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Research Article

Impact of Long Term Exposure to Petroleum Products on Hematological Parameters in Petrol Pump Workers of Dehradun Region

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ABSTRACT

Petroleum products are used for various reasons by human beings at homes, in manufacturing and petrochemical industries. The individuals most frequently exposed are those working in enterprises concerned with petrol and diesel, like petrol pumps. Chronic exposure to these compounds causes CNS depression and affects the kidney, liver, blood and systems. Hence, the present study was undertaken to assess the extent of damage caused by the chronic inhalation of petrol fumes on the hematopoietic system of human cases. The study was carried out on adult human subjects in Dehradun region.150 fuel attendants were included in the study. These were divided into three groups based on years of working experience in petrol pumps. The complete blood count was performed in department of Biochemistry, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun (UK) using KX-21 sysmex cell counter. Data pertaining to different parameters of hematology, were recorded from 50 subjects each from three groups based on years of working experience in petrol pumps viz 1 – 5 yrs, 6 – 10 yrs and >10yrs. The data was analyzed applying one way ANOVA Technique. The main factor was the categories of years of experience at petrol pumps. The Statistical Package Genstat -32 was used.

We found significant decrease in hemoglobin, RBC count, PCV, MCHC and platelets with respect to years of exposure, other parameters such as TLC, DLC, MCV, and MCH were varying insignificantly with respect to years of working experience in petrol pumps. All the parameters were within normal limits. This concludes that chronic exposure to petroleum fumes has adverse effects on human hematopoietic system, leading to bone marrow depression and resultant pancytopenia.

Key words: *Haemoglobin, Petroleum products, TLC, MCHC, MCH*

INTRODUCTION

Petroleum products are used for various reasons by human beings at homes, in manufacturing and petrochemical industries. The daily use of petroleum products both in and outside petroleum industries may have effects on users.

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Those who work directly in petroleum industries and are occupationally exposed are likely to be more affected than their counterparts who do not work in these industries. The individuals most frequently exposed are those working enterprises concerned with petrol and diesel, like the petrol pumps. The workers involved in the job of filling the petrol or diesel in the vehicles are the one maximally exposed to the petroleum fumes. Sources of petroleum vapours at the petrol pumps include losses from underground tanks, displacement vapour losses from filler pipes during refueling, fuel spillage and evaporative and tailpipe emissions from motor vehicles.

The available toxicokinetic data on petrol/gasoline shows that it is absorbed from all exposure routes, including perinatal. Some petroleum components are absorbed more rapidly than others. For example, aromatic compounds like benzene, toluene, and xylene which have both high blood/air partition coefficients and skin penetration rates are absorbed more rapidly than other petrol components. Acute exposure to petrol/gasoline and benzene, toluene etc. has been associated with skin and sensory irritation, central nervous system depression and effects on the respiratory system, whereas prolonged chronic exposures to these compounds affects these organs as well as kidney, liver and blood systems of these, particularly benzene is considered to be the most hematotoxic[1].

Benzene, an aromatic hydrocarbon that is a natural component of crude oil and natural gas, is toxic to the blood and blood-forming organs. Chronic hematotoxic effects of benzene exposure, including reduced lymphocyte, neutrophil and platelet counts in peripheral blood, have been detected at occupational exposure below a level that had previously been considered not to cause any health effects. Whether these abnormalities represent bone marrow damage and/or initial events in the development of a true neoplastic disease is not known[2].

Previous research studies carried out were on composite fumes evaporating from kerosene, petrol and diesel and such studies were carried out on experimental animals. Hydrocarbons like benzene, metals like lead and volatile nitrates have all been shown to produce harmful effects on the bone marrow, spleen, and lymph node[3].

Hence, the present study was undertaken to assess the extent of damage caused by the chronic inhalation of petrol fumes on the haematopoetic system of human cases. The aim was to ascertain whether the years of working experience in petrol pumps has any significant bearing on their haematological parameters or not.

MATERIAL AND METHODS

The study was carried out in adult human subjects, from Dehradun city, aged between 20 to 40 years who gave informed consent to the study. Since most of the petrol pump workers were males, the study involved only male subjects. For the study, the blood sample of total 150 petroleum attendant were taken 50 petroleum attendant were having work experience between 1-5 years, 50 attendants were having work experience between 6-10 years and 50 petroleum attendants were having work experience of more than 10 years . The whole blood samples were collected in EDTA vacationers by standard vein puncture method and analyzed by fully automated hematology analyzer KX-21 of Trans Asia Biomedical Limited .The parameters under consideration were TLC (Total Leukocyte Count), Lymphocytes percentage, Neutrophils percentage, Eosinophils percentage, Monocyte percentage, Total RBC Counts PCV (Packed cell volume), MCV (Mean corpuscular volume), MCH (Mean corpuscular Hemoglobin), MCHC (Mean corpuscular Hemoglobin concentration) and Platelet count. All the parameters are represented in their standard units. Data pertaining to different parameters of hematology, were recorded from 50 subjects each from three groups based on years of working experience in petrol pumps *viz* 1 – 5 yrs, 6 – 10 yrs and >10yrs. The data was analyzed applying one way ANOVA Technique. The main factor was

the categories of years of experience at petrol pumps. The Statistical Package Genstat -32 was used. The findings of the analyses have been tabulated showing parameters, mean values, the level of significance and values of critical difference (CD).

