Original article

The Potential Biochemical and Clinical Hazards in Some Petroleum Station Workers

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ABSTRACT

Background: Petrol station attendants are workers chronically exposed to petroleum derivatives primarily through inhalation of the volatile fraction of petrol (or gasoline) during vehicle refueling. These point sources can emit significant levels of group of aromatic VOCs, namely BTEX (benzene, toluene, ethyl-benzene and xylenes) into the ambient air. **Objectives:** To describe the demographic data and habits of workers in petroleum stations in different delta governorates, and to assessment of the toxicological health hazards in these workers. **Subjects and Methods:** The present study was a cross sectional community-based on study for monitoring the potential biochemical and clinical hazards in some petroleum station workers. The study was done on 200 workers in petroleum station in Delta area and 200 persons in the same age and sex as a control. This study concentrated on characterizing the health effects of BTEX compounds of petroleum stations in Delta region; (Dakahlia, Gharbiya, Damietta, Sharqiyah and Qalyubiya governorates). **Results:** Smoking pattern of the studied workers revealed that more than half of studied exposed subjects were smokers (58%).Regarding health problems of exposed subjects, the present study showed only 28% had abdominal and pelvic problems and the respiratory problems .All studied groups were subjected to ECG, very highly significant difference were found between exposed and non- exposed groups regarding normal, and sinus tachycardia. This study showed alteration in CBC parameters, although it was within its normal range but it was significantly lower in WBC, lymphocytes, neutrophils, basophils, RBC, hematocrit, MCH, MCHC, monocytes, hemoglobin and platelet count and was significantly higher in lymphocytes,and all subjects had normal morphology of WBCs, RBCs platelet and absent blasts. All lipid profile values determined for Petroleum Station workers in this study were greater than the acceptable level. Moreover, Statistical analysis revealed a significant gradual increasing with increased duration of exposure in renal function biomarker; kidney injury molecule 1 (KIM-1) which plasma concentration reflects renal tubular injury. **Conclusion:** Our findings indicate that controlling emissions of BTEX compounds and monitoring employees' exposure and protecting petroleum workers and public health near these areas are important. It is important to decrease exposure of people to high BTEX concentrations in hot spots such as gas stations and to move such facilities outside urban centers.

Keyowrds: BTEX, Potential Biochemical, Clinical Hazards, Petroleum Station Workers.

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I.INTRODUCTION

Volatile organic compounds include benzene, toluene, ethyl benzene, and xylene (BTEX). Well-known carcinogens include benzene and ethyl benzene. Additionally, hematological system, central nervous system and reproductive system are also susceptible to benzene effects. **(ACGIH, 2010).**

The BTEX compounds can be generated while performing out a variety of oil and gas operations tasks, such as flaring, venting, and

running various kinds of apparatus. BTEX substances can be directly ingested, inhaled, or met skin by gas station attendants. Inhalation, however, is the major exposure route. **(Chauhan et al., 2014).**

Filling station employees, service station attendants, gasoline truck drivers, and refinery employees are at a higher risk of exposure to gasoline fumes. Because gasoline products are volatile, they are always easily available in the atmosphere wherever they are supplied, especially at gas stations and depots. **(Gupta and Dogra, 2002).** Despite long-standing recognition, occupational disorders that affect gas station attendants in many ways are nevertheless an issue everywhere in the globe. In developing nations, the actual prevalence of many occupational disorders is significantly higher than what is reported. Both in emerging and industrialized nations, occupational illness cases and types are rising. **(Saponaro et al., 2009).**

BTEX is one of the fuel pollutants that can cause several ailments, including cancer and neurological disorders. Teratogenicity may also result from it. Benzene, which is regarded as the most dangerous pollutant in gasoline due to its genotoxic and carcinogenic properties, has also been linked to numerous disorders affecting the immunological, endocrine, cardiovascular, respiratory, and reproductive systems. **(El-Mahdy et al., 2015).**

People could be exposed to high concentrations of petroleum products during their regular activities at home and at work since toxic petroleum product concentrations could persist in the environment. **(Ujowundu et al., 2011).** The haemopoietic system's dysfunction and bone marrow depression may be the primary causes of the harmful health effects of gasoline exposure. **(Sahb, 2011).** It was discovered that long-term exposure to gasoline affected renal function, and these alterations were noted to occur between 5 to 10 years after the exposure. **(Khalaf and Abdel Raheim, 2010).** It was discovered that Mean Red Blood Cells (RBCs) count, hemoglobin level, and Hematocrit (HCT) level were significantly lower in petrol station attendants. ***(Abou-El Wafa et al., 2015).***

When there is kidney damage, the tarns membrane glycol-protein known as kidney injury molecule 1 (KIM-1) is significantly expressed in the kidney's proximal tubular cells. **(Ichimura et al., 2004).** The KIM-1 released into urine and can be quantified as a sensitive and specific biomarker for acute kidney injury (AKI) in rodents and humans **(Koyner et al., 2010).**

Aim of this work was to describe the demographic data and habits of workers in petroleum stations in different delta governorates. Assessment of selected toxicological health hazards in these workers.

II. SUBJECTS AND METHODS

The present study was a cross sectional community-based on study for monitoring the potential biochemical and clinical hazards in some Petroleum station workers. The study was done on 200 workers in petroleum station in Delta area and they were compared to a matched group of healthy 200 male workers. This study concentrated on characterizing the health effects of BTEX compounds of Petroleum stations in delta region; (Dakahlia, Gharbiya, Damietta, Sharqiyah and Qalyubiya governorates).

