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Changes in the Complete Blood Counts Measurements of Gas Stations Workers in Eastern Libya

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Abstract:
The adverse effects of daily exposure to benzene may be related to the inability of the hematopoietic system with bone marrow suppression, an increased hazard of blood cell morphology abnormality and creating cancer. Objective: To evaluate the complete blood count measurements among gasoline-exposed workers at foul station as compared to non-exposed controls in east Libya. Methods: This comparative cross-sectional study was conducted on 102 participants (exposed group) and 102 participants (unexposed group). Socio-demographic characteristics and duration of exposure information were collected employing a structured questionnaire. NIHON KOHDEN was utilized for hematological analysis. Data were entered and analyzed utilizing SPSS version 25. Results: Compared to the control group, the study`s mean red blood cell count, white blood cell count, hemoglobin level, hematocrit, and mean cell hemoglobin concentration of gas station employees showed a significant increase. Conversely, as compared to healthy controls, the mean cell volume (MCV), mean cell hemoglobin (MCH) value, and platelet count (PLT) of gas station employees showed a considerable decline. Additionally, there was a significant relation observed between mean cell hemoglobin, and red blood cell count was seen during the duration of exposure to gasoline. Conclusion: The majority of hematological parameters of petrol filling workers in this study showed an increase compared with healthy controls, this might be associated with exposure to petrol chemicals. However, further longitudinal studies with a larger sample size and advanced tests should be conducted to explore the impact of petrol exposure on hematopoiesis.

Keywords: Gas Station, Gasoline, CBC Parameters.

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التغييرات في قياسات العد الكامل للدم لعمال محطات الوقود في شرق ليبيا

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الملخص
قد تكون الآثار الصحية الضارة للتعرض المستمر للبنزين مرتبطة بإعاقة الجهاز المكون للدم مع تثبيط نخاع العظام، وزيادة خطر تشوه خلايا الدم وخلق السرطان.

الهدف: لتقييم قياسات عدد الدم الكامل بين العمال المعرضين للبنزين في المحطات الفاسدة مقارنة بالمجموعة غير المكشوفة في شرق ليبيا. **الطرق:** أجريت هذه الدراسة المقطعية المقارنة الشاملة على 102 مشارك (مجموعة معرضة

للبنزين) و102 مشارك (مجموعة غير معرضة). تم جمع معلومات الخصائص الاجتماعية الديمغرافية ومدة التعرض باستخدام استبيان. تم استخدام NIHON KOHDEN لتحليل عدد الدم الكامل، وتم إدخال البيانات وتحليلها باستخدام الإصدار 25 من.SPSS
النتائج: مقارنة بالمجموعة الضابطة، أظهرت الدراسة ازدياد متوسط عدد خلايا الدم الحمراء، وعدد خلايا الدم البيضاء، ومستوى الهيموجلوبين، والهيماتوكريت، ومتوسط تركيز الهيموجلوبين الخلوي لموظفي محطة الوقود زيادة كبيرة. على العكس من ذلك، بالمقارنة مع المجموعة الضابطة الصحية. أظهر متوسط حجم الخلية(MCV) ، ومتوسط قيمة الهيموجلوبين الخلوي(MCH) ، وعدد الصفائح الدموية (PLT) لموظفي محطة الوقود انخفاضًا كبيرًا، بالإضافة إلى ذلك، كانت هناك علاقة سلبية كبيرة لوحظت مع متوسط الهيموجلوبين الخلوي(MCV) ، على الرغم من وجود علاقة إيجابية كبيرة مع عدد خلايا الدم الحمراء خلال فترة التعرض للبنزين.
الاستنتاج: أظهرت غالبية المعلمات الدموية لعمال تعبئة البنزين في هذه الدراسة زيادة مقارنة بالضوابط الصحية، وقد يرتبط ذلك بالتعرض لمواد كيميائية بالبنزين، ومع ذلك، يجب إجراء مزيد من الدراسة الطولية بحجم عينة أكبر واختبارات متقدمة لاستكشاف تأثير التعرض للبنزين على تكوين الدم.

الكلمات المفتاحية: محطة وقود، بنزين، اعداد الدم الكامل.

