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CARDIAC RISK FACTOR IN RELATION TO LEAD LEVEL AMONG SUDANESE WORKERS IN GASOLINE STATIONS

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ABSTRACT

Background: Occupational lead exposure is one of the major public health problems, no previous publishd research was conducted on lead exposure gasoline station workers in khratoum state. **Objectives:** The present study aimed to assess the blood lead level in relation to cardiac risk factors among Sudanese Workers in gasoline Stations in Khartoum state. **Materials and Methods:** This is a comparative case control study that was carried in Khartoum state, 50 controlled gasoline station worker (case group) exposed to lead though filling of cars with gasoline in addition to 50 healthy volunteer age and sex matched as control group. The lipid panel were measured by Mindary (BS-200 chemistry analyzer), and lood lead levels (pb) were measured by atomic absorption spectrophotometer, data obtained analyzed via statistical pakage of social version 22. **Result:** the level of lead element was significantly higher in gasoline station workers (1.03±0.316 mg/L) when compared to non exposed subjects (0.001±0.0030 mg/L) (p= 0.000). Furthermore the study observed that triglyceride, total cholesterol, and LDL were significantly increased(154.16±17.7 mg/dl versus 92.54±26.54 mg/dl, p = 0.000), (208.98±12.84 mg/dl versus 125.72±22.04 mg/dl p= 0.000), (152.84± 21.756 mg/dl versus 70.30±12.963 mg/dl p= 0.000) respectively. whereas HDL level is significantly decreased in exposed subjects when compared with nonexposed control group. Plasma lead level is significantly positively correlated with DBP and duration of exposure(R= 0.440, p= 0.001. R=0.350, p = 0.03) respectively. Farthermore plasma lead level showed insignificant correlation with lipid panel and the study subjects age $p \geq 0.05$. Also the study recorded that triglyceride and cholesterol were insignificantly correlated with exposed subjects age $p \geq 0.05$. In contrast exposed subjects age is significantly positively

correlated with LDL R= 0.36, p= 0.01, and significantly inversely correlated with HDL (R-0.44, p =.002). **Conclusion:** our data suggests that occupationally lead exposed is associated with increased risk of cardiovascular diseases.

KEYWORDS: lipid panel, lead element, cardiovascular disease, gasoline workers.

INTRODUCTION

Lead (pb) is one of the oldest chemical toxin and harmful environmental pollutant. Although lead is the most useful industrial element but servers no useful function in human body.[1] In fact it is not degradable in nature and will thus once released to the environment stay in circulation. The majority of it is noxious risk comes from breathing exhaust fumes evaporative and refueling emission rather than from skin contact from spills.[1,2] Lead poisoning is presently becoming the most common disease of environmental origin and is increasing very rapidly in developing countries.[1,3] Environmental toxicants, including lead and other metals, are potentially preventable exposures that may explain population variation in cardiovascular disease rates.[3] The cardiovascular effects of lead, however, are not limited to increased blood pressure and hypertension, but also been associated with an increased incidence of coronary heart disease, stroke, and peripheral arterial disease.[4,5]

Lipid panel are abroad group of naturally-occurring molecules which includes fats, waxes, fat soluble vitamins “such as vitamins A, D, E and K, monoglycerides, triglyceride, phospholipids and others.[5,6] The clinical significance of lipid is primarily associated with their contribution to coronary heart disease (CHD) and various lipoprotein disorders. Increase cholesterol is the factor in the cause of atherosclerotic diseases, that numerous studies have established that when the total cholesterol and LDL cholesterol concentration are high. The incidence and prevalence of CHD are also high. In contrast to LDL cholesterol, increased HDL cholesterol concentration have been shown to protective for CHD.[7.8] The main cause of atherosclerosis is yet unknown, but is hypothesized to be initiated by inflammatory processes in the vessel wall in response to retained low-density lipoprotein (LDL) molecules. The artery becomes inflamed from depoition of cholesterol that form plaque. The cholesterol plaque causes the muscle cells to enlarge and form a hard cover over the affected area. This hard cover is what causes a narrowing of the artery, reduces the blood flow and increases blood pressure.[7,8]