Inclusion criteria: male workers between twenty and sixty years in direct contact with petroleum products vapours, in petroleum stations in region of the study**,** workers at least 8hrs daily continuous for at least one year before this study, and no history of exposure to other chemical materials.(garage workers, taxi drivers, petroleum industries).

Exclusion criteria: Working less than one year or interrupted exposure, history of disease or medical proplem befor enrollment in the work as (cancer, chemotherapy, drug dependence,….)

Ethical considerations:

Ethical approval obtained according to Faculty of Medicine Assiut University ethical committee regulations. Protecting privacy and confidentiality will be guaranteed to ensure both patients safety and data quality. Informed consent obtained from all participating patients. Complete freedom of the participants to be withdrawn from the research at any time without any harm. All results of the study including the results of clinical examination and investigation will be

available for the workers to know after the end of the study.

The study was divided into two parts:

The first part of the study : structured questionnaire of the exposed group which include questions about:

1- Demographic data of workers as age, residence,somking habit, education, marital state and fertility .etc

2- Duration of work at gasoline station in year, days of work per week, hours of work per day.

3- The general health status of the workers prior to work enrollment, and any symptoms aggravating during their work shift.

4- All possible symptoms that may be attributed to exposure to the toxic elements to which the workers exposed as :malaise headache, dyspnea.etc

5- The nutritional status of the workers.

6- Using of protective measures in the working place and reasons for non-usage.

The second part of the study:

i. Examination of the exposed and non exposed groups including :

1- Vital signs as pulse. respiratory rate,Temperature and blood pressure.

2- Measurement of height, weight and body mass index calculation.

3-Electrocardiography(ECG) examination.

ii. Laboratory Investigations of the exposed and non exposed groups including :

1- Complete blood picture .

2- Peripheral blood film according to **(Berend, 2000**)

3- Blood urea and serum creatinine.

4- Determination of serum kidney injury molecule 1 (KIM 1)by Human Kidney Injury Molecule 1(KIM-1) (ELISA Kit) .

5- Determination of lipid profile according to **Lund-Katz et al., 2003** and **Nauck et al., 2002.**

Statistical Methods:

The collected data was entered in excel sheet, and analyzed using SPSS version 25 software. Categorical data was done in the form of numbers and percentages while quantitative data was done in the form of mean and standard deviation. Then analytic statistics was done as chi square. Independent sample t test, correlation and regression tests. Values were considered significant when p values equal or less than 0.05. Kolmogorov-Smirnov test was done to test the normality of data distribution. Significant data was considered to be nonparametric. Mean, Standard deviation (± SD) for parametric numerical data, while median and range for non-parametric numerical data. Frequency and percentage of non-numerical data. Regression analysis: Logistic regression analyses were used for prediction of risk factors, using generalized linear models. All tests were 2-sided and a P-value<0.05 was considered statistically significant.

III. RESULTS

The current study was conducted on 200 exposed male workers in petroleum staion in Delta area (Dakahlia, Gharbiya, Damietta, Sharqiyah, Qalyubiya governarates) and 200 persons in the same age and sex as a control from (1/11/ 2017 to 30/11/ 2018). It consisted of questionnaire results (tables from 1 to 8) and the results of examination of exposed and non-exposed groups (tables from 9 to 26).

Table (1) represented age and gender distribution of the exposed and non-exposed subjects and revealed that about half of exposed group were above 35 years (51%), and their mean age was 36.4 years while non-exposed group 44% aged more than 35 years, and their mean age was 35.3 years, all studied subjects (exposed and non-exposed) were males.

Table (2) revealed that subjects working at work petroleum stations from, 26% of reside near the rapid roads, while 74% away the rapid roads, most of them were married (87%), while 13% were single. Number of children was from 0 to 7 children. Most of them attended secondary schools (66%), while 10% were illiterate, 5.5%

read and write, 12.5% had university education. and only 6% attended primary schools.

Table (3) represented the type of work at the station where 92 subjects work in dump and fill (46%), and only 2 subjects work as station office.

Table (4), figure (1) show that the work duration varied widely, 37% worked from 1 to 5 years, 30% worked from 6 to 10 years, and 33% worked more than10 years. Most of studied subjects worked 8 hours per day (60%), while 40% worked 12 hours per day. with mean work duration 9.2 years, and mean work hours was 10.7 hours/ day.

Table (5), figure (2) show that more than half of studied exposed subjects were smokers (58%), mean smoking duration was 12.9 years, mean cigarettes was 18.2 cigarettes/ day. In addition, 2.5% smoked shisha, 2% smoked gouza. 59.4% smoked from 1 to 10 years, 40.6% smoked for more than 10 years. Most of studied subjects smoked from 3 to 30 cigarettes (61.2%), while only 38.8% smoked from 21 to 40 cigarettes. Mean cigarettes\day was 15±4.5, and mean smoking duration was 9.3±3.2. Range of daily smoked cigarettes was 3 to 30.

Table (6) revealed that most of exposed subjects knew the name of the primary substance. And only half of exposed subjects had direct contact with primary substances.

Table (7) revealed that all exposed group had not worn protective measures.

Table (8) showed no significant differences were found regarding weight, height, and body mass index between studied groups ($p>0.05$ for each).

Table (9) showed that during examination of blood pressure of the participants that the exposed group had very highly significantly higher DBP ($p<0.001$). while SBP did not differ significantly between both groups.

Table (10) showed that sinusitis is the main problem in the exposed persons (42.4%) followed by allergic rhinitis (40%).

Table (11) showed that the exposed group were within normal range CBC parameters, of although this group had significantly lower WBC, neutrophils, basophils, RBC, hematocrit, MCH, MCHC ($p=0.015$, 0.012, 0.019, 0.017, 0.046, 0.035, 0.037), very highly significantly lower monocytes, hemoglobin, platelet count ($p<0.001$ for each), significantly higher lymphocytes when compared to non-exposed group ($p=0.036$).