Introduction: Hematopoiesis is the production of all of the cellular components of blood and plasma, it occurs within the hematopoietic system, which includes tissue and organs such as the bone marrow, liver and spleen [1].

A unique kind of fluid in the human body that acts as a source of nutrients and oxygen for every cell is blood. It has a role to play in regulating all the important vital processes such as breathing, heartbeats, distribution of excretory waste products, maintenance of osmotic equilibrium, and transportation and metabolism of cellular components. Blood consists of two major parts, namely; formed elements (45%) and plasma (55%). In terms of composition, plasma contains 91-92% water plus 8-9% dissolved solids, whereas the formed elements are three main types specifically; Red Blood Cells, White Blood Cells, and Platelets [2].

Important details about the number of different cell types in the blood (RBC, WBC and Platelets) are provided by the complete blood count (CBC) tests. Many blood diseases, such as anemia, some malignancies, kidney problems, and allergic reactions, can be diagnosed with the help of the test. [3]

Petrol is composed mainly of organic compounds that are produced from the distillation of petroleum through the addition of some components, while diesel is a class-specific fractionated product derived from petroleum fuel oil that is made up of hydrocarbons [4]. Petrol station attendants can breathe in volatile gases, ingest particles while eating and drinking, and absorb particles onto their skin as they perform their job duties [5, 6]. Therefore, exposure to petrol occupational hazards leads to hemo-toxicity and blood diseases.

Chemicals that you simply may breathe in while filling your car with petrol are known to cause blood cancer (leukemia), aplastic anemia, and bone marrow diseases [7]. Also, exposure to the petrol vapors produced in the workplace is responsible for serious injury to organs such as the heart, lungs, skin, and kidneys, or systems like the respiratory, immune, and nervous systems, leading to death [8].

A blood test known as the complete blood count (CBC) offers results on the cell distribution and quantity in the bloodstream. Information about types of cells found in blood, specifically red blood cells (RBC), white blood cells (WBC), and platelets, is important because they will help medical practitioners determine symptoms to check for, such as weakness, fatigue, or bruising. Furthermore, it can be used to diagnose conditions like anemia. CBC also shows if a person has an acute or chronic infection, allergies, or issues with clotting [9].

In turn, the extent of benzene hematotoxicity is an easily and readily available screening tool for all blood elements [9]. With this regard, the present study was planned to evaluate the effect of petrol on the hematological profile of people working at petrol filling stations .

Objective

To evaluate the complete blood count measurements among gasoline-exposed workers at foul stations as compared to non-exposed controls in east Libya.

Material and methods

Study Design

A comparative cross-sectional study was conducted on 46 gas station attendants in east Libya during the period from November 2023 to January 2024.

Study Population

Study Groups

The study included 102 males of gas station attendants, aged 20–60 years, working for at least one year at those gas stations and who volunteered to participate in the study were selected.

Comparison Group (Control group)

One hundred and two Libyan healthy, non-benzene exposed as control group

Participants with the following information were avoided from the study: history of any severe illness, chronic diseases, people taking medications that affect blood cell counts, and people with a blood disorder to date.

Specimen Collection and Examination

5 mL of blood was collected in Ethylene a Diamine Tetraacetic Acid (EDTA) tube from participants who completed the questionnaire (focusing on socio-demographic information, and years of exposure) and who agreed to give blood. Complete blood count (CBC) tests (RBC WBC, Hb and HCT platelet, MCV, MCH, MCHC, were analyzed within 2 hours of blood collection using NIHON KOHDEN the hematological auto analyzer within 2 hours of blood collection.

Data Analysis

Information was entered and statistically analyzed utilizing the Statistical Package for the Social Sciences (SPSS) version 25.

Results and discussion

The study included 46 foul stations in eastern Libya, and all study participants were males since females in Libya don't regularly work in fuel stations. Ages extended from 20 to 60 years. Duration of work varied from 20 to 47 years.

Table 1 shows a Comparison of changes in hematological parameters between exposed and unexposed groups, expressed as numbers and % of cases within normal, below (Low) and above (High) the reference range.

Table 1 Comparison of change in hematological parameters between exposed and unexposed groups.

