial jobs have been formed [1]. Human health and safety threats are increasing in the majority of vocations worldwide. Some jobs and work environments can induce physical, chemical, biological, and psychological illnesses [2]. Unsanitary working conditions and a lack of safety precautions can lead to a variety of health issues for employees. Fuel is one of the world's most popular commercial products. Filling station personnel, service station attendants, gas truck drivers, and refinery workers are among those who are more exposed to fuel [3]. Fuel is one of the world's most popular commercial products [4]. Certain persons are more exposed to fuel, such as filling station personnel, service station attendants, gasoline truck drivers, and refinery workers [5]. Station employees are exposed to petrol and diesel derivatives while refueling at filling stations [6]. A filling station is a location where fuel and lubricants for automobiles are sold. These facilities provide fuels such as petrol (Premium Motor Spirit), liquefied natural gas (LNG), diesel (Automated Gas Oil), and kerosene (Dual Purpose Kerosene). Fuel is a material that stores potential energy and then releases it to generate heat and electricity for labor [1]. Fuels are petroleum products derived from fractional distillation of crude oil that contain various types of saturated and unsaturated hydrocarbons as well as other compounds [7]. Because of the volatile nature of fuel at filling stations, different hydrocarbons are easily emitted into the environment. Thus, filling station

employees are frequently exposed to fuel vapor [8]. The volume of petrol vaporized relies on air temperature, which is higher in tropical regions [9]. Petrol and diesel are made up of different hydrocarbons. Petrol is a highly flammable liquid generated from petroleum that contains volatile hydrocarbons such as benzene, toluene, ethylbenzene, and xylene (together known as BTEX). Heavy metal pollutants include iron, nickel, copper, vanadium, cadmium, and lead. According to the International Agency for Research on Cancer, benzene and ethylbenzene are categorized as carcinogenic agents in groups 1 and 2B, respectively, while others impair our body's central nervous system [10]. Diesel contains 75% saturated hydrocarbons and 25% aromatic hydrocarbons. Diesel is primarily composed of paraffin [11]. For decades, occupational health concerns have been known among filling station personnel. Workers worldwide suffer greatly as a result of various ailments. Work-related disorders are substantially more prevalent in underdeveloped nations [4]. To assess changes in hematological profile, a complete blood picture (CBP) is a convenient method. CBP is a quick, simple, and reachable method for detecting any harmful effects of hematological illnesses [12]. However, no data is available on the hematological parameters of filling station personnel in Bangladesh who are consistently exposed to petroleum compounds and exhaust emissions. This study will contribute to our understanding of the hematological status of filling station personnel in our country. Aside from that, knowledge of health concerns among these personnel will be increased, and safety measures can be implemented to promote the health of filling station workers.

METHODOLOGY

A cross-sectional study was done from January 2022 to December 2022 in the Department of Physiology, Dhaka Medical College, Dhaka. A total number of 80 participants comprising 40 in study group and 40 in control group were recruited by purposive sampling technique after fulfilling the ethical aspect.

Inclusion criteria

For study group

1. Filling station workers of Dhaka City.
2. Between 20 to 55 years of age group.
3. Duration of exposure is at least 8 hours per day.
4. Working experience in filling station is minimum 1 year.
5. Non- smokers, non-alcoholics.

For control group

1. Not working or living nearby fuel stations.
2. Age between 20 to 55 years.
3. Non- smokers, non-alcoholics.

Exclusion criteria

For both groups

1. History of acute illness.
2. History of any pathological conditions like chronic obstructive pulmonary disease (COPD), asthma, musculoskeletal abnormality, diabetes mellitus, hypertension, heart disease, liver disease, kidney disease, TB, malignancy.
3. History of blood donation or received blood within last 3 months.
4. History of taking anticoagulant, cytotoxic chemotherapy, iron therapy and long-term corticosteroid medication (at least 3 months).

Study Variables

1. Total count of white blood corpuscles (WBC)
2. Differential count of WBC
3. Platelet count
4. Mean platelet volume (MPV)

Statistical analysis

Statistical analysis was performed by using a computer based statistical program SPSS (statistical package for social science) version 26. Results were expressed as mean and standard deviation (mean ± SD). Unpaired student's t-test was used to compare the parameters among study and control group. One way ANOVA test with Bonferroni was used to determine whether there were any significant differences between three sub groups of study group. For skewed distribution, Kruskal-Wallis test was performed. Pearson's correlation coefficient (r) test was done to observe the relation between duration of exposure and hematological parameters. p value <0.05 was considered as level of significance.

RESULT

Table-1 depicts that the mean (±SD) age of study group A and control group B were 39.32±8.80 and 36.55±8.32 years respectively. The mean (±SD) diastolic blood pressure of study group A and control group B was 80.0±4.53 and 78.9±5.0 mm of Hg respectively. In this table p value of all of the parameters were > 0.05, so no statistically significant differences were found in age, BMI, systolic pressure and diastolic pressure between study and control group.