Table (12) represented the comparison of peripheral blood film for all studied subjects. All subjects had normal morphology of WBCs, RBCs, platelets, and absent blasts either exposed or non-exposed.

Table (13) showed high urea was present in 26.5% of exposed and 24.0%of non-exposed, mean urea level did not show significant differences between exposed and non-exposed groups ($p>0.05$). High creatinine was present in 17.5% of exposed and 4% of non-exposed with significant association with exposure ($p<0.001$). Mean higher creatinine level was significantly associated with exposed group ($p=0.002$).

Table (14), figure (3) and figure (4), show significantly higher cholesterol, TG, LDL ($p=0.036$, 0.036, 0.045 respectively) and significantly lower HDL concentration ($p=0.041$) when compared to non-exposed group.

Table (15) Showed very highly significantly higher KIM -1 concentration of exposed group when compared to non-exposed group ($p<0.001$).

Table (16) showed KIM-1 concentration increased gradually with increased duration of exposure.

Table (17) showed that all studied groups were subjected to ECG, non-exposed group showed 92% normal, and 7% sinus tachycardia and 1% sinus bradycardia. While exposed group showed 71% normal, 25% sinus tachycardia with very highly significant relation between exposed and non-exposed, 1% premature ventricular contraction, 1% supra ventricular tachycardia, 1% right ventricular hypertrophy and 1% old inferior MI.

Table (1). Comparison of demographic data between exposed and non-exposed groups.

Demographic data	Non exposed subjects = 200		Exposed subjects = 200		*P*
	Mean	**SD**	**Mean**	**SD**	
Age (years)	35.3	8	36.4	9	0.119
	N	**%**	**N**	**%**	
≤35 years	112	56%	98	49%	0.177
>35 years	88	44%	102	51%	
Sex (males)	200	100%	200	100%	-

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).

Table (2). Sociodemographic data of exposed group.

Socio demographic data		Exposed subjects = 200	
		N	%
Residence	Dakahleya	52	26%
	Sharqeya	40	20%
	Gharbeya	34	17%
	Damiette	38	19%
	Qaliobeya	36	18%
House	Beside rapid road	52	26%
	Away from rapid road	148	74%
Marital stats	Single	26	13%
	Married	174	87%
Education	Illiterate	20	10%
	read and write	11	5.5%
	Primary schools	12	6%
	Secondary schools	132	66%
	University	25	12.5%
Number of children range (exposed workers)		0 – 7	

Table (3). Type of work at the station.

Type of Work in station	Exposed subjects = 200	
	N	%
Dump and filling	92	46%
Laundry	70	35%
Station manager	12	6%
Tire repair	8	4%
Station Accountant	4	2%
The station supermarket	4	2%
Station office	2	1%
Achievement and remark	8	4%
Total	200	100%

Table (4): Duration of work at the station.

Duration of work at the station.	Exposed subjects = 200	
	N	%
Work duration (years)		
1-5 y	82	41%
6-10y	58	29%
>10y	60	30%
Work hours/day		
8h/day	120	60%
12h/day	80	40%

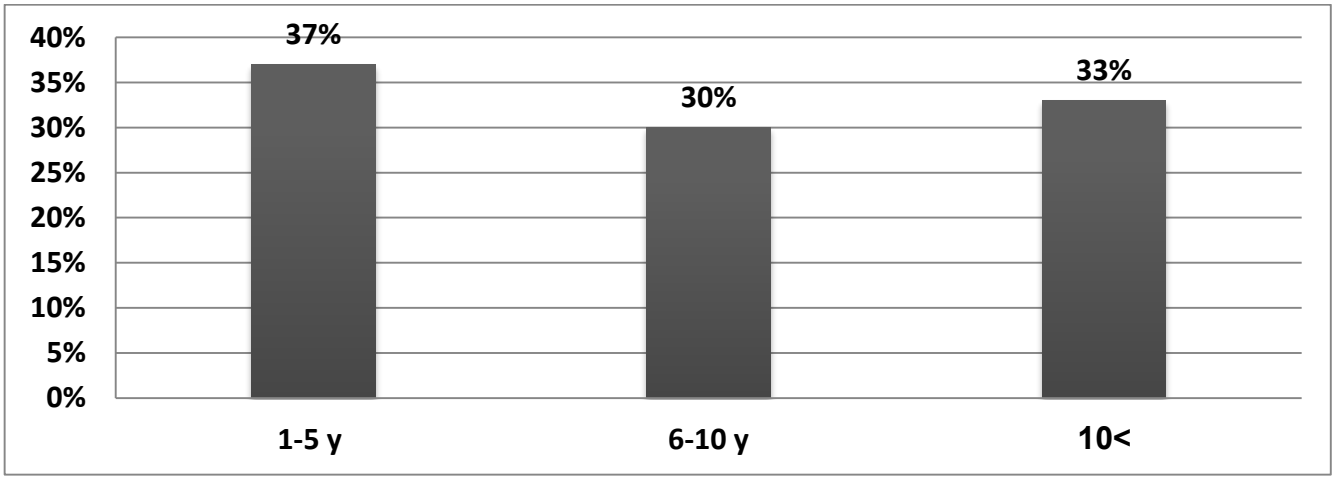


Figure (1). Duration of work at the station (years).

Table (5): Smoking habits in the exposed group.

