Haematological Profile of Painters

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ABSTRACT

The health status of paint factory workers from north Algeria has been investigated. Individuals were divided into two groups; the control and painters. Workers of approximately the same age and working periods were selected. The mean length of employment was almost similar between the two groups, in which it was 13.76±9.18 years for the control, and 15.29±8.20 years for the exposed group. In this study, the measurement of some haematological parameters (red blood cells, hematocrit, haemoglobin, mean cell volume, white blood cells, lymphocytes, granulocytes and platelets) was carried out. Blood haematology was then related to 4 different working period categories ((1≤5, >5≤10, >10≤15, and >15 years). Results showed that the most noticeable change in haematology was the decrease in RBC, WBC, haemoglobin, hematocrit and lymphocytes in painters who worked for a longer period. However, the painters’ granulocyte counts were decreased during all the working periods, but it was significant only in the first period of >1-5 years. Contrary, platelet counts were significantly increased after the longest working period of >15 years. No noticeable variation was observed in MCV level between the two groups of workers during the 4 different working periods. To conclude, the haematological parameters of exposed workers have been affected only after 10 years employment, probably because of the acceptable working conditions.

INTRODUCTION

The relationship between chemical compound exposure and human health is an important worldwide problem. Perhaps it is not so hard to believe that paint-related products are one of the worst environmental pollutants. They're the second largest source of Volatile Organic Compounds (VOCs) emissions into the atmosphere after automobiles[1].

There are different types and grades of paint which provide different application and resistance properties, depending upon the kinds and levels of ingredients used to create the paint. As a result, many chemicals are found in paint, such as solvents; trace metals etc[2]. Typical household paint contains up to 10,000 chemicals, of which 300 are known toxins and 150 have been linked to cancer[1]. Once in the body, metals accumulate and thereby disrupt the functions of vital organs such as the brain, kidneys, liver, etc[3].

The health effects of VOCs can vary greatly according to the chemical composition of compound, which can range from being highly toxic to having no known health effects [4]. Also it depends on nature of the VOCs, the level of exposure, and length of exposure [5, 6 and 1]. According to a report by The World Health Organisation, there is a link between working as a professional painter and an increased risk of cancer of up to 20-40% [7].

Concerning blood, authors were found a toxic impact of different paints on blood parameters, and sometimes with contradictory results, which is certainly related to the different chemical compositions of paint and the working conditions [8, 9, 10, 11, 12 and 13]. However, the mode of action of paint is due principally to its effects (solvents and then metals) on bone marrow, the liver and the central nervous system [14, 15 and 16].

The objectives of the present work are to investigate the impact of paint components on the health of painters from Algeria, because no study was published so far concerning this subject. Therefore, a haematological evaluation throughout different working periods was carried out.

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MATERIALS AND METHODS

Place of study:

The present study investigates the health status among male painters from north Algeria (SA41/14). Workers exposed to paints (n=33) and a control group (n= 34) were chosen. Moreover, the frequency of self-reported clinical symptoms, the age and some socio-economic factors among workers were obtained from a questionnaire given to each worker. The socio-economic status of workers was considered to be similar. Only workers with approximately similar age and working period were taken from each group, to avoid the effect of these two factors on blood parameters. Subjects, then, were divided into 4 different working period categories ((1-5, >5-10, >10-15 and >15 years). Though, workers take free daily meal rich with all nutrients. Also workers are supplied with the necessary protective equipments (gloves, eye-goggles, anti-dust mask, and solvent-respirator). Smokers and person with known chronic dieases like diabetes, hypertension, and renal failure were excluded.

Blood collection and laboratory analysis:

Blood was collected at the beginning of the morning shift in the presence of the anticoagulant (EDTA) and used for haematological study (red blood cells, white blood cells, granulocytes, lymphocytes, haemoglobin, hematocrit, mean corpuscular volume, platelets), by means of Coulter Counter Rubis based on impedance variation (Coulter Principle), this process induce the transformation of particles' volume to electrical signal. Statistical analysis was used by applying Student t-test to compare the control with the exposed group in each working category.

Results:

Age and working period:

The obtained results showed that the mean workers’ age of the control was (43.03±9.82 years), whereas that of the exposed group was (41.44±7.82 years). Consequently, statistical analysis has revealed no significant difference between the two groups. Also, the mean length of employment was almost similar between the two groups, in which it was 13.76±9.18 years for the control, and 15.29±8.20 years for the exposed group.