Table-1: General characteristics of the subjects in study and control groups (N = 80)

Parameters	Group A (n=40) Mean±SD Range	Group B (n=40) Mean±SD Range	p-value
Age (years)	39.32±8.80 (21.0–55.0)	36.55±8.32 (21.0–55.0)	0.151

Systolic blood pressure	122.0±8.76	122.5±9.06	0.802
(mm of Hg)	(100–135)	(100–135)	
Diastolic blood pressure	80.0±4.53	78.9±5.0	0.295
(mm of Hg)	(60–85)	(65–85)	

In Table-2 the mean (±SD) total count of WBC was 7.78±1.39 and 8.05±1.29 $\times 10^3$ /µl in group A and group B respectively. In this study, the mean (±SD) total count of WBC was lower in group A in comparison to that of group B which was not statistically significant (p= 0.363). The mean (±SD) total count of platelets was 197.35±39.93 and 233.27±39.80$\times 10^3$ /µl in group A and group B respectively. In this study, the mean (±SD) total count of platelet was lower in group A in comparison to that of group B which was statistically significant (p<0.001). The mean (±SD) of MPV was 11.05±0.85 and 10.94±0.77 fL in group A and group B respectively. In this study, the mean (±SD) of MPV was higher in group A in comparison to that of group B which was not statistically significant (p= 0.536).

Table-2: Comparison of WBC and Platelet Profile between Study Group and Control Group (n=80)

Parameters	**Group A (n=40) Mean±SD Range**	**Group B (n=40) Mean±SD Range**	**p-value**
TC of WBC ($\times 10^3$/µl)	7.78±1.39	8.05±1.29	0.363
	(3.7–10.8)	(4.8–11.2)	
Neutrophil (%)	58.51±8.28	60.52±7.75	0.266
	(33.6–78.4)	(48.4–71.4)	
Lymphocyte (%)	35.11±7.63	32.77±6.80	0.152
	(17.0–54.5)	(14.9–44.9)	
Monocyte (%)	3.04±0.90	2.94±1.00	0.64
	(1.8–5.6)	(0.3–4.9)	
Eosinophil (%)	3.34±1.99	3.76±1.86	0.332
	(0.4–9.2)	(0.8–9.4)	
Basophil (%)	0.00±0.00	0.01±0.05	0.206
	(0.0–0.0)	(0.0–0.3)	
Platelet count (×103/µl)	197.35±39.93	233.27±39.80	<0.001
	(120.0–290.0)	(158.0–322.0)	
MPV (fL)	11.05±0.85	10.94±0.77	0.536
	(9.1–12.9)	(9.0–12.7)	

The mean (±SD) total count of WBC was 8.16±1.43, 7.96±1.24 and 7.41±1.45 $\times 10^3$ /µl in group A1, group A2 and group A3 respectively. In this study no significant differences were found between groups (p=0.337). No statistically significant result was found in the study of differential count of WBC. P value of Neutrophil, Lymphocyte, Monocyte and Eosinophil were 0.229, 0.410, 0.494 and 0.071. The mean (±SD) total count of platelets was 197.64±44.74, 213.67±40.85 and 185.65±33.80$\times 10^3$ /µl in group A1, group A2 and group A3 respectively. In this study, the mean (±SD) total count of platelet was lower in group A3 in comparison to group A1 and group A2 which was not statistically significant (p=0.179). The mean (±SD) of MPV was 11.30±0.74, 11.23±0.72 and 10.76±0.95 fL in group A1, group A2 and group A3 respectively and no significant differences (p=0.178) were found between groups [Table-3].

Table-3: Comparison of WBC and Platelet profile with duration of exposure in study group (n=40)

Parameters	**Group A1 (n=11) Mean±SD**	**Group A2 (n=12) Mean±SD**	**Group A3 (n=17) Mean±SD**	**p-valuea**
TC of WBC ($\times 10^3$/µl)	8.16±1.43	7.96±1.24	7.41±1.45	0.337
	(5.54-9.85)	(6.10-10.80)	(3.70-9.20)	
Neutrophil (%)	60.28±4.86	55.07±8.78	59.79±9.30	0.229
	(55.20-70.10)	(33.60-65.30)	(43.10-78.40)	
Lymphocyte (%)	33.80±5.45	37.59±7.95	34.21±8.55	0.41
	(24.10-40.40)	(24.80-54.50)	(17.00-48.60)	
Monocyte (%)	3.16±1.12	3.21±1.03	2.84±0.62	0.494
	(1.80-5.60)	(2.20-5.40)	(2.00-4.40)	