Smoking habits	Exposed subjects = 200	
Non-smokers	84	42%
Smokers	116	58%
Cigarette's smoking	107	53.5%
Sheesha (N, %)	5	2.5%
Gouza (N, %)	4	2%
Years of smoking		
(1- 10 y)	69	59.4%
(Above 10 y)	47	40.6%
Daily smoked Cigarettes		
(3-20) cigarettes	71	61.2%
(21-40) cigarettes	36	38.8%
Cigarettes\day (mean SD)	15	±4.5
Smoking duration (years) (means SD)	9.3	±3.2
Range of daily smoked cigarettes	3-30	

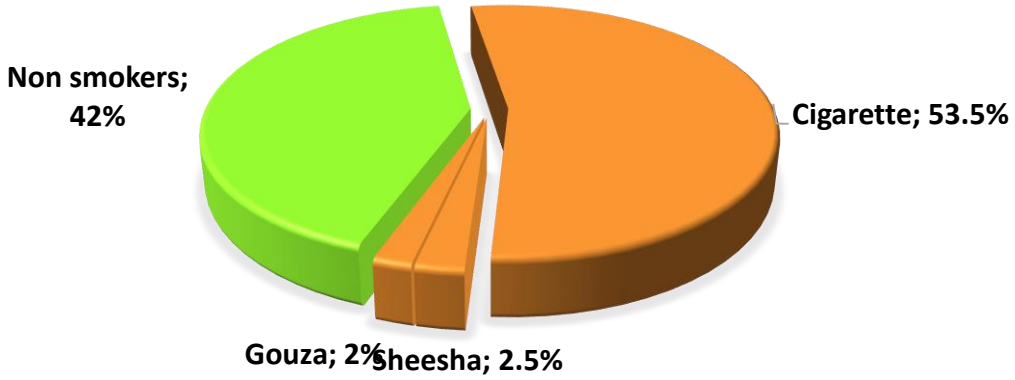


Figure (2). Smoking habits in the exposed group.

Table (6). Knowledge about substance name and direct contact with primary substances in exposed group. (Benzene, gasoline or other)

Knowledge about substance name, direct contact with primary substances	**Exposed subjects= 200**	
	N	%
Knowledge of substance name	197	98.5%
Direct contact with primary substances	100	50%

Table (7): Protective measures in exposed group. (Masks, boots, aprons, and gloves)

Protective measures	**Exposed subjects= 200**	
	N	**%**
Protective measures	0	0%

Table (8): Comparison of anthropometric data between exposed and non-exposed groups.

Anthropometric data	**Non exposed subjects= 200**		**Exposed subjects= 200**		**P**
	Mean	**SD**	**Mean**	**SD**	
Weight (kg)	86.7	11.3	87.1	16.9	0.283
Height (cm)	176.6	6.4	174.6	12.7	0.357
BMI (kg/m2)	27.6	4.6	28.6	5.6	0.276

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).
BMI, body mass index.

Table (9): Comparison of blood pressure between exposed and non-exposed groups.

Blood pressure	**Non exposed subjects = 200**		**Exposed subjects = 200**		**P**
	mean	**SD**	**Mean**	**SD**	
SBP (mmHg)	128.2	11.4	130	12.4	0.153
DBP (mmHg)	82.4	7.4	85.2	8.2	<0.001***

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).
SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table (10). Clinical chest examination and respiratory problems in exposed group.

Respiratory problems	Exposed subjects = 200	
	N	%
Bronchial asthma. (BA)	8	12.1%
Dyspnea	10	15.2%
Sinusitis	28	42.4%
Allergic rhinitis	20	40.0%
Total	66	33%

Table (11): Comparison of CBC between exposed and non-exposed groups.

Complete blood count	Non exposed subjects = 200		Exposed subjects = 200		P
	Mean	SD	Mean	SD	
WBC ($X10^9$/L)	8.4	2.3	7.7	2	0.015*
Neutrophils (%)	55.2	10.6	51.4	11.5	0.012*
Lymphocytes (%)	35.2	9.2	37.2	10	0.036*
Monocytes (%)	7.7	2.3	6.5	2.2	<0.001***
Eosinophils (%)	3.4	1.1	3.4	1.1	0.959
Basophils (%)	0.5	0.1	0.3	0.1	0.019*
Hemoglobin (g/dL)	14.9	1.6	13.9	1.5	<0.001***
RBC ($X10^6$/L)	6.4	2.1	5.2	1.4	0.017*
HCT (%)	44.6	10.8	42.9	6.6	0.046*
MCV	82.6	10.2	84.6	5.9	0.096
MCH	28.3	2.7	27.2	2.2	0.035*
MCHC	33.5	1.2	32.2	2	0.037*
RDW CV (%)	14.3	1.9	14.1	3.2	0.465
Platelet ($X10^9$/L)	280.2	77.5	238.6	74.3	<0.001***

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).

Table (12). Comparison of peripheral blood film between exposed and non-exposed groups.

Peripheral blood film		Non exposed subjects = 200		Exposed subjects = 200	
		N	%	N	%
WBC morphology	Normal	200	100%	200	100%
	Abnormal	0	0%	0	0%
RBCs morphology	Normal	200	100%	200	100%
	Abnormal	0	0%	0	0%
Platelet's morphology	Normal	200	100%	200	100%
	Abnormal	0	0%	0	0%
Blasts	Absent	200	100%	200	100%
	Present	0	0%	0	0%

Table (13): Comparison of kidney functions between exposed and non-exposed groups.

