

## Effect of Petroleum Products on Liver Function among Petroleum Filling Workers Stations in El-Obied City –Sudan

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**Abstract:** Background: Lengthened exposure to petrol has been shown to be a significant health risk, especially for liver, renal, and circulatory, reproductive and immune systems. Objective: This study aimed to investigate the hepatotoxic effects of petroleum products on filling workers stations after chronic exposure more than one year on their liver function tests. Patients, Materials & Methods: A cross sectional study conducted during the period from October 2015 to August 2016 to determine the plasma levels of liver function tests of filling workers stations in El-Obied city.

Thirty Seven filling workers were selected as a test group in comparison to 30 apparently healthy volunteers as control group matched for age and sex to the tested group. Blood specimens were collected from both groups, and the plasma levels of total protein, albumin, total bilirubin (direct, Indirect) and ALT were measured using a spectrophotometric technique. Results: The study revealed to significant raised levels of the plasma albumin ( $4.7 \pm 0.8$  g/dl) and ALT ( $17.6 \pm 5.1$  u/l) of the test group when compared with the control group whereas no significant different in the plasma levels of total protein ( $7.5 \pm 0.6$  g/dl), total bilirubin ( $0.7 \pm 0.3$  mg/dl), direct bilirubin ( $0.3 \pm 0.1$  mg/dl) and indirect bilirubin ( $0.3 \pm 0.2$  mg/dl) of the test group when compared with the control group ( $7.3 \pm 0.7$  g/dl,  $0.8 \pm 0.4$  mg/dl,  $0.3 \pm 0.2$  mg/dl and  $0.4 \pm 0.3$  mg/dl respectively). Conclusion: This study indicates that; liver function impairment and hepatotoxicity among filling station workers may attribute to prolong exposure to petroleum product, therefore upgrading of working condition and regular checkup is recommended.

**Key words:** North Kordofan state, Filling station petroleum, Total protein, Albumin.

### Introduction:

Petrol or Gasoline is an unstable and inflammable petroleum-derived liquid mixture, primarily used for internal composition of engines. It consists of hydrocarbon (aromatic, saturated and unsaturated) and non-hydrocarbon substances (N, S, O<sub>2</sub>, nickel and vanadium)<sup>(1) (2)</sup>. Certain peoples have a larger risk of contact to petrol vapors; these include filling station workers, attendants to service station, drivers of gasoline refinery workers and trucks. The volatile nature of petrol products make them readily available in the environment any time it is dispensed, especially at depots and petrol filling stations<sup>(3)</sup>.

Sources of petroleum vapors at the petrol pumps included displacement vapor losses from filler pipes during refueling, losses from underground tanks and fuel spillage. The available toxic kinetic information on petrol show that it is absorbed from all exposure routes. Some petroleum components are absorbed more

rapidly than others. For example, aromatic compounds like toluene, benzene, and xylene which have both high blood/air partition coefficients and skin penetration rates are absorbed more rapidly than other petrol components and cause many effects. The harshness of effect depends on the chemical nature and the level of these substances. Inhaled low concentration of vapor during filling can cause a lot of symptoms like nose and throat frustration, headaches, faintness, nausea, sickness, confusion, and breathing difficulties. Some effects of skin contact with gasoline include rash, redness, and swelling. Allergic reactions (hypersensitivity) have been reported but these are rare occurrence<sup>(4)</sup>, but cause seriously harmful effects in liver, kidney, skeletal, circulatory, immune and reproductive systems.

