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The Effect of Air Pollutants on liver Enzymes and Pituitary Gland Hormones of Smokers and non-smokers of Oil Refinery and Gas Station Workers in Basra/Iraq

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Abstract

Air pollutants that originated from oil refineries and gas pump stations can have a negative effect on human organs, especially liver and brain. This study focuses on evaluating the pollutants from oil refinery and gas station on workers' health by measuring three hepatic enzymes GOT (Glutamic Oxaloacetic Transaminase), GPT (Glutamic Pyruvic Transaminase), ALP(Alkaline phosphatase) and three pituitary gland hormones LH (Luteinizing hormone), FSH (Follicle-stimulating hormone), TSH (Thyroid-stimulating hormone). Study groups were (i) 33 males from Basra oil refinery workers including 16 smoker and 17 non-smoker (ii) 23 male from Gas station, 11 of them were smoker while the other 12 are non-smoker (iii) 24 male local volunteers from Basra (all had non-oil related job) as a control group, 12 smoker and 12 non-smokers. All three groups' subjects had neither family history of raspatory problems nor diabatic. The results indicated a significance decrease in FSH, LH, TSH hormones and GPT, ALP enzymes of oil refinery workers, comparing to the control group. The same trend was also observed among gas station workers, suggesting hepatotoxicity and alternation in pituitary hormones. Pollutants that circulating around oil industry sites can negatively impact human body especially for those who work near these locations.

Keywords: Pituitary gland; hormones; liver enzymes; oil; air pollution.

Introduction

During oil processing, natural gas is usually burned in open air leaving particulate matter, polyaromatic hydrocarbons, volatile organic compound. Gas flaring can be very dangerous not only to human but to animals and to the environments.[1] Organs such as heart, lung, kidney, and skin can be negatively affected by oil industry by-products.[2] The hypothalamic-pituitary-gonadal (HPG) axis is a system that combined the effect of hypothalamus and pituitary gland and gonadal glands. This system achieve many tasks because it includes many important hormones and affecters. Any change or dysfunction in one of these hormones can change or effect HPG.[3] One of factors that can interrupt the functions of HPG are the anthropogenic disrupting chemicals (EDCs), which are outside chemicals that

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can cause damage to the endocrine system. EDCs are found in outdoor air that have been mixed with different pollutants including polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and diesel exhaust (DE). Pollutant like PAH can damage the estrogenic and the aryl hydrocarbon receptors.[4]

The levels of some infertility hormones such as Follicle stimulating hormone (FSH) and Luteinizing hormone(LH) have also found to be associated with exposure to fossil fuel emissions, especially in the petroleum sites.[5] Since the pituitary gland also produce thyroid stimulated hormones which act on thyroid gland[6], it will also be affected by EDCs. Liver main catalytic enzymes are glutamate oxaloacetate transaminase (GOT), glutamate pyruvate transaminase (GPT), and alkaline phosphatase (ALP). These enzymes help moving the amino groups of aspartate and alanine to a-keto groups of ketoglutaric acid.[7] Previous studies have found that PAHs in the air can alter the levels of these enzymes.[8] In this study, we evaluate the impact of air pollutants on workers in petroleum industry via analysing the levels of the above mentioned compounds in the blood serum samples.

Methods

Sampling:

Blood withdrawal as well as centrifuging were achieved inside Basra oil refinery clinic. Similarly, the gas station worker blood samples were locally collected and centrifuged. The sampling of the third group was conducted in a medical laboratory in Basra city which is a city located in the southern part of Iraq. The process of sample collection lasted from February 15 to January 16, 2020.

Sampling notes:

- All workers have been working for at least one year.
- All haemolysis samples were discarded during measurements.
- All test were done in a certified medical laboratory in Basra city.
- Only male participants were selected to this study.

Hormones Measurements

MINI VIDAS is an autoanalyzer using solid phase fluorescence Immunoassay. It is the smaller version of VIDAS (Biomerieux, Marcy-l'Étoile, France). This analyser is widely used in Middle East and Europe due to the high sensitivity and multisampling technology. Every test has its own kit, which was purchased from the analyser company. The kits contain solid phase receptacle (SPR), control and a calibration reagent, and a sealed multigap reagent strip. The kit master lots (MLE) were scanned by the analyser barcode reader before the analysis. Every kit has a unique (MLE) to identify test relative fluorescence values and calibration ranges. If a calibration were out of the master lot ranges, system will not run. For FSH, LH and TSH, a 200 µl were pipetted in the sample gape in the reagent stripes and inserted in the analyser, along with the receptacle solid-phase (SPR). Each reagent strip contains dilutant, washing buffer, second dilutant, second washing buffer, and substrate. The measurement started when the solid phase interacts with every gap in reagent strip. All tests reports were printed in mini Vidas build-in printer.

Liver enzymes measurements

Measurements of liver enzymes were performed using Chem 200 instrument from Gesan production (Campobello Di Mazara, Italy). Calibration standards and controls were prepared and measured immediately before the actual samples. Levels of GOT, GPT, and ALP enzymes were determined in all samples using the analyser computed system.

- **Statistical analysis**

SPSS (version 26) was used for statistical analysis such as mean, average standard deviation, and t-test. Paired-sampled t-test was used to compare between control group and workers of oil Refinery. The difference considered to be significant when *p*-value was less than 0.005.

- **Results findings and discussion**

The results of the study showed a significant decrease in the level of TSH, FSH and LH hormones for each of the workers in oil refinery and gas stations, compared to the control group, as shown in Table 1. These results may indicate a minor defunction of hypothalamic-pituitary gland, which can be attributed to the change in the tropic hormone, downregulation

of gonadotropin-releasing hormones (GnRH).[5] The detected lower levels of TSH among the oil refinery workers in study groups can be used as a sign for the exposure to a high concentrations of pollutions.[9]

Table 1: FSH, LH, TSH hormones levels in (Mean±SD) along with P-values.