Inclusion criteria

1. Age group of 20 to 40 years.
2. Subjects who have given written consent.

Exclusion criteria

1. Subjects suffering from significant cardiovascular disorders.
2. Subjects with family history of malignancies.
3. Chronic smokers, smoking at least 20 cigarettes or beedies per day for not less than 10 years.
4. Subjects with chronic Renal or Respiratory diseases.
5. Subjects with thyroid history or history of hypertension.
6. Subjects with morbid obesity.
7. Individuals on corticosteroid therapy, radiotherapy or chemotherapy.

RESULTS

Table 1: Variation of Age and BMI among different groups exposed to petroleum vapours

PARAMETERS	YEARS OF EXPOSURE			LEVEL OF SIGNIFICANCE	CD
	1-5 YEARS	6-10 YEARS	11-15 YEARS		
Age (yrs)	**30.82**	**32.48**	**32.04**	NS	
BMI	**21.79**	**21.41**	**25.65**	NS	

Table 2: Variation of Hematological parameters among different groups exposed to petroleum vapour

PARAMETERS	YEARS OF EXPOSURE			LEVEL OF SIGNIFICANCE	CD
	1-5 YEARS	6-10 YEARS	11-15 YEARS		
Hemoglobin(gm/dl)	14.83	14.17	13.97	** ($p \leq 0.01$)	0.567
TLC/ MM^3	7402	6856	6796	NS	--
Lymphocytes %	34	34.32	35.76	NS	--
Neutrophils %	56.60	57.36	54.28	NS	--
Eosinophils %	3.9	3.74	4.22	NS	--
Monocytes %	5.14	4.84	5.64	NS	--
Total RBC Counts (million / mm^3)	5.038	4.99	4.679	*** ($p \leq 0.001$)	0.573
PCV %	43.379	41.050	40.392	***($p \leq 0.001$)	4.439
MCV (FL)	86.13	83.9	85.26	NS	--
MCH(PG)	30.31	29.44	28.78	NS	--
MCHC gm/dl	34.48	3 4.16	33.15	***($p \leq 0.001$)	0.732
Platelets	2.736	2.352	2.227	***($p \leq 0.001$)	0.254

Table 2 shows the distribution of hematological parameters among petroleum workers. The workers were divided into three groups first group with 1-5 years of exposure, second group with exposure and third group with 11-15 years of exposure. We found insignificant difference among three groups with respect to age and BMI as shown in (Table 1).

We found significant decrease in hemoglobin, RBC count, PCV, MCHC and platelets with respect to years of exposure, other parameters such as TLC, DLC, MCV, and MCH were varying insignificantly with respect to years of working experience in petrol pumps. However all the parameters were within the normal limits.

DISCUSSION

Decrease in hemoglobin content could be due to decrease in red blood cells or impaired biosynthesis of heme in bone marrow. Decreased haemoglobin and red blood cell could also be attributed to insufficiency of protein synthesis that mainly induces decrease of essential amino acids and shortage of the energy source of protein synthesis incorporated in haemoglobin production. The decrease in red blood cell count was observed in the exposed population[5].

Our findings are in accordance with that of a study, performed in Baghdad city on 292 workers of petrol filling station with five years duration of employment and consequently in which 146 petrol filling workers were found with hematopoietic changes. Significant changes in haemoglobin level were observed as compared with individuals who are not exposed to workplace. Petrol station attendants are workers chronically exposed to petroleum derivatives primarily through inhalation of the volatile fraction of petrol during vehicle refuelling. The adverse health effects of gasoline exposure may be primarily related to the impairment of the haemopoetic system with bone marrow depression[6].

Another study done in Nigeria on fuel attendants showed partial similar results, with a global reduction in the mean values of total leucocyte count, red blood cell count, Packed Cell Volume and other red blood cell indices in exposed individuals[3].