### **Patients, Materials & Methods:**

This is quantitative, descriptive and cross sectional study conducted during the period from December 2015 to August 2016. The samples were collected from different petroleum stations in Elobied City capital of North Kordofan State. Thirty seven filling station workers were enrolled in this study as test group in addition to thirty healthy volunteers age and sex corresponded were involved as controls group. An interview with the workers was done to obtain clinical data and to provide health education by using questionnaire sheet recorded by the workers. After informed consent, a local antiseptic (70% ethanol) was used to clean the skin. Venous blood (5ml) was taken from each participant in this study by standard procedures. Sample was separated by centrifugation at 3000 rpm for minutes at room temperature within a day. The supernatant was collected by the mean of micropipettes in tightly sealed plain containers and kept at refrigerator temperature till used later. The plasma then allowed to warm at room temperature and investigated of study variables by using spectrophotometer. The precision and accuracy of all methods used in this study were checked in each patch analyzed by including commercially prepared control sera [Total protein<sup>5</sup>, albumin<sup>6</sup>, Total bilirubin (direct + indirect<sup>7</sup>) and ALT<sup>8</sup>. The result was analyzed by SPSS (version 20). The mean and standard deviation (SD) obtained and "t" test was used for comparison. Linear regression also used for correlation. P.value was obtained to assess the significance. P.value < 0.05 is considered significant and P.value < 0.01 is highly significant.

### **Results:**

**Table 1** shows a significant difference between the means of the plasma albumin and ALT of filling workers in petrol stations when compared with control. The results showed (Mean ± STD) of albumin (4.7±0.8g/dl) and ALT (17.6±5.1µL) amongst 'petrol station' attendants were significantly elevated (P<0.05) compared to those of the control (3.7±0.6g/dl and 13.4±4.6 µL respectively).

**Table 2** shows insignificant difference between the means of the plasma total protein, total bilirubin, direct and indirect bilirubin of filling workers in petrol stations compared with control. Results showed (Mean  $\pm$  STD) of total protein ( $7.5 \pm 0.6$ g/dl), total bilirubin ( $0.7 \pm 0.3$ mg/dl), direct bilirubin ( $0.3 \pm 0.1$ mg/dl) and indirect bilirubin ( $0.3 \pm 0.2$ mg/dl) amongst ‘petrol station’ attendants to be in-significant ( $P > 0.05$ ) compared to those of the control ( $7.3 \pm 0.7$ g/dl,  $0.8 \pm 0.4$ g/dl,  $0.3 \pm 0.2$ g/dl and  $0.4 \pm 0.3$  respectively). The relationship between the duration of exposures in (years) and liver function among filling station workers ( $r = 0.012$ ,  $P = 0.525$ ) illustrated in figures from 1 to 6.

**Table1: Comparison of plasma albumin and ALT levels of test and control groups:**

Variables	Test group n= 37	Control group n= 30	P. value
Albumin (g/dl)	$4.7 \pm 0.8$	$3.7 \pm 0.6$	<b>0.000</b>
Range	(3.5 - 6.1)	(2.4 - 4.6)	
ALT(U/L)	$17.6 \pm 5.1$	$13.4 \pm 4.6$	<b>0.001</b>
Range	(4 - 29)	(8 - 29)	

- Values shows as mean  $\pm$  SD and probability ( $P$ . value  $\leq 0.05$ ) T-test was used for comparison to found significant.

Table2: Comparison of plasma total protein, total, direct and indirect bilirubin levels of test and control groups:

Variables	Test group n= 37	Control group n= 30	P. value
Total proteins (g/dl)	7.5 ± 0.6	7.3 ± 0.7	<b>0.306</b>
Range	(6 - 8.2)	(6 - 9.4)	
Total bilirubin (mg/dl)	0.7 ± 0.3	0.8 ± 0.4	<b>0.395</b>
Range	(0.4 - 2)	(0.3 - 1.5)	
Direct bilirubin (mg/dl)	0.3 ± 0.1	0.3 ± 0.2	<b>0.705</b>
Range	(0.1 - 0.6)	(0.1 - 1)	
Indirect bilirubin (mg/dl)	0.3 ± 0.2	0.4 ± 0.3	<b>0.359</b>
Range	(0.1 - 1.3)	(0.1 - 0.8)	

- Values shows as mean ± SD and probability (P. value ≤ 0.05) T-test was used for comparison to found significant.