Variable	Exposed group (n=102)		Un Exposed group (n=102)	
	Frequency	Percentage %	Frequency	Percentage %
WBC (3.4-7 x10^3/µl)				
Low (< 3.4) Normal (3.4- 7) High (> 7)	0 22 80	0 21.6 78.4	1 50 51	1 49 50
RBC (4.35- 5.65 x 10^6 cells/µl)				
Low (< 4.35) Normal (4.35- 5.65) High (> 5.65)	2 97 3	2 95.1 2.9	39 59 4	38.2 57.8 3.9
HB (12.2- 16.6 g/dl)				
Low (< 12.2) Normal (12.2 – 16.6) High (> 16.6)	62 39 1	60.8 38.2 1	54 44 4	52.9 43.1 3.9
HCT (38.3- 48.6 %)				

Low (< 38.3) Normal (38.3 – 48.6) High (> 48.6)	5 96 1	4.9 94.1 1	30 63 9	29.4 61.8 8.8
MCV (80-100 femtoliter(fl))				
Low (< 80) Normal (80 – 100) High (> 100)	13 89 0	12.7 87.3 0	6 96 0	5.9 94.1 0
MCH (27-33 Picogram (Pg))				
Low (< 27) Normal (27 – 33) High (> 33)	90 10 2	88.2 9.8 2	33 69 0	32.4 67.6 0
MCHC (32- 36 g/dl)				
Low (< 32) Normal (32 – 36) High (> 36)	19 79 4	18.6 77.5 3.9	34 68 0	33.3 66.7 0
PLT (150- 350 $X10^3/\mu l$)				
Low (< 150) Normal (150 – 350) High (> 350)	21 81 0	20.6 79.4 0	2 96 4	2 94.1 3.9

Table 2 displays the demographic information for the subjects.

Table 2: Demographic information for the subjects.

Variable	Exposed group (n=102)	Un Exposed group (Control) n=102
	Mean ± Std. Deviation	Mean ± Std. Deviation
Age (Years)	30.3 ± 9.7	36.2 ±16.2
Duration of work (years)	5.9 ± 6.8	-

The hematological parameters for the exposed and control groups are displayed in Table 3. The participants who were not exposed to benzene and those who were exposed to it had different hematological parameters. The mean of WBC, RBC, HB level, HCT, and MCHC increased significantly in the exposed workers. Table 3 illustrates that the mean MCV, MCH, and platelets count of the petrol workers were considerably lower than those of the control group.

Table 3: Hematological parameter of study participants.

Variable	Exposed group (n=102)	Un Exposed group (Control) n=102
	Mean ± Std. Deviation	Mean ± Std. Deviation
WBC (White Blood Cells)	8.439 ± 1.9595	7.2277±2.33530
RBC (Red Blood Cells)	5.227 ± .3332	4.6592±.61091
HCT (hematocrit)	42.809 ± 2.4812	41.0941±5.54651
MCV (Mean Cell Volume)	± 6.5667685.4775	88.3218±6.07739
MCH (Mean of Corpuscular Hemoglobin)	± 2.1721625.1435	28.2644±2.17879
MCHC (Mean of Corpuscular Hemoglobin Concentration)	± 1.6768433.0661	31.9832±1.01893
HB (Hemoglobin)	13.118 ± .9882	13.1653±1.85507
PLT (Platelets)	183.50 ± 38.893	257.2970±59.69381

As outlined in Table 4, there was a relationship between RBC and MCH with years of exposure. Duration of foul exposure appeared a significant relationship with RBC count ($r = -0.225$, $p<0.023$), and the MCH ($r = 0.260$ & $p<0.008$). There were non-significant correlations seen in several hematological markers, nevertheless.

Table 4: Relationships between the RBCs count, MCH value and the length (Years) of benzene exposure.

Parameters	Years of exposure	
	r	***P value***
RBCs	-.225-*	.023
MCH	.260**	.008

Results

Results of the current study showed that there was an increment of white blood cell (WBC) count in foul-exposed participants as compared to non-exposed groups. This result is in agreement with study conducted by Ita S, Udofia U. (2011) [10]. This might be explained by different studies, tall rate of disease in exposed groups due to the immunosuppressant effect of poisonous petrol items, which in turn leads to an increment in WBC, and conflicting with a study conducted in India by Shilpi GS, et al (2016) [11] appeared non-significant diminish of WBC between gasoline exposed and unexposed groups. This could be contrasted in the length of exposure time of study participants.