Numerous study in both humans and animals deduce that chronic lead exposure altered lipid metabolism.[9,10,11,12,13,14] The pathophysiological mechanisms of lead caused this changes are obscure. Lead enhance lipid oxidation in the presence of hemoglobin or Fe2+.[15,16] Lead accelerate Fe2+-initiated lipid oxidation in liposomes, erythrocytes, microsomal fractions and rat brain homogenates.[9,15,16] chronic lead exposure causes alteration in fatty acid composition of erythrocyte membranes.[13,17,18]

Because serum lipids is risk factors for cardiovascular diseases and the lead element is considered as toxic element, its worthful to investigate the relationship between blood lead and cardiac risk markers among Sudanese workers in petrol stations.

MATERIALS AND METHODS

Study Population: Comparative case- control study was conducted in Khartoum state, during the period from March-2018 to October 2018.Particpaters whom working at petrol stations were enrolled in this study. 50 case petrol station workers aged from 20 to 30 years were included in this study. The control group (n=50) age and sex matched and not exposed to lead element.

Inclusion criteria: Petrol stations workers who work in the petrol station of more than 8 hours per day were included in the study.

Exclusion criteria: Subjects with previous history of diabetes mellitus, hypertensive patients, Smoker cessation, Patients with chronic diseases, Petrol stations workers that refused to participate in the study, were excluded from the study.

Ethical consideration: Informed consent was taken from all participants and ethical approval was obtained from El-Neelain University Research Committee.

Sampling: Venous blood samples were drawn between 8.00 am and 10.00 am from the study subjects after an overnight fast. using sterile disposable plastic syringe and plastic stander non traumatic vein puncture technique. Then sample were emptied in Heparin container, then centrifuged for 3600 rpm for 5 mins and separated (hemolysed and lipemic sample were excluded) into Eppindourf tube, stored at 2-8 c until analyzed.

Estimation of Lipid panel: Plasma level of lipid panel were measured by Mindary (BS-200 chemistry analyzer).

Estimation of Lead: lead levels (pb) were measured by atomic absorption spectrophotometer which is automated Lead analyzer. According to the manufacturer's protocol.

Quality Control: Preci Control Universal was used in addition to other three control levels (low, normal, and high) of control sera of lead and lipid panel values were used to verify the performance of measurement procedure, and results of +/- 2SD of target values of the control sera were accepted.

Data analysis: The demographic characteristics of the study and control groups were compared using SPSS program version 22, the results expressed as mean, SD and. way independent T. test was performed to compare the mean concentration of study parameters. Pearson correlation was used to study the relations between the study parameters and is significant at $P \leq 0.05$.

RESULTS

The study comprised 100 male participants divided into two groups. 50 subjects working in gasoline station as test group, with age range 19- 42 years, duration of work in petrol station range 4 - 12.5 years, and with BMI range 16.1-25.9 in table 1 .In addition to other 50 volunteers healthy subjects as control group age and sex matched.

As presented in table 2 the level of lead element was significantly higher in gasoline station workers (1.03±0.316 mg/L) when compared to non exposed subjects (0.001±0.0030 mg/L) (p= 0.000.

As illustrated in table 2. The levels of triglyceride, total cholesterol, and LDL were significantly increased (154.16±17.7 mg/dl versus 92.54±26.54 mg/dl, p = 0.000. 208.98±12.84 mg/dl versus 125.72±22.04 mg/dl p= 0.000. 152.84±21.756 mg/dl versus 70.30±12.963 mg/dl p= 0.000) respectively. where as HDL level is significantly decreased in exposed subjects when compared with nonexposed control group.