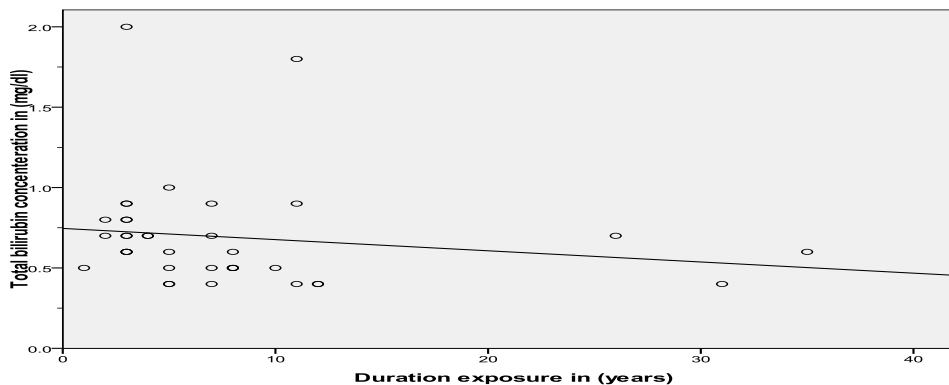


Figure 1: The relationship between the duration of exposures in (years) and the total bilirubin (mg/dl) among filling station workers (r = 0.160, P = 0.014).

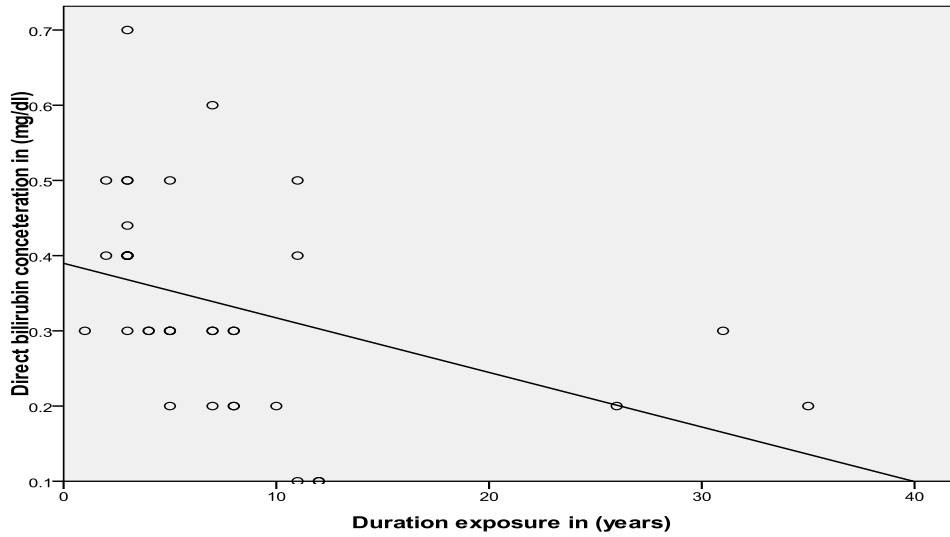


Figure 2: The relationship between the duration of exposures in (years) and the direct bilirubin (mg/dl) among filling station workers ( $r = 0.024$ ,  $P = 0.355$ ).