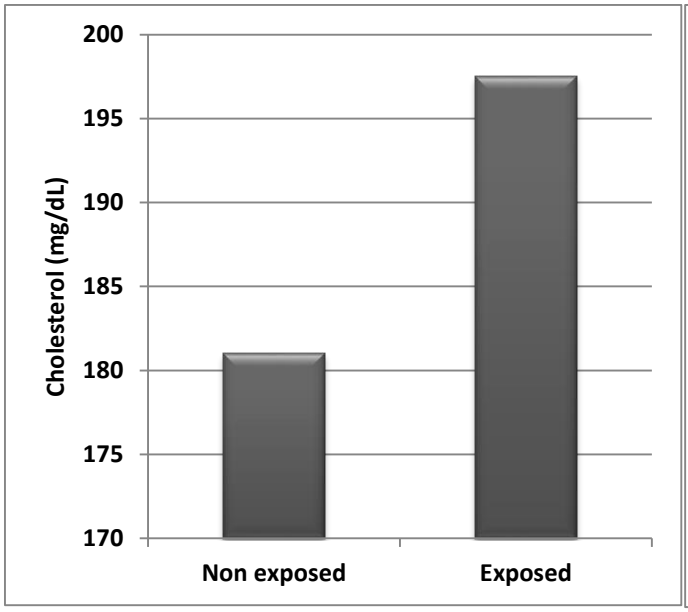
kidney functions	Non exposed subjects = 200		Exposed subjects = 200		P
Urea (mg/dL) (mean±SD)	25.2	4.5	24.2	5.1	0.306
Normal urea (5 – 20 mg/dL) (N, %)	152	76.0%	147	73.5%	0.565
High urea (above 20 mg/dL) (N, %)	48	24.0%	53	26.5%	
Creatinine (mg/dL) (mean±SD)	0.9	0.2	1.1	0.3	0.002**
Normal creatinine (0.6-1.2 mg/dL) (N, %)	192	96.0%	165	82.5%	<0.001
High creatinine (N, %)	8	4.0%	35	17.5%	

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).

Table (14): Comparison of lipid profile between exposed and non-exposed groups.

Lipid profile	Non exposed subjects = 200		Exposed subjects = 200		P
	mean	SD	mean	SD	
Cholesterol < (200 mg/dL)	181	42.4	197.5	183	0.036*
Triglycerides < (150mg/dL)	121.5	73.2	130.8	48	0.036*
LDL < (120 (mg/dL)	92.8	36.8	110.6	27	0.045*
HDL (40-60 mg/dL)	47.5	13.7	41.2	8	0.041*

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).
LDL. low density lipoprotein. HDL, high density lipoprotein.



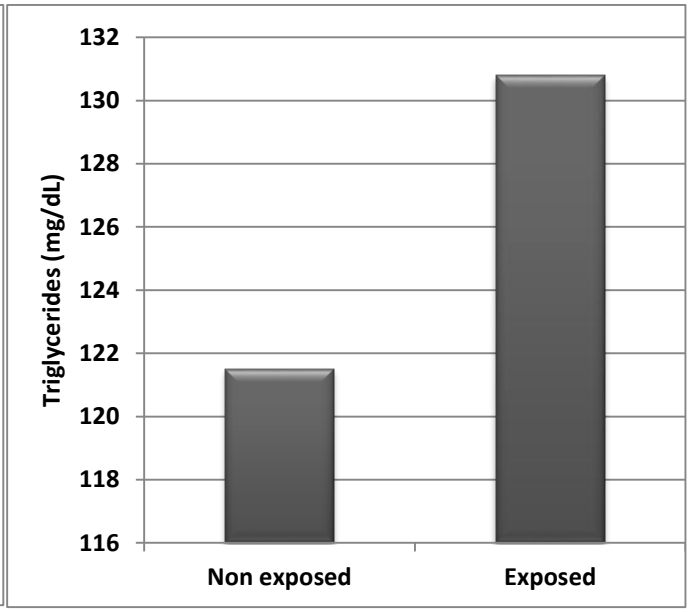


Figure (3) Cholesterol in exposed and non-exposed groups. Figure (4) TG in exposed and non-exposed groups

Table (15): Comparison of KIM concentration between exposed and non-exposed groups.

KIM concentration	Non exposed subjects = 200		Exposed subjects = 200		P
	mean	SD	Mean	SD	
KIM	27.1	8.2	52.8	10.3	<0.001***

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).
KIM, kidney injury molecule 1.

Table (16): Distribution of KIM concentration according to duration of exposure in exposed group.

Duration (years)	Number of exposed subjects	KIM concentration	
		Mean	SD
≤5	74	24.5	7.1
6-10	60	58.9	13.2
≥10	66	78.9	3.9

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).

Table (17): Comparison of ECG findings between exposed and non-exposed groups.

ECG findings	Non exposed subjects = 200		Exposed subjects = 200		P
	N	%	N	%	
Normal	184	92%	142	71%	**<0.001*** **
Sinus tachycardia	14	7%	50	25%	**<0.001*** **
Sinus bradycardia	2	1%	0	0%	0.156
Premature ventricular contraction	0	0%	2	1%	0.156
Supra ventricular tachycardia	0	0%	2	1%	0.156
Right ventricular hypertrophy	0	0%	2	1%	0.156
Old inferior MI	0	0%	2	1%	0.156

*, Significant (p<0.05); **, highly significant (p<0.01); ***, very high significant (p<0.001).
MI, myocardial infarction.