Basophil (%)	0.00±0.00 (0.00 -0.00)	0.00±0.00 (0.00 -0.00)	0.00±0.00 (0.00 -0.00)	-
Platelet count (×103/µl)	197.64±44.74 (150.00-283.00)	213.67±40.85 (156.00-290.00)	185.65±33.80 (120.00-254.00)	0.179
MPV (fL)	11.30±0.74 (10.10-12.90)	11.23±0.72 (10.10-12.30)	10.76±0.95 (9.10-12.10)	0.178
	median	median	median	P value[b]
Eosinophil (%)	2.40 (0.40-7.40)	3.75 (1.20-9.20)	2.80 (0.70-6.70)	0.071

In Table-4 neutrophil showed positive correlation (r=+0.121) with duration of exposure in group A which was not statistically significant (p=0.456). Lymphocyte, Monocyte and Eosinophil showed negative correlation (r=-0.101, -0.205 and -0.025 respectively) which were not statistically significant and p values were 0.535, 0.204 and 0.879 respectively. MPV showed negative correlation (r=-0.265) with duration of exposure in group A which was not statistically significant (p=0.126).

Table-4: Correlation of duration of exposure with WBC and Platelet profile in Group A (n=40)

Parameters	r-value	p-value
TC of WBC (×10^3/µl)	-0.232	0.149
Neutrophil (%)	+0.121	0.456
Lymphocyte (%)	-0.101	0.535
Monocyte (%)	-0.205	0.204
Eosinophil (%)	-0.025	0.879
Platelet count (×103/µl)	--0.246	0.126
MPV (fL)	-0.265	0.098

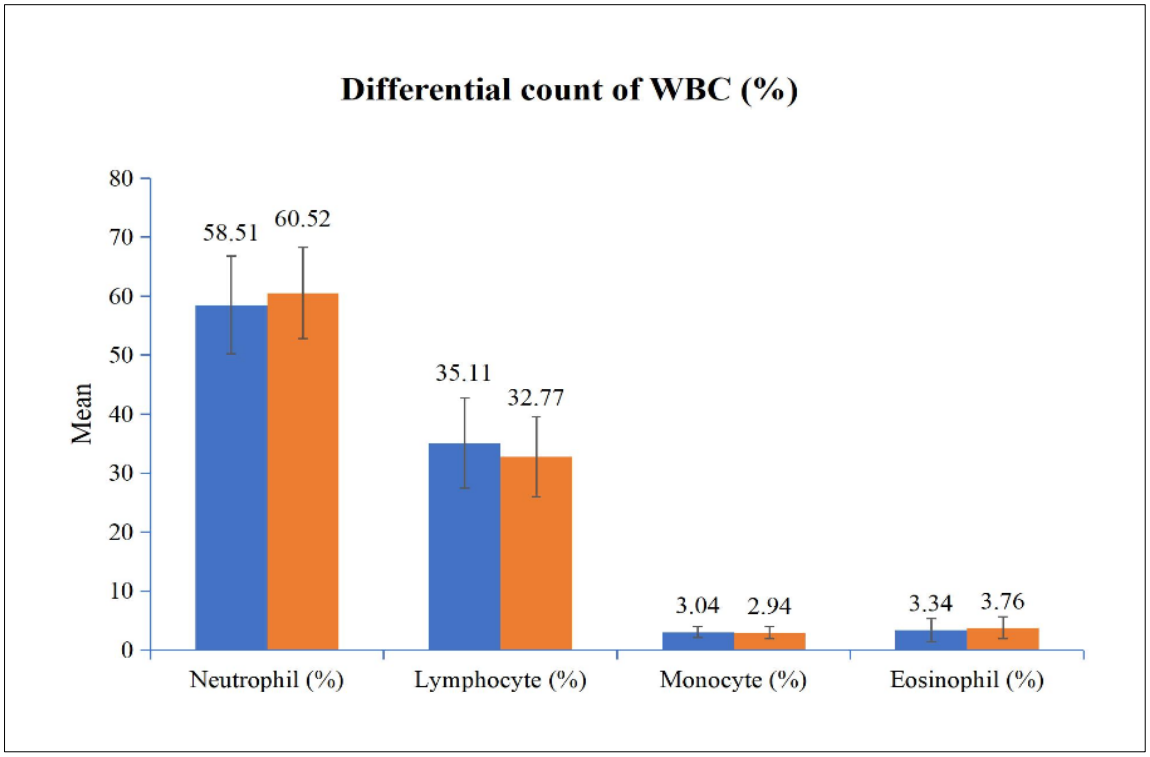

Figure-1: Bar diagram showing the mean of differential count of WBC between two groups

No statistically significant result was found in the study of differential count of WBC. Lymphocyte and monocyte showed nonsignificant increase in group A in comparison to that of group B. Neutrophil and eosinophil showed nonsignificant decrease in group A in comparison to that of group B. p value of neutrophil, lymphocyte, monocyte, eosinophil and basophil was 0.266, 0.152, 0.640, 0.332 and 0.206 [Figure-1].