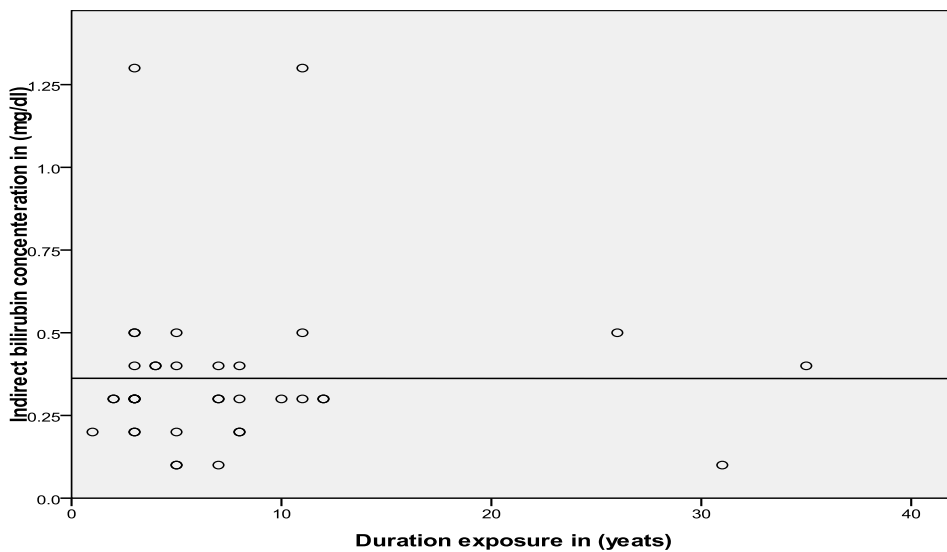


Figure 3: The relationship between the duration of exposures in (years) and the indirect bilirubin (mg/dl) among filling station workers ( $r = 0.000$ ,  $P = 0.997$ ).

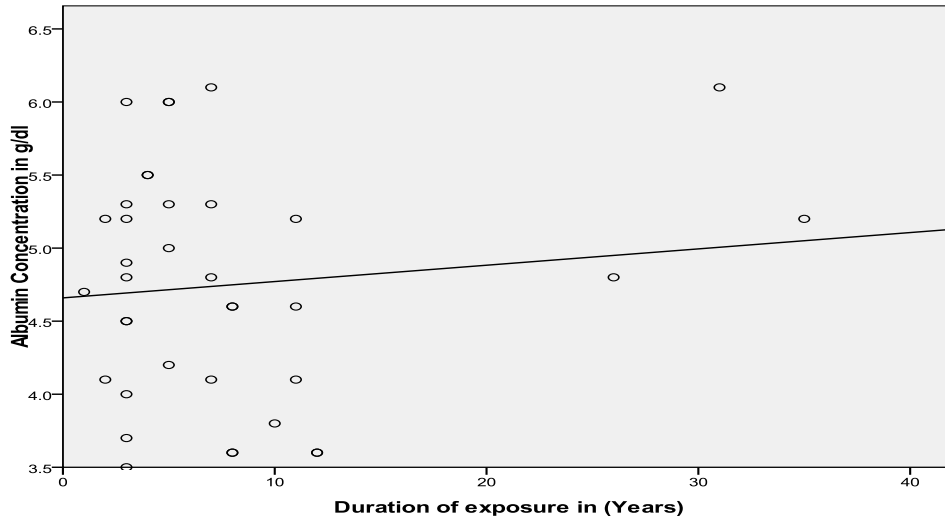


Figure 4: The relationship between the duration of exposures in (years) and the plasma levels of albumin (g/dl) among filling station workers ( $r=0.012$ ,  $P=0.525$ ).