IV. DISCUSSION

Regarding the age and gender distribution of the studied workers (200 Petroleum station Workers) were ranged from 18-55years with mean age was 35.3 years, In addition to (200 non exposed subjects) of matched age and gender. All studied subjects were males. About half of exposed group were above 35 years (51%), while non exposed group, 44% aged more than 35 years, which is in concurrent with findings of similar studies done in Brazil where male staff were 90.5% **(Rocha et al 2014)** and 75% in Nigeria were males **(Ahmed et al 2014)**

Regarding Sociodemographic data and educational status of the Petrol station workers The present study was conducted on subjects working at work stations from different delta governorates, 26% of them reside near the rapid roads and 64% away from the rapid roads. Most of them were married (87%), while 13% were single. Median children number was 3, ranged from 0 to 7 children, and (66%) of them attended secondary schools, while 10% were Illiterate, 5.5% read and write, 6% attended primary education, and only 12.5% had University education.

Consistent with these findings, (**Ekpenyong et al., 2013)** showed that 71.1% were single and 85.1% of petrol pump workers had a secondary level of education, While **(Reddy et al., 2014)** showed that the majority of the gas station attendants (70.95%) had a poor level of education**.** However, the study of **(Abdel Monem et al., 2010)** reported that more than a third of the workers completed high school, while less than a quarter completed primary school, and that the majority of the workers were married.

Regarding the type and duration of work In the present study near half of studied subjects work in dump and fill (46%), while 35% work in laundry while 1% station office and the work duration varied widely, 41% worked from 1 to 5 years, 29% worked from 6 to 10 years and 30% worked more than10 years, most of studied subjects worked 8 hours per day (60%), while 40% worked 12 hours per

day. with mean work duration 9.2 years, and mean work hours was 10.7 hours/ day.

Our results came in agreement with study of (***Rocha, 2013)*** conducted in Brazil's Rio Grande. The results of this quantitative, descriptive, and exploratory study, which involved 221 employees from 22 gas stations, revealed that the workers had an average experience of more than ten years.

Smoking pattern of the studied workers revealed that more than half of studied exposed subjects were smokers (58%).

Smokers are found to be significantly higher than nonsmokers ***(Lovreglio et al., 2014).*** As many as 41 people or 83.7% of 49 respondents had smoking habits ***(Febrian et al., 2019).***

Heibati et al; (2018) reported (32%) of workers as smokers respectively. but **Abou-ElWafa et al; (2015)** reported that (45.1%,) of petrol station workers were smokers respectively.

Regarding knowledge about substance name and direct contact with it. Our study demonestrated that most of exposed subjects knew the name of the primary substance, while, only half of them had direct contact with it. **Kaufman etal; (2009)** found that 17% of the workers studied recognised gases derived from fuels, 20% of the individuals under investigation recognised chemicals used in their workplace, and 14% recognised vapours produced by cars.

These findings supported those of ***(Abdel Monem et al., 2010),*** which showed that employees knew a lot about how gasoline affected the environment and human health. However, the level of knowledge of the workers was largely unaffected by their education.

This was supported by ***(Abd ElAziz and Abd-ElAal, 2012)*** who stated that there was no significant relation regarding the knowledge of workers and their education.

Regarding personal protective equipment (PPE) none of the exposed group used protective measures in the current study.

The current result was in agreement with study ***(Abou-El Wafa et al., 2015)*** which demonstrated that neither the exposed nor the non-exposed groups had worn personal protective equipment (PPE) because it was not readily available.

Also present result comes in contrast to ***(Alves et al., 2017)*** who found that in Feirade Santana, boots (100%), glasses (37.8%), and gloves (20.0%) were the PPE items most frequently utilised by workers, compared to boots (96.0%), gloves (47.2%), and goggles (47.2%) in Salvador.

Regarding weight, height and BMI of studied groups. The present study revealed that no significant differences were found which is in agreement with the findings of (**Campo et al., 2016)**. In contrast to the present study of these parameter in ***(Egbuonu et al., 2015)*** the BMI, weight, and height were greater in the exposed group compared to the control group in the study, although these differences were not statistically significant.

Regarding blood pressure of the studied workers this study made assessment of multiple hematological effects in workers at gasoline station and found that the exposed group had very highly significantly Diastolic blood pressure .While systolic blood pressure did not differ significantly between both groups.

In the study of **Egbuonu et al., (2015)** The only blood pressure (BP) differences between the group of gas station employees and the control group were a difference in diastolic blood pressure of 10 mmHg and a difference in the computed systolic to diastolic blood pressure ratio (SBP: DBP) of 0.17.

In a study by ***(Wiwanitkit., 2007***) The group with high levels of benzene exposure (100%) had a considerably higher prevalence of hypertension than the group with low levels of benzene exposure (49%). According to this study, hypertension caused by benzene may be caused by a disruption of the nitric oxide pathway.

Regarding Clinical chest examination and respiratory problems in exposed subjects, In the current study, the respiratory problems consisted of 33%, they varied widely as BA, dyspnea, sinusitis, allergic rhinitis. A study by **Tunsaringkarn et al., (2011)** revealed that headache, fatigue, and throat discomfort were the

most often mentioned complaints by gas station employees while, **Alves et al; (2017)** in his study found that symptoms among gas station employees included headache 33.3%, vertigo 26.7%, cough 33.3%, and nausea 26.7%.

Regarding complete blood count parameters and peripheral blood film between exposed and non exposed groups. Our results showed that the mean WBC count, neutrophils, basophils, RBCs count, hemoglobin level, hematocrit, MCH, MCHC, monocytes and platelet count of petroleum station workers were very highly significantly lower than those of the comparison group (non exposed group) and were significantly higher lymphocytes between both groups. And the comparison of blood film was done for all studied subjects. All subjects had normal morphology of WBCs, RBCs, platelets, and absent blasts.

Similar to this, in a haematological evaluation of gasoline exposure in Baghdad, workers at gas stations had mean haemoglobin levels, WBC counts, and RBC counts that were considerably lower than those of the comparison group. **(Sahb, 2011).**Likewise, studies by **Ajugwo et al., (2014)** and **(Aleemuddin et al.,2015).**in Nigeria made a similar observation.