Toxic constituents of crude oil such as Benzene and Lead are reported to be activated in the bone marrow and the cytotoxic effects observed are mediated through disturbance in DNA function. The resultant bone marrow depression is characterized by inadequate production of red cell and other formed elements[7]. White blood cells function primarily in body defence against foreign bodies and this is often achieved through leucocytosis and antibody production. In a study, the white blood cell count decreased significantly in humans of both sexes exposed to petroleum fumes and the decrease was greater in those exposed for more than two years. Benzene is reported to produce haematological changes ranging from pancytopenia to total bone marrow aplasia, affected through its myelotoxic action[8].

Petroleum fumes occupational exposure in petroleum sector has been described to have toxic effects on, immune and nervous systems. Different organs such as the skin, heart, kidneys, and lungs are affected by these toxic effects resulting in various diseases and different forms of carcinogenic, neurotoxic, immunotoxic, genotoxic and mutagenic manifestations[9]. Similarly, the impact of occupational hazards on erythrocyte and haemoglobin levels and menstrual cycle characteristics in women exposed to aromatic hydrocarbons was studied by[10] and found that the mean RBC counts and Haemoglobin levels of the subjects exposed to benzene were statistically significantly lower than those of the control group and the difference was mainly due to the direct influence of aromatic hydrocarbons in the working environment on hematopoiesis[11] designed a study to evaluate the expected toxic effects of long-term exposure to petrol products in 48 gasoline filling workers with an age range between 27 to 65 years within Sulaimani city area and found significant differences in means of haemoglobin level on most workers.

A study conducted by Mohammed[12] in petroleum workers of Shivamogga city, the mean values of haemoglobin %, RBC count and Total Leucocyte Count (TLC) were found to be significantly decreased in the test group when compared with the control group.

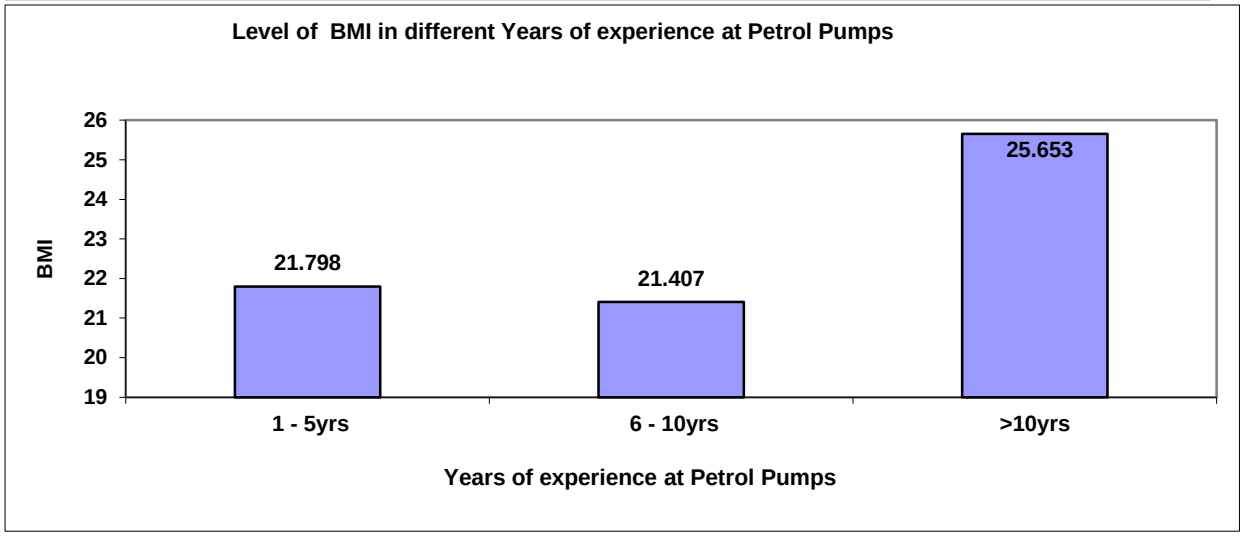

Fig. 1: Variation of BMI in different groups of petrol pump workers with increasing experience