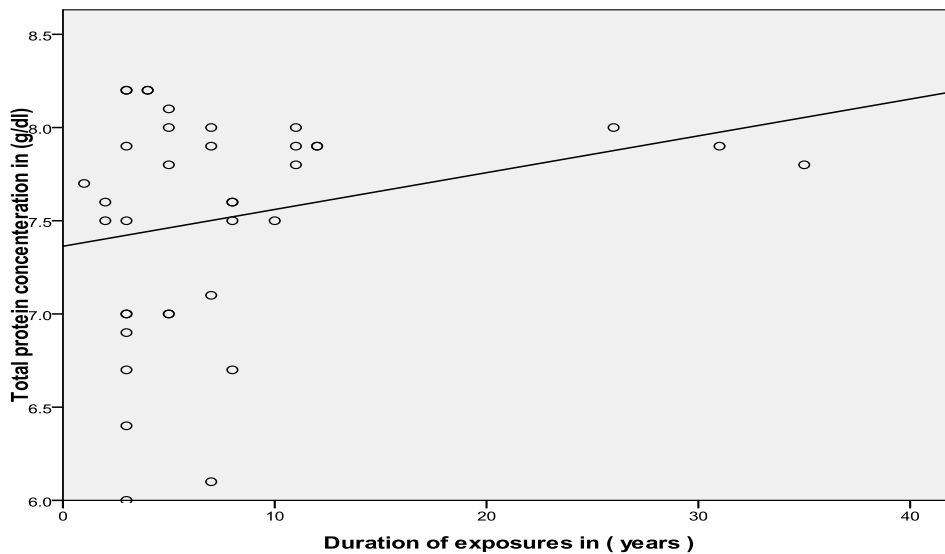
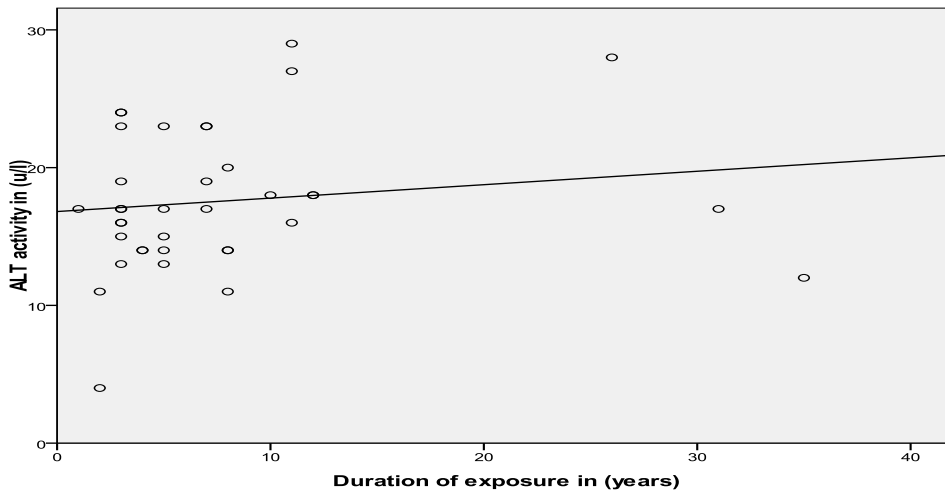


Figure 5: The relationship between the duration of exposures in (years) and the plasma levels of total protein (g/dl) among filling station worker( $r=0.064$ ,  $P=0.132$ ).



**Figure 6: The relationship between the duration of exposures in (years) and the plasma ALT activity (u/l) among filling station workers ( $r = 0.021$ ,  $P = 0.398$ ).**

### Discussion:

The use of petroleum products by humans is inevitable. They are used for various reasons in a daily life. Previous studies on the potential health hazards of petroleum products in humans had concentrated on petrol station attendants. Their findings show that inhalation, ingestion and absorption through skin of petroleum products could cause hepatic impairment(9).

The results obtained from this study showed that most of the filling workers were between the age of 22 and 65 years and a large proportion (75.6 %) of these workers have spent between 1– 9 years on this job and were usually worked in stations for many hours (16-24) per day without gap and didn't used any protective devices (gloves, boots, coat and mask) during filling or drainage the fuel from the tankers, although were knew the riskiness of these products on body health.

In the current study there is a significant difference between the mean level of plasma albumin in the test group when compared with that of the control group, the mean of the test group is significantly elevated ( $P$ .value = 0.000) and this may be due to the inhalation, ingestion and absorption through skin contact that can occur as a result for long exposure to petrol products which may effect on the synthetic function of the liver. This agrees with previous study who reported that; there is a significant elevation in the albumin level among workers exposed to petroleum station pollutants in Mosul City, Iraq (10).