This study found that when compared to healthy controls, the mean RBC and Hb values of foul-filling workers significantly increased. These results were consistent with the earlier research, as reported by Mistry H, et al (2015) [12], AlJothery AH, et (2017) [13], SM M.(2014) [14], Uzma N, et al. (2008) [15], Aleemuddin M, et al. (2015) [16], and Pesatori AC, et al. (2009) [17].

The current investigation also revealed a statistically significant increase in the exposed group's mean HCT value when compared to the control group. Our results were consistent with those of previous investigations by Mistry H, et (2015) [12] and by Ezejiofor TIN. et al. (2016) [18]. However, studies carried out by in Pesatori AC, et. al (2009) [17] and by Abou-Elwafa HS,et (2015) [19] were not agreed with our finding.

As compared to the control group, our results indicated a considerable decline in the mean MCV value of the foul filling workers. A reliable outcome has been stated by Elderdery AY, et al. (2015) [20], Kang SK, et al (2010) [21], Ibeh NC, et al. (2016) [22] and Okoro AM, et al. (2006) [23]. Data indicated that changes to the membrane might be the cause of a decrease in the size of the cell. Although its exact mechanisms are unknown, benzene may affect the cell's permeability and flexibility [24].

Furthermore, the cell membrane is harmed by the metabolism of gasoline compounds, which produce free radicals [25].

The study found that the exposed group had considerably lower mean MCH values than the control group. Another study by Firouzkouhi et al. (2016) [26] and by Nair et al. (2015) [27] that found statistically significant increases in MCH does not support this finding.

Our findings indicated that, in comparison to healthy controls, the median MCHC level of filthy filling workers had significantly increased. The outcome matched a study conducted by Hamad A, et al. (2008) [28].

Our result was opposite to discoveries detailed by D'Andrea MA, et al. (2014) [25] and by Salehiforouz B, et al. (2017) [29] that detailed a lower MCHC value within the exposed group than the control group.

One possible explanation for this disparity could be the difference in exposure duration. Compared to a study from Iran [29] that included participants with the shortest exposure history of 5 years, where exposure duration had an effect, a greater portion of study participants in our study had an exposure history of at least 5 years. Studies indicate that an increase in MCHC can be a significant clinical indicator of enlarged spherocytosis, which should be monitored after benzene exposure [24].

The current study demonstrate a noteworthy diminish in PLT count in exposed groups than control which was backed by S. Mohammed, et al (2014) [30]. On the other hand, this result was opposite to the prior study who famous a noteworthy increment in PLT count in petrol filling workers compared with healthy controls as detailed by S. Getu, et al.(2020) [31]. Another study done by B.N. Obodo, et al (2020) [32] which was demonstrated that there are no statistically significant contrasts in PLT between gas station workers and healthy individuals that don't concur with our study. In any case, the varieties in sample size, socio-demographic factors, and exposure duration can be the conceivable reason for the inconsistencies between the considers.

In expansion, our result appeared a relationship between RBC number and MCH value of foul filling workers with duration of exposure which is in agreement with the past study done by Uzma N, et al (2008) [15]. On the other hand, our result was opposite to studies detailed by Aleemuddin M, et al (2015) [16] and by Abou-Elwafa HS,et al (2015) [19]. Variety within the sample size, study period, socio-demographic factors, and duration of presentation can be the conceivable reason for the discrepancies.

Conclusion:

Results in this study led to the conclusion that the larger part of hematological measurements (RBC, WBC, Hb, Hct, and MCHC) of petrol filling workers appeared an increase compared with healthy controls which can be related to the effect of petrol. On the other hand, the MCV, MCH value and platelets count of the study group showed a decrement compared with healthy controls. In addition, length of exposure appeared a significant relationship with RBC and MCH levels of the study group, which can recommend the effect of petrol on hematological parameters.

Hence, it is imperative to survey the common well-being of petrol workers at stations, and this done by perform a longitudinal study by utilizing progressed tests (Differential tests, blood film, molecular, and biochemistry test) to induce the cause-effect connections between petrol exposures and alter in hematological parameters and to distinguish any others changes.

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