	Oil Refinery	P[1] value	control	Gas station	P[2] value
FSH (mlu/ml)	3.48±2.30	P <0.001	8.48±1.32	3.43±1.80	P <0.001
LH (mlu/ml)	5.08±3.13	P <0.001	5.93±0.60	4.65±1.89	P <0.001
TSH (μU/ml)	1.86±0.50	P <0.001	4.84±2.60	1.90±0.61	P <0.001

A comparison between smokers and non-smokers in the oil refinery and gas stations with the control group has been performed. The results showed a significant decrease of FSH, LH, and TSH among smokers workers, compared to the smokers from control group, Table 2. The results suggest that smoking is a vital factors because smokers can more be harmed by toxins than non-smokers.[10] Table 2 indicate that the mean concentration of FSH among the smokers in oil refinery is 4 mlu/ml, compared to 2.9 mlu/ml among non-smoker of the same group. When comparing the FSH levels of smokers (8.5 mlu/ml) from control group to the non-smokers of oil refinery workers (2.9 mlu/ml), we can easily conclude that a person who is non-smoker and work in petroleum industry can have a more damage to the hypothalamic-pituitary gland hormones than a typical smoker who does not work in oil relating job.

Table 2: FSH, LH and, TSH hormones as in smokers and non-smokers samples.

	FSH (mlu/ml)	LH (mlu/ml)	TSH (μU/ml)	FSH (mlu/ml)	LH (mlu/ml)	TSH (μU/ml)
	Non-Smoker			Smoker		
Oil Refinery workers	2.90±1.19**	4.70±2.20	2.04±0.51**	4.00±3.10**	5.40±3.90**	1.60±0.59**
Gas station workers	3.60±1.75**	4.50±2.20	1.95±0.60**	3.10 ±1.90**	4.70±1.50*	1.90±0.59**
Control group	8.30±1.36	5.70±0.66	7.03±2.00	8.50±1.30	6.10±0.50	2.60±0.61

P values when compared with control: *<0.05, **<0.001

The study also evaluated the effectiveness of liver enzymes for each of the workers in the oil refinery and gas station. The results of the study showed that GOT enzyme level was significantly increased among the samples of the workers in oil refinery compared to the control group, while no significance change in GOT was observed among the gas stations workers. Meanwhile, the levels of both GPT and ALP enzymes decreased significantly in each of the workers in the oil refinery and gas stations compared to the control group, Table 3. GOT and GPT are liver enzymes and also exist in various tissues, and a change in the levels of these enzymes indicates a liver disease. However, GOT considered a better indicator compared to GPT, because many health issues in the human body increase the serum GPT.[11] For this reason, the elevation in GOT in oil refinery group is likely related to the destruction of liver cells and releasing GOT enzyme in the blood. The results also showed a lower serum ALP levels for both of oil refinery and gas station, compared to the control group. The lower ALP levels indicates a deficiency of zinc or magnesium in the blood serum of the workers in both groups, as ALP function is directly linked to levels of these two metals.[12]

1 A significant difference between Oil refinery workers and control group (P <0.05).
2 A significant difference between Gas station workers and control group (P <0.05)

Table 3: Liver enzymes GOT, GPT, ALP in (Mean±SD) with P-values.

	Oil Refinery	P[1] value	Gas station	P[2] value	control
GOT (U/L)	31.45±11.91	P <0.001	16.87±9.50	0.71	17.33±4.44
GPT (U/L)	17.95±11.00	P <0.05	11.70±8.10	P <0.001	25.46±5.33
ALP (U/L)	141.58±52.30	P <0.001	141.17±38.60	P <0.001	210.50±11.98

Table 4 list the results of the liver hormones levels for smokers and non-smokers . That data indicated a significant decrease in GPT and ALT enzymes among smokers in the refinery workers, while GOT levels increase within the same group. For the smokers in gas station, the results showed a decrease in ALP and GPT enzymes compared to the smokers of the control group. Similar trend is observed with liver enzymes when comparing a non-smoker from oil refinery to a smoker from control group. The mean serum GOT is significantly higher (27.30 U/L) than the control group(17.33 U/L), while the levels of serum ALP was less (151.35 U/L) than the values found in the control group(215.50 U/L), and for both of oil refinery and gas station workers.

Table 4: GOT, GPT and ALP enzymes for smokers and non-smokers in the three study groups.

	GOT (U/L)	GPT (U/L)	ALP(U/L)	GOT (U/L)	GPT (U/L)	ALP (U/L)
	Non-Smoker			Smoker		
Oil refinery workers	27.30±9.80**	19.80±11.90	151.35±64.00	35.80±12.60**	15.90 ±10.00**	131.10±35.20**
Gas station workers	16.10±3.80	10.70±6.30**	143.00±40.20**	17.60±13.50	12.70±9.90**	139.10±38.70**
Control group	17.33±4.59	24.50±6.15	205.50± 9.94	17.33±4.40	26.41±4.40	215.50±12.10

P values when compared with control: *<0.05, **<0.001

Conclusion

The study conclude that direct and indirect exposure to pollutants resulting from petroleum products causes a clear effect on the level of pituitary gland hormones, as well as an effect on liver enzymes. These findings are important and can be used to improve the work environment for the people work in the oil industry.

Conflict of Interest: The authors declare no conflict of interest.

Funding: This study was self-funding.

Ethical clearance: This study was approved by the committee of Ethical research in University of Basra, Department of chemistry. And later on, a paper was sent to the oil refinery and Al-jazaer gas station to get blood samples from workers and use it for this research.

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