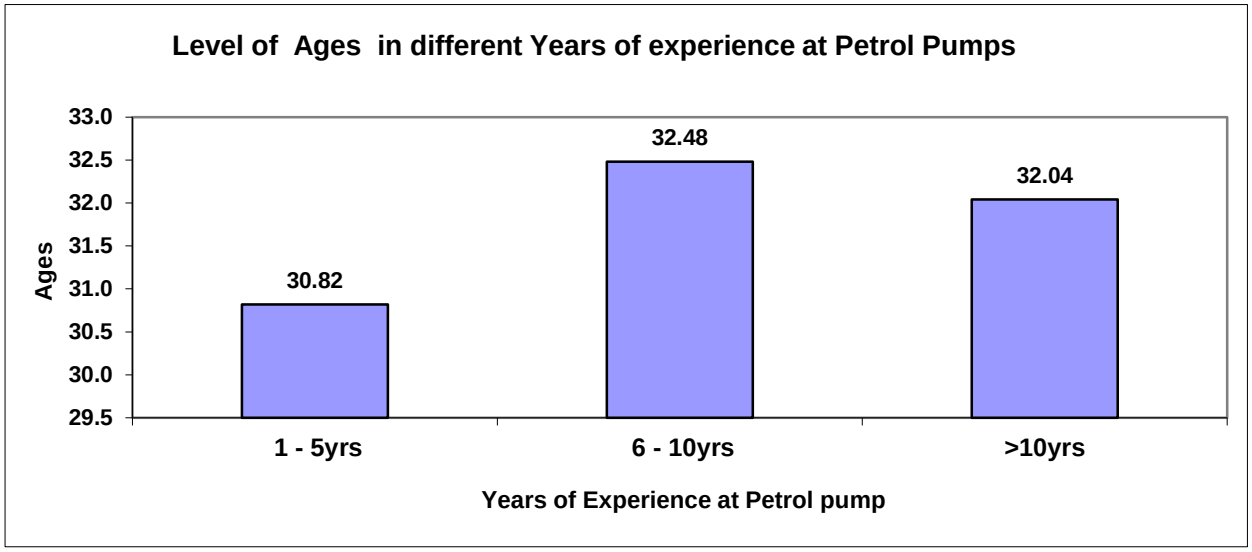

Fig. 2: Variation of Age in different groups of petrol pump workers with increasing experience

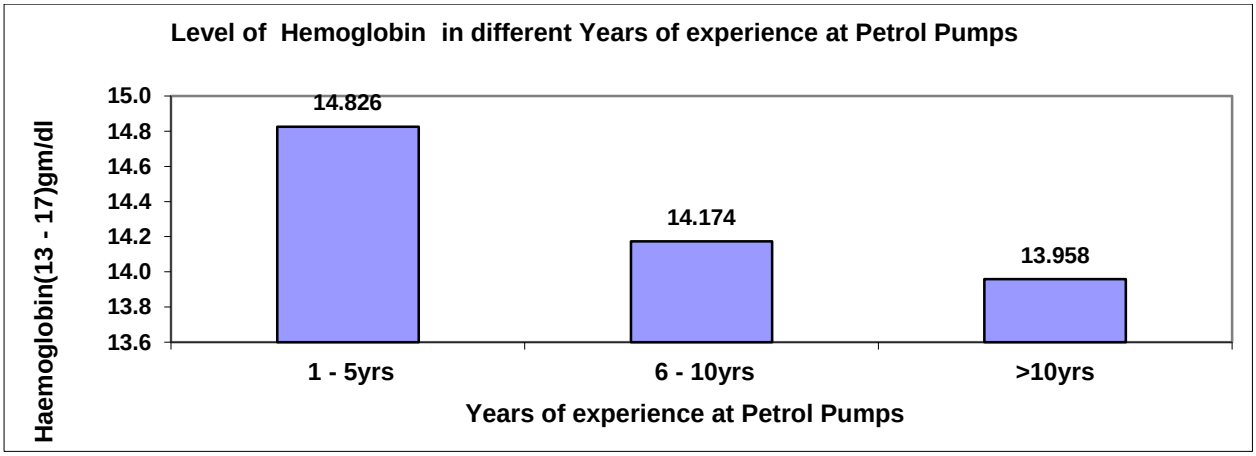

Fig. 3: Variation of Hemoglobin in different groups of petrol pump workers with increasing experience