Hematological parameters:

Results of haematological profile of paint workers are showed in figures Fig 1-8. Compared to the control, results of red blood cell count reveal a significant decrease in the exposed painters of the working period >10-15y and >15y. However, there was no remarkable change in the remaining periods (Fig 6). The level of hematocrit was significantly decreased in the exposed painters of the last two working period categories >10-15y and >15y (Fig 7). Results have showed a slight variation in hemoglobin concentration between the two groups of workers in all working periods, except in >10-15y category where it has been reduced significantly in the exposed painters (Fig 8). However, No noticeable variation was observed in MCV level between the two groups of workers during the 4 different working periods (Fig 9). White blood cell count was significantly decreased in the working period >10-15y, but its variation was not significant in the remaining periods (Fig 10). Concerning the exposed painters, results indicated a significant drop of lymphocytes in working period >10-15y. This drop is observed also in the other working periods, but it was not statistically significant (Fig 11). The painters’ granulocytes were decreased during all the working periods, but it was significant only in the first period of >1-5y (Fig 12). Compared to the control, platlets were significantly higher in the exposed workers only after the longest working period of >15y (Fig 13).

Fig. 1: Mean red blood cell count (X±SD) of the two groups of workers in relation to the working period categories.
Fig. 2: Mean hematocrit level (X±SD) of the two groups of workers in relation to the working period categories.

Fig. 3: Mean hemoglobin concentration (X±SD) of the two groups of workers in relation to the working period categories.

Fig. 4: Mean cell volume (X±SD) of the two groups of workers in relation to the working period categories.

Fig. 5: Mean white blood cell count (X±SD) of the two groups of workers in relation to the working period categories.
Discussion

An examination concerning the haematological parameters has been carried out between paint makers and the control. It showed some variation in paint makers, especially after long exposure. The mentioned significant drop in granulocytes during the early working period indicates how paint chemicals suppress the immune system. Moreover, the immune profile has been weakening over time by the recorded decline in WBC and lymphocytes. The only explanation for such change is due to the toxic effect of paint components. In parallel, it has been reported a significant drop in the number of leukocytes in workers exposed to the effect of benzene for a long period of time [9]. Contrary, severe airway obstruction is accompanied with increased WBC in metal spray painter [17].

In the current study, the other haematological parameters were not affected in the first and the second working period. Accordingly, leucocytes among workers exposed to low level of benzene demonstrated values within normal ranges during the early working years [12]. Contrary, WBC count, except eosinophilsof petrol filling workers [13] and lymphocyte count of rat exposed to organic solvents [18, 19] were significantly decreased. However, lymphopenia (decreased number of lymphocytes) is usually considered to be the earliest
and most sensitive indicator of benzene toxicity with low-level exposure, but there was no increase in the prevalence of lymphopenia among benzene-exposed workers [11].

In the present study, the levels of RBC, hematocrit, haemoglobin and MCV have not been affected after 10 years employment. Thus, the changes come only after this period, which indicate the presence of paint toxicity. The mechanism of such toxicity might come from the blood forming organs (bone marrow), the liver and the central nervous system [15, 16 and 14]. Accordingly, the mean blood count among workers exposed to low level of benzene demonstrated values within normal ranges during the early working years [12]. Moreover, other studies have reported no changes in MCV, total white blood cells, red blood cells, hemoglobin, and platelets among benzene-exposed workers [11], and also red blood cells and hematocrit of car spray painters [20]. Length of employment (more than 10 years) was significantly related to the reduction in MCV and platelet counts [12]. In petrol filling workers using organic solvents, a significant increase in haemoglobin (>16 mg %) and RBC (>5.4 million/mm3) were observed in workers with longer period of exposure when compared with the control subjects (14.483 mg/100ml and 4.83 million/mm3 for Hb and RBC, respectively) [13]. Moreover, painters of a car repair factory (long term and low exposure level) have showed a significant increase in MCV and platelets, but there RBC count was significantly decreased [10]. A mixture of organic solvent used in paint factories has induced an activation of workers’ platelets by increasing the turnover of phosphatidic acid [21]. On the other hand, [10] was found in house painters a decrease in RBC count accompanied by a decrease in hematocrit and platelets.

As metals are part of paint components, chromium was found to have hematological and immunological effects [22, 23]. Paint occupational exposure has significantly increased haemoglobin, hematocrit, and different leucocytes populations, especially lymphocytes, with no remarkable effect on platelets [24]. Methylcyclohexane, a compound widely used in paint industry has altered white blood and red blood cell counts when given to animals [25]. Paint nitrobenzene was reported to oxidise hemoglobin into Methemoglobin, reducing however, hemoglobin level [26, 27 and 28].

It has been reported that the use of hematological parameters when combined with the solvent exposure measurements are possibly useful in early detection of blood cell changes before the appearance of clinical symptoms [10]. Moreover, cell blood values may serve as a useful tool for biological monitoring for workers with low-level benzene exposure [12]. It is not the case for this study, where the hematological parameters have generally changed only after 10 years of employment, except for granulocytes.

Conclusion:
The RBC, WBC, haemoglobin and hematocrit have decreased in painters who worked for a long period. Granulocytes were declined at the beginning of employment, but that of platelets were higher after more than 15 years of work. The workers health status of painters seems similar to that reported in the literature. In spite of the availability of protective equipments (gloves, eye-goggles, anti-dust mask, solvent-respirator), some workers do not respect the necessary precautions.

REFERENCES