Plasms lead level is significantly positively correlated with DBP and duration of exposure (R= 0.440, p= 0.001. R=0.350, p = 0.03) respectively. Furthermore plasma lead level showed insignificant correlation with lipid panel and study subjects age $p \geq 0.05$ in table 3 and figure 1 respectively.

Triglyceride and cholesterol were insignificantly correlated with exposed subjects age p ≥ 0.05 figure 2 and 3. In contrast exposed subjects age is significantly positively correlated with LDL (R= 0.36, p= 0.01), and significantly inversely correlated with HDL (R-0.44, p =.002) figure 4 and 5.

Table (1): Demographic data of the case group.

Variables	Minimum	Maximum	Mean	SD
Age (Years)	19.0	42.00	34.52	5.37
Duration (Years)	4.00	12.50	6.83	2.47
BMI	16.1	25.90	21.73	2.34

Table (2): Mean comparison of the study parameters in exposed and non-exposed.

Parameters	Case (Mean±SD)	Control (Mean±SD)	P-value
Triglyceride (mg/dI)	208.98±12.84	125.72±22.04	0.000
HDL (mg/dI)	15.87±6.652	36.62±9.037	0.000
LDL (mg/dI)	152.84±21.756	70.30±12.963	0.000
Total Cholesterol (mg/dI)	154.16±17.709	92.54±26.540	0.000
lead (mg/L)	1.03±0.316	0.001±0.003	0.000
SBP	140.76±8.130	114.90±9.923	0.000
DBP	86.22±4.917	75.30±5.571	0.000

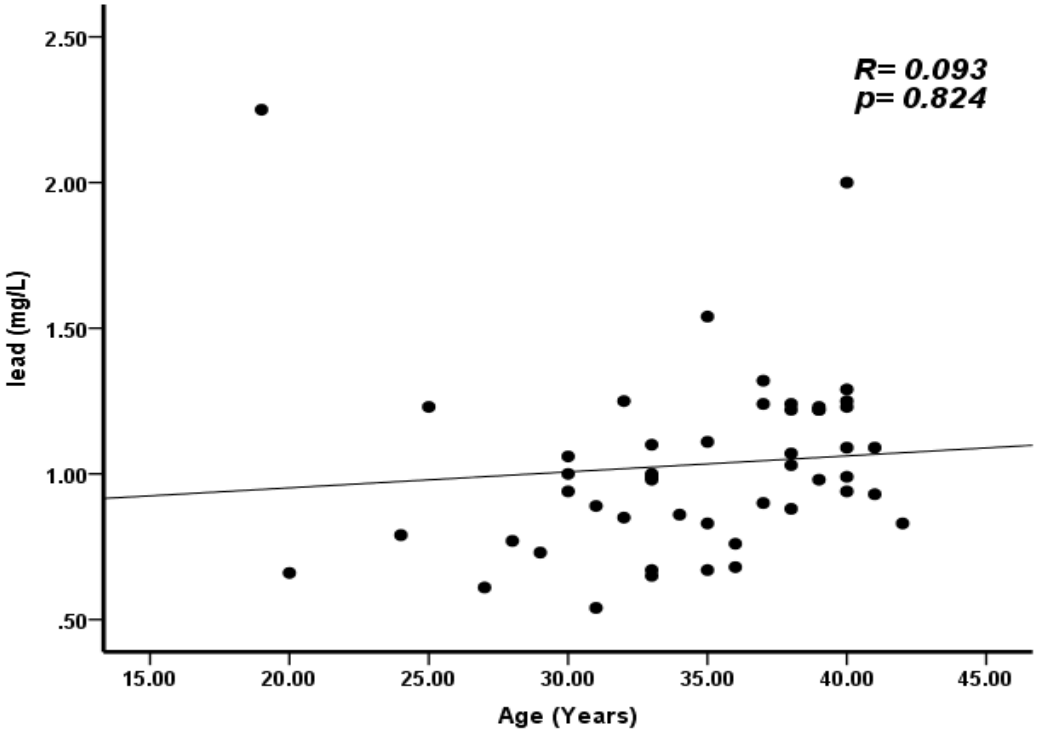
Table (3): Correlation of lead, blood pressure and duration with lipid panel and lead in the study group.