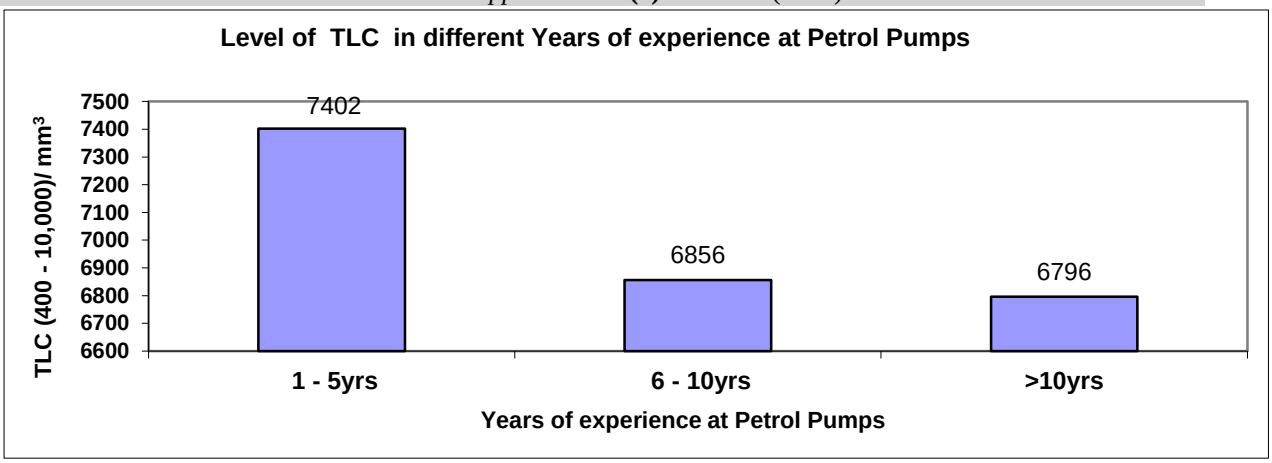

Fig. 4: Variation of TLC in different groups of petrol pump workers with increasing experience

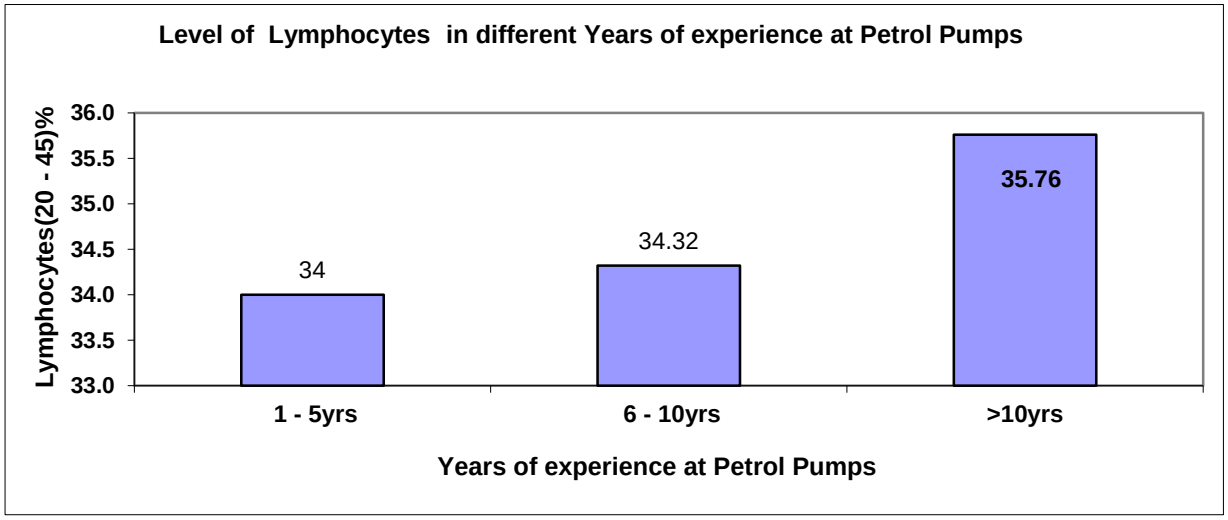

Fig. 5: Variation of lympocytes in different groups of petrol pump workers with increasing experience