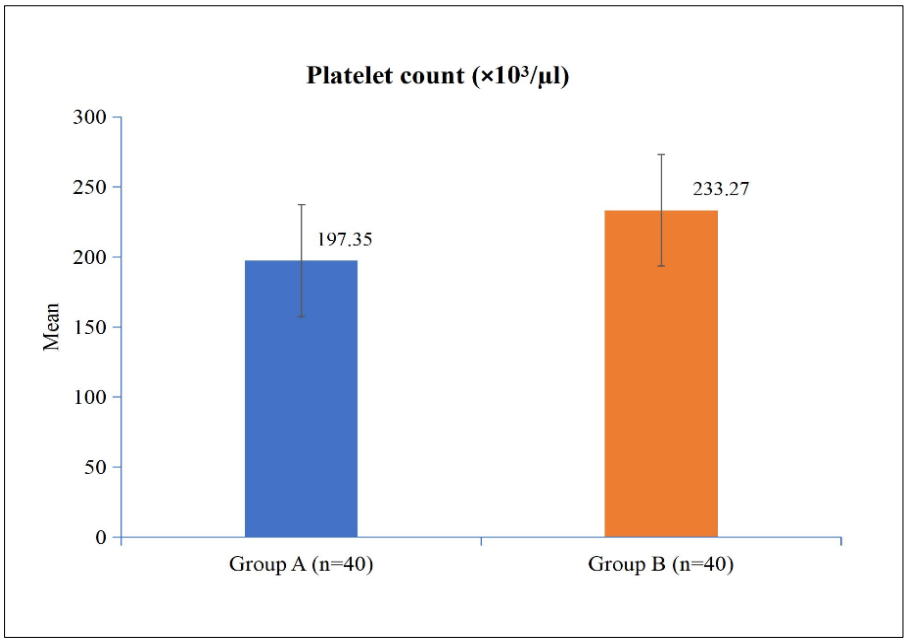

Figure-2: Bar diagram showing the mean of Platelet count (×10³/µl) between two groups

The mean (±SD) total count of platelets was 197.35±39.93 and 233.27±39.80× 103 /µl in group A and group B respectively. In this study, the mean (±SD) total count of platelet was lower in group A in comparison to that of group B which was statistically significant (p<0.001) [Figure-2].

DISCUSSION

The present study was undertaken to observe the hematological parameters (total count of WBC, platelet count, differential count of WBC, MPV). In present study, all subjects were male in both groups as female did not find in filling stations as worker. So, gender was chosen as male for both groups. 40 subjects with age ranging from 20 to 55 years were selected from different filling stations of Dhaka metropolitan city according to inclusion and exclusion criteria. Then 40 healthy adult subjects were taken from Dhaka medical college and different offices of Dhaka city from personal contact who had no history of exposure to fuel vapor as control group. The age range of control group was from 20 to 55 years. In this study, age and blood pressure of all the subjects in study and control groups were almost similar and statistically no significant differences were observed among them. The mean value of age of study group was 39.32±8.80 and control group was 36.55±8.32 with p value 0.151. This observation was in agreement with the studies carried out by several researchers of different countries. Elnabi *et al.,* (2021) from Egypt and Teklu *et al.,* (2021) from Ethiopia mentioned that there were no statistically significant differences in age between study group and control group in their study [13, 14]. TC of WBC, Lymphocyte, Monocyte, Eosinophil, Platelet count and MPV showed negative correlations which was not statistically significant. Neutrophil showed positive correlation which was not statistically significant. These findings were almost similar with Hussain *et al.,* (2019) and Teklu *et al.,* (2021) [3, 14]. Teklu *et al.,* found negative correlation in platelet with years of exposure [14]. They also found positive correlation in absolute number of neutrophils with duration of exposure. On the contrary, Elnabi *et al.,* (2021) reported that WBC count was positively correlated with duration of exposure while platelet count was negatively correlated [13]. These discrepancies may be due to variations in the sample size, control subjects, duration of exposure, air concentration of gasoline and use/neglect of safety equipment.

Limitation of the study:

The study used a single focus point and small sample sizes. As a result, the study's findings may not accurately reflect the overall situation.

CONCLUSION & RECOMMENDATION

After analyzing the results of the study, it can be concluded that TC of platelet count was significantly decreased in study group compared with control group. Total count of WBC was also decreased in study group which was not statistically significant. MPV was also found increased in study group which was not statistically significant. Total count of WBC and platelet count showed negative correlation with duration of exposure while neutrophil showed positive correlation. So, long time exposure to fuel impacts haematological parameters.

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