Sahb., (2011) When compared to non-smokers, workers filling gasoline outside had relatively similar haemoglobin levels and RBC counts, but their haemoglobin and WBC levels were significantly different, which could be explained by the agonistic effect of smoking and benzene exposure.

Differently from these data by **(Sirdah et al., 2013)** showed RBC, haemoglobin, HCT, MCH, MCHC, and platelet values were considerably greater than those of the comparison group, although the mean WBC count was significantly lower. Additionally, it demonstrated a significant difference between the exposure to Liquefied Petroleum Gas (LPG) and the reference group in terms of the haematological parameters of gas station attendants.

In the study of **(Abou-El Wafa et al., 2015)** the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) were similar in both groups with a statistically non-significant difference between them, the mean HCT value was significantly lower in the gas station attendants than the comparison group. The findings of the study also revealed that while gas station employees' mean white blood cells (WBCs) and platelet counts were higher than those of the comparison group, their mean haemoglobin level and RBC count were significantly lower than those of the latter group.

We believe that this change in the WBC differential is the result of long-term immunological sensitization to natural gas components in the bone marrow, which gradually depressed neutrophils. The findings also suggest that neutrophils may be more vulnerable than lymphocytes to long-term exposure to sulphur components. The discrepancy between these findings could be explained by the involvement of additional factors, such as exposure to additional compounds, the components of the gasoline, the time and level of gasoline exposure at work, variations in assessment measures, and individual variation (e.g., physical activity level, body mass index (BMI)).

Regarding the renal function parameters of sutdied subjects, the present study assessed the effect of long-term exposure to gasoline fumes that is constantly inhaled by the workers on kidney function as an aspect of general humoral immunity.

The majority of fuel products are harmful to several organ systems, including the kidney, and are combinations of aliphatic and aromatic hydrocarbons primarily associated to gasoline. **(Ravnskov, 2005),** This may be related to an increase of hazardous metabolites that are liberated, such as reactive oxygen species. While studies on rats show that inhaling the aromatic compounds toluene, styrene, and xylene might cause kidney damage. **(Rankin et al., 2008).**

Of these substances, the significance of organic solvents in chronic kidney disorders, notably chronic glomerulonephritis, has long been disputed. **(Brautbar, 2004)**

In the present study, Exposed group showed within normal range urea and creatinine

(markers of renal function), High urea was present in 76%of exposed and 73.5% of non exposed, mean urea level did not show significant differences between exposed and non exposed groups (p>0.05), High creatinine was present in 17.5% of exposed and 4% of non exposed with significant association with exposure (p<0.001). Mean higher creatinine level was significantly associated with exposed group (p=0.002).

These findings met the earlier reports that suggested that gasoline may induce renal function alterations due to recurrent urinary tract infections **(Ishola et al., 2006).** Benzene is known to adversely influence both humoral and cellular acquired immunity due to change of the immune system and/or persistent urinary tract irritation.

This result is consistent with some reports of previous studies **(Nwanjo and Ojiako, 2007)** where the mean concentrations of urea and creatinine increased significantly (p 0.05) for the group exposed to fuel vapour for 6 to 10 years compared to the control group, however no significant rise was seen for the group exposed to the vapour for a maximum of 5 years.

Abou-ElWafa et al; (2015) found that, although not statistically significant, the serum urea and creatinine levels of gas station workers were greater than those of the comparison group..

Similarly, The serum levels of urea and creatinine were also found to be considerably higher in gasoline filling workers in Sulaimani City, Kurdistan, compared to the reference group, despite the fact that these values are still well within the recognised normal ranges. **(Hussain et al., 2013).**

In **(Khalaf et al.,2016)** when compared with the control group, the workers who were exposed to gasoline had significantly higher serum urea and creatinine levels.

Regarding lipid profile of studied subjectes, In our study, exposed group showed significantly higher cholesterol (p=0.036) and significantly lower HDL concentration (p=0.041) when compared to non exposed group, suggesting impaired lipid metabolism and possibly liver disease.

In apparent support of the present result on cholesterol concentration, The TG concentration was higher (p=0.036) in the exposed group, which appears to validate the current cholesterol concentration finding. The inability of the Low-Density Lipoprotein (LDL) cholesterol to transport the deposited triacylglycerol back to the adipose tissue is further suggested by **(Egbuonu and Osakwe, 2011).** This probably resulted in higher serum LDL, cholesterol in the exposed group than in the control observed in this study.

Compromised function of LDL is a risk factor for arteriosclerosis **(Ochei and Kolhatkar, 2008)** by impairing lipid metabolism. Animals that have impaired lipid metabolism, which results in elevated serum concentrations of total cholesterol and triacylglycerol, may be more susceptible to heart disorders. **(Egbuonu et al., 2010).** This could suggest that the depot workers are at risk for heart dysfunction. Lipids can increase blood pressure by creating plaques that constrict blood vessels since they are atherogenic. **(Egbuonu and Ezeanyika, 2012).**

Regarding distribution of KIM concentration according to duration of exposure in exposed group. in this study we used more recent renal function biomarker; kidney injury molecule 1 (KIM-1) whose plasma concentration reflects renal tubular injury**.** In this current research, we build on the work reported by **Sabbisetti et al. (2014)** and they looked into the idea that circulating KIM-1 measurement could be a useful early indicator of patient nephrotoxicity in the case of chronic gasoline exposure.