In the present study there is a significant diversity between the mean activity of ALT in the test group when compared with that of the control group, the mean of the test group is significantly elevated (P.value = 0.001) and this may be as a result of the effects of the petroleum products which may cause a cellular damage, loss of functional integrity of cell membrane and finally leakage of the enzyme in the circulation. This finding agrees with previous study who reported that; hydrocarbons as one products of petrol may lead to liver damage and enzymes release from hepatocytes (10). More over in this study there was a significant positive correlation between the level of total bilirubin and the duration of exposure in years and this may reflect the alteration of exposure to petrol product for long period of time on the excretory function of the liver. These agree with previous finding who reported that; our results are expressed in a time exposure dependent manner. The levels of GOT, GPT, and ALP showed a significant increases with increasing the time of exposure to kerosene and gasoline(11). The results of this study also revealed insignificant positive correlations between the duration of exposures in (years) with direct, indirect bilirubin, albumin, total protein and ALT among filling station workers.

### **Conclusion:**

Prolong contact to petroleum products without use of any protective devices can cause an alteration in some hepatic functions and may implicate in a number of liver diseases on filling station workers. Therefore, there is need for this group of workers to be sensitized on regular medical checkup and management.

### **Recommendations:**

- There should be introduction of initial medical or laboratory testing for petrol station attendants before being hired to their jobs to check their fitness and suitability for duties at petrol stations.
- A medical observation including pre-employment and periodic medical checkup for early recognition and removal of sensitive workers from their working places before development of chronic impairment should be done.
- The availability and use of personal protective equipment at work to minimize workplace petrol exposure should be encouraged. Further longer term perspective studies of petrol workers help to get a more comprehensive picture of long term effects of petrol exposure.

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## أثر المواد البترولية علي وظائف الكبد لدي العاملين بمحطات تزويد الوقود بمدينة الأبيض - السودان

الملخص: قد تبين حديثاً أن التعرض للمواد البترولية لفترات زمنية طويلة قد تشكل خطراً صحياً على صحة الإنسان خاصة بالنسبة لوظائف الكبد، الكلى، الدورة الدموية، جهاز المناعة والجهاز التناسلي. الهدف من هذه الدراسة هو التعرف على الآثار التي تسببها المواد البترولية على وظائف الكبد خاصة بالنسبة للعاملين في محطات تزويد الوقود بعد العمل لفترة زمنية أكثر من عام. أجريت هذه الدراسة المقطعية الوصفية في الفترة ما بين أكتوبر 2015 حتى أغسطس 2016 لتقويم مستويات وظائف الكبد في بلازما الدم للعاملين في محطات تزويد الوقود بمدينة الأبيض. تم اختيار 37 عاملاً كمجموعة اختبار (تجريبية) ومقارنتهم مع 30 متطوعاً أصحاء ظاهرياً كمجموعة ضابطة. حيث تم جمع عينات الدم من كلتا المجموعتين ومن ثم تم تحديد مستويات البروتين الكلي، الزلال، اليرقان الكلي والمباشر وإنزيم الألائين أمينو ترانسفيريز باستخدام جهاز قياس الأطياف الضوئية. وأظهرت نتائج الدراسة زيادة ذات دلالة إحصائية في متوسطات مستويات الزلال وإنزيم الألائين أمينو ترانسفيريز في مجموعة الاختبار عند مقارنتها مع المجموعة الضابطة، ولا يوجد اختلاف ذو دلالة إحصائية في متوسطات مستويات البروتين الكلي، اليرقان الكلي واليرقان المباشر وغير المباشر في مجموعة الاختبار عند مقارنتها مع المجموعة الضابطة. وأيضاً أشارت نتائج هذه الدراسة إلى عدم وجود علاقة ارتباط ذات دلالة إحصائية بين فترة التعرض للمواد البترولية بالسنوات مع مستويات الزلال، إنزيم الكبد، البروتين الكلي واليرقان المباشر وغير المباشر. وفي الختام أشارت نتائج هذه الدراسة إلى وجود ضعف في وظائف الكبد وربما يعزى ذلك لأثر التعرض إلى المواد البترولية لفترة زمنية طويلة، وبذلك نوصي بتحسين بيئة العمل والفحص الدوري لتفادي مضاعفات أمراض الكبد بالنسبة للعاملين في محطات تزويد الوقود.

الكلمات المفتاحية: ولاية شمال كردفان، محطات الوقود، البروتين الكلي، الألبومين.