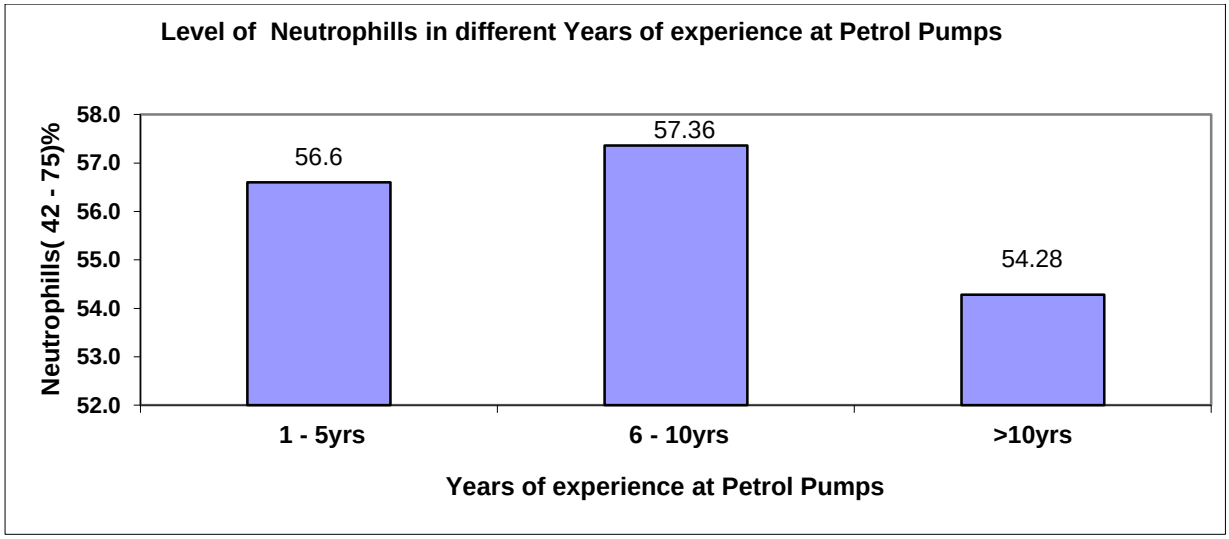

Fig. 6: Variation of neutrophils in different groups of petrol pump workers with increasing experience

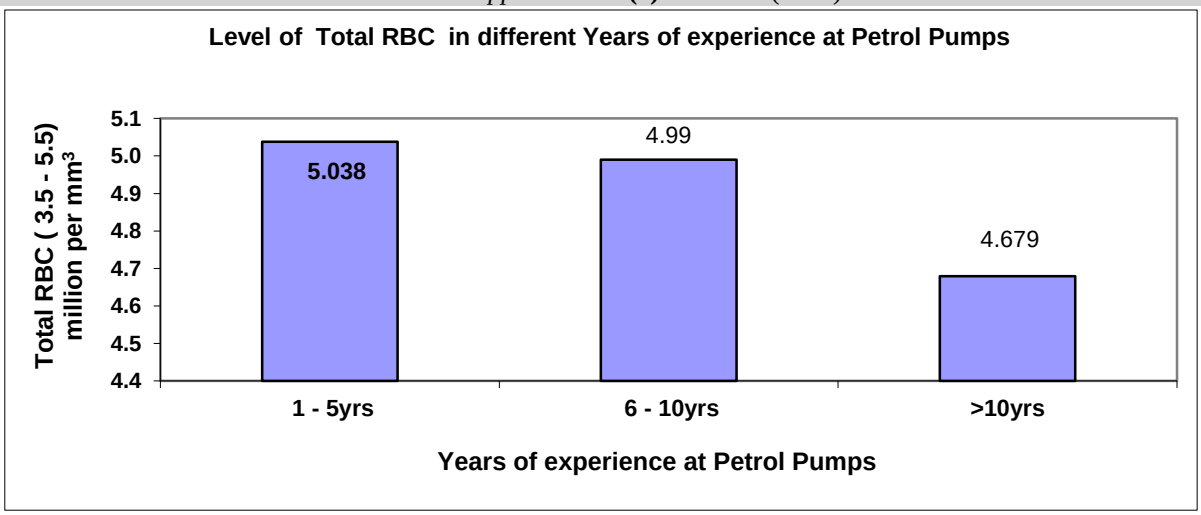

Fig. 7: Variation of RBC count in different groups of petrol pump workers with increasing experience

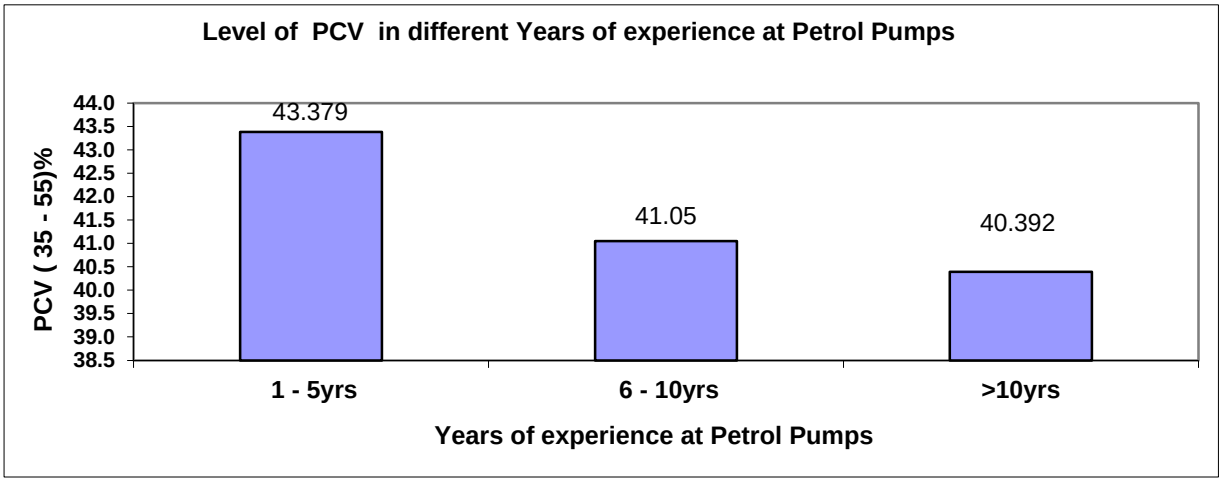

Fig. 8: Variation of PCV in different groups of petrol pump workers with increasing experience