In our study, the exposed group showed very highly significantly higher KIM concentration when compared to non-exposed group (p<0.001) and also increased gradually with increased duration of exposure. This is in full agreement with many previous studies **(Khalaf et al., 2016).**

Regarding cardiac examination by ECG findings between exposed and non exposed groups.the current study found a very highly

significant difference between both groups regarding normal, and sinus tachycardia, no significance difference between both groups regarding sinus bradycardia, premature ventricular contraction, supra ventricular tachycardia, Right ventricular hypertrophy and old inferior MI.

Tsai et al., 2010 studied the relationship between outdoor concentrations of six particular VOCs and cardiovascular mortality in Taiwan and found elevated risks for propane, isobutane, and benzene. Where as ***(Pekkanen et al., 2002)*** found that increase risk of ST-segment depression.

V. CONCLUSION

Our findings indicate that controlling emissions of BTEX compounds and monitoring employees' exposure and protecting petroleum workers and public health near these areas are important.

It is important to decrease exposure of people to high BTEX concentrations in hot spots such as gas stations and to move such facilities outside urban centers. Additionally, regulations to reduce pollution from gas stations are recommended and populated buildings would benefit from being far from such pollutant hot spots.

There should be the introduction of increasing the safety measures at these stations including the establishment of workers insurance system, the use of protective measures (gloves, masks, clothes, …etc), periodic medical and laboratory examination, and treating the diseased persons as early as possible. It is a hope to develop a safer fuel in the near future.

VI. RECOMMENDATIONS

1. The association between exposure to natural gas and toxicological health hazards changes is apparent.
2. Increased public awareness of the dangers of environmental contamination by natural gas leakage and more epidemiological investigations are necessary to determine the exact role of occupational hydrocarbon exposure in the biochemical and clinical changes and the long-term significance of these changes.
3. The study highlighted the need for the petroleum depot workers and petrol station pump attendants to wear personal protective equipment (PPE) and to assess their health status on a regular basis.
4. There should be the 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.

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المخاطر البيوكيميائيه والإكلينيكيه المحتمله لدى بعض عمال محطات البنزين

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الخلفية: العاملون في محطة الوقود هم عمال يتعرضون بشكل مزمن للمشتقات البترولية من خلال استنشاق الجزء المتطاير من البنزين أثناء إعادة التزود بالوقود في السيارة. يمكن أن تنبعث هذه المصادر النقطية بمستويات كبيرة من مجموعة المركبات العضوية المتطايرة العطرية ، وهي BTEX (البنزين والتولوين وإيثيل بنزين والزيلين) في الهواء المحيط.

الأهداف: وصف البيانات الديموغرافية وعادات العاملين في محطات البترول في مختلف محافظات الدلتا ، وتقييم المخاطر الصحية السمية لدى هؤلاء العاملين.

والدراسه الحاليه هى دراسة مجتمعية مقطعية لرصد هذه المخاطر البيوكيميائية والسريرية لدى بعض عمال محطات البترول. فقد أجريت هذة الدراسة على 200 عامل يعملون في محطات البترول فى بعض المحافظات بمنطقة الدلتا (الدقهليه –الشرقيه –دمياط – الغربيه – والقليوبيه) والذين تحققت فيهم شروط الدراسه و200 شخص في نفس العمر والجنس كمجموعة ظابطة.

النتائج: أظهر نمط التدخين لدى العاملين الخاضعين للدراسة أن أكثر من نصف الأشخاص المعرضين للدراسة كانوا مدخنين (58٪). وفيما يتعلق بالمشاكل الصحية للأشخاص المعرضين. أظهرت الدراسة الحالية أن 28٪ فقط يعانون من مشاكل في البطن والحوض وفي الجهاز التنفسي وقد تعرضت جميع المجموعات التي خضعت للدراسة لتخطيط القلب ، ووجدت فروق ذات دلالة إحصائية عالية بين المجموعات المعرضة وغير المعرضة فيما يتعلق بتسرع القلب الطبيعي وتسرع العقده الاذينيه.

وتشير الفحوصات المعمليه للحالات المشاركه فى الدراسه ان هناك تغيرًا في مكونات صوره الدم الكامله ، على الرغم من أنها كانت ضمن نطاقها الطبيعي حيث وجد انخفاض خلايا الدم البيضاء ، الخلايا الليمفاوية ، الخلايا القاعدية ، كرات الدم الحمراء ، نسبه الهيماتوكريت ،متوسط نسبه الهيموجلوبين في كرات الدم الحمراء ، الخلايا الوحيدة ، الهيموجلوبين وعدد الصفائح الدموية بينما لوحظ زيادة الخلايا الليمفاوية عند مقارنتها بالمجموعة غير المعرضة. كما لا يوجد تغيرًا فى تركيب اوشكل خلايا الدم . كانت جميع قيم نسبة الدهون المحددة لعمال محطة البترول في هذه الدراسة أكبر من المستوى المقبول. علاوة على ذلك ، أظهر التحليل الإحصائي زيادة تدريجية كبيرة فى وظائف الكلى و جزيء إصابة الكلى 1 (KIM-1) متزامنا مع زيادة مدة التعرض للمواد البترولية الذي يعكس تركيزه في البلازما الإصابة الأنبوبية الكلوية.

الخلاصة: تشير النتائج التي توصلنا إليها إلى أن التحكم في الانبعاثات السامه من المواد البترولية ومراقبة تعرض الموظفين وحماية عمال البترول بالقرب من هذه المناطق أمر مهم.

التوصيات : يجب تقليل تعرض الناس لتركيزات عالية من المواد البترولية في المناطق الساخنة مثل محطات الوقود ونقل هذه المرافق خارج المراكز الحضرية للحد من الاضرار السميه المحتمله للمواد البترولية .