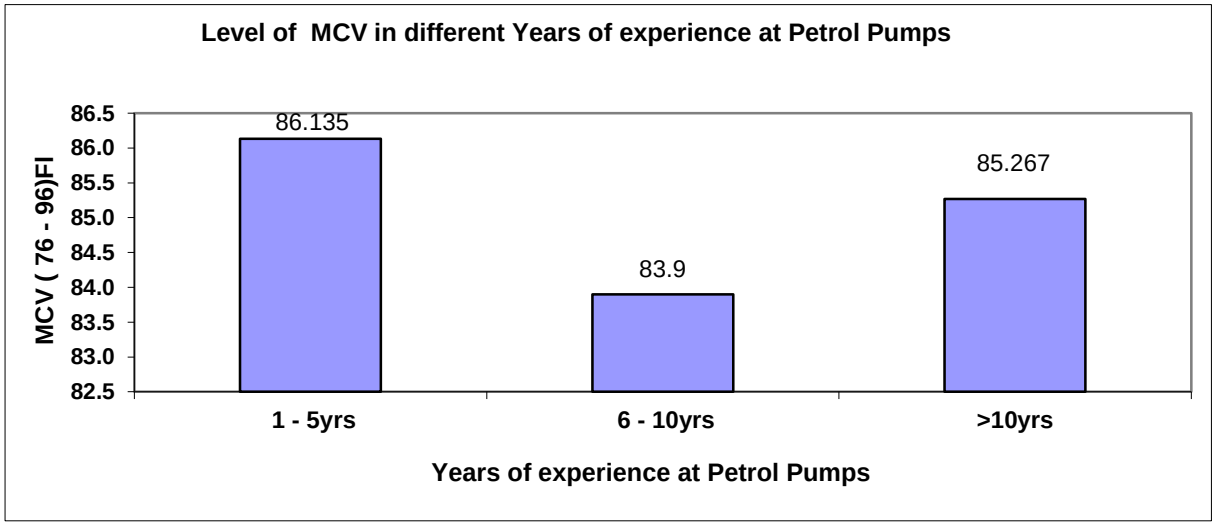

Fig. 9: Variation of MCV in different groups of petrol pump workers with increasing experience

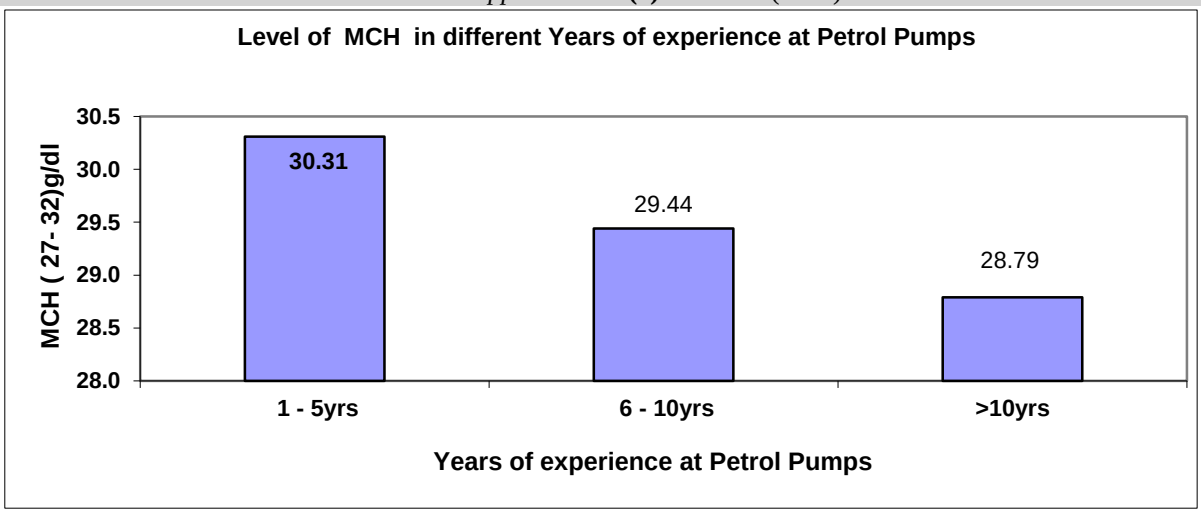

Fig. 10: Variation of MCH in different groups of petrol pump workers with increasing experience

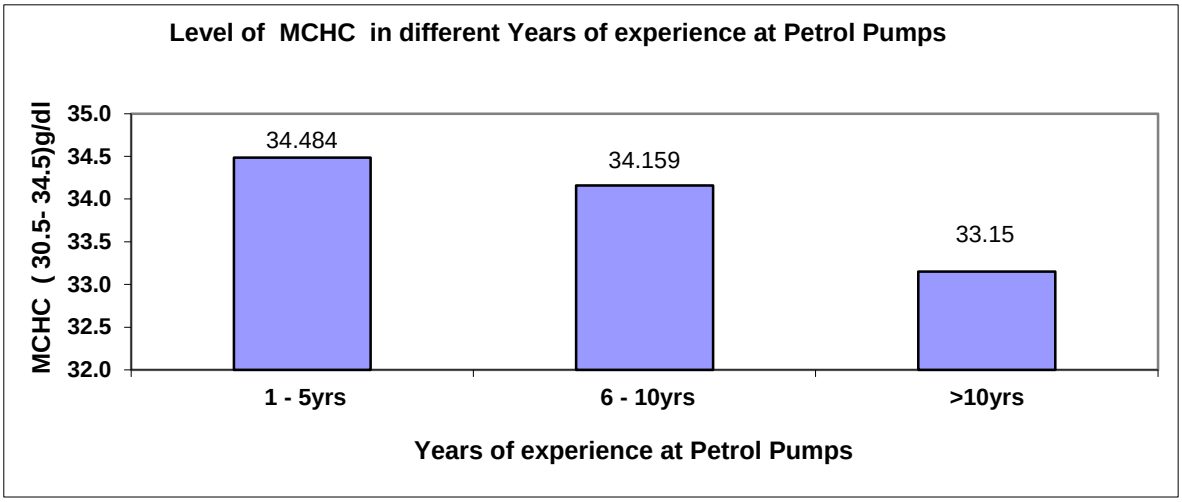

Fig. 11: Variation of MCHC in different groups of petrol pump workers with increasing experience

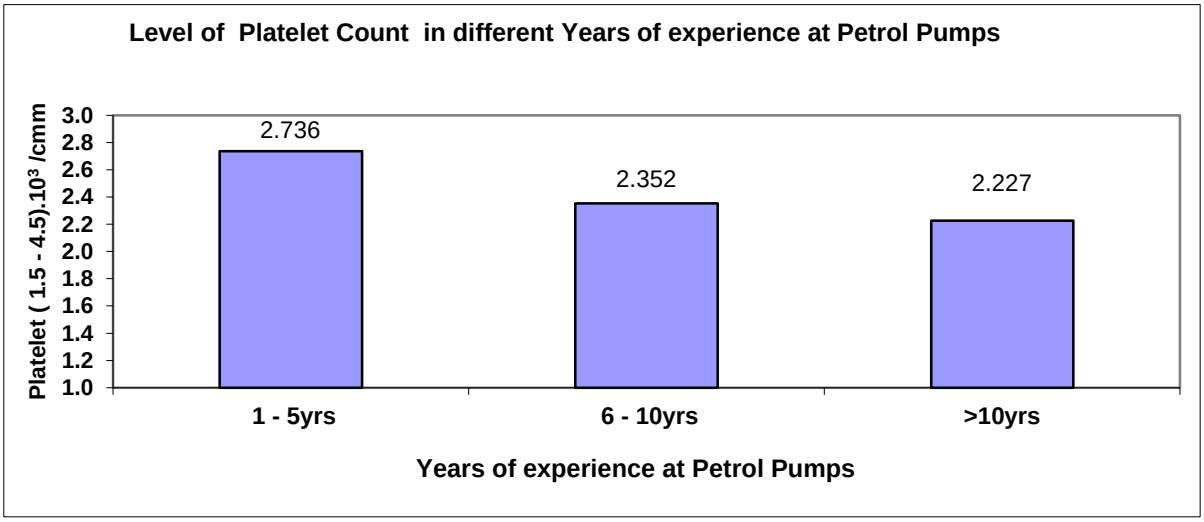

Fig. 12: Variation of MCHC in different groups of petrol pump workers with increasing experience

CONCLUSION

Hence, the present study concludes that chronic exposure to petroleum fumes has adverse effects on human hematopoetic system, leading to bone marrow depression and resultant pancytopenia. These findings are also supported by various studies done elsewhere which conclude the adverse effects

of the toxic compounds in petrol fumes having adverse effects on various other systems like the nervous, respiratory including the hematopoetic system. Therefore there is need to periodically evaluate the individuals at risk and prevent further damage either by changing the work type if possible, or provision of protective gear like specialized gowns to protect from transdermal absorption, and gas masks for effective prevention against inhalation the petroleum fumes.

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