Parameters	Statistic	Triglyceride (mg/dI)	HDL (mg/dI)	LDL (mg/dI)	TG (mg/dI)	Lead Mg/L
lead (mg/L)	R-value	0.096	-0.096	-0.043	0.113	-
	P-value	0.509	0.507	0.765	0.437	-
SBP	R-value	0.056	-0.135	0.156	-0.149	0.089
	P-value	0.698	0.349	0.279	0.302	0.539
DBP	R-value	-0.060	0.194	-0.238	-0.303*	0.440**
	P-value	0.680	0.177	0.096	0.033	0.001
BMI	R-value	.570**	-.083-	0.018	0.172	0.14
	P-value	.000	.565	0.900	0.232	0.32
Duration (Years)	R-value	.618**	-0.038	0.281*	0.423**	0.350**
	P-value	.000	0.793	0.048	0.002	0.03

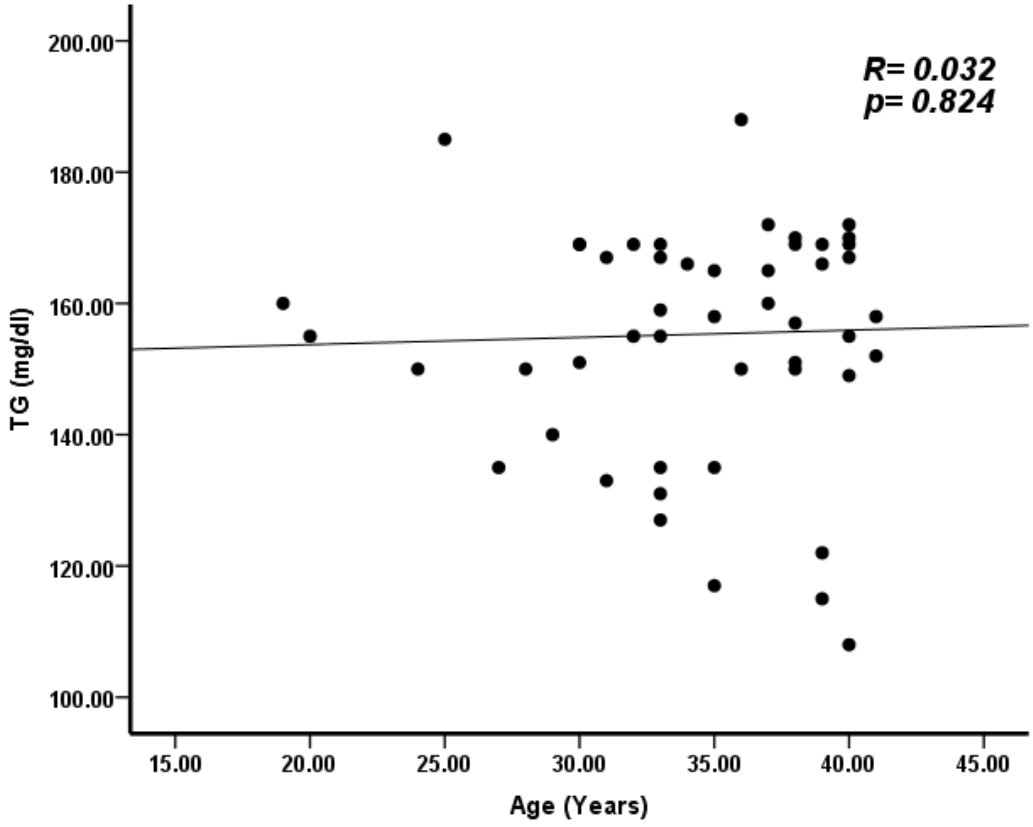
***The significant difference is at p ≤ 0.05**

****The significant difference is at p ≤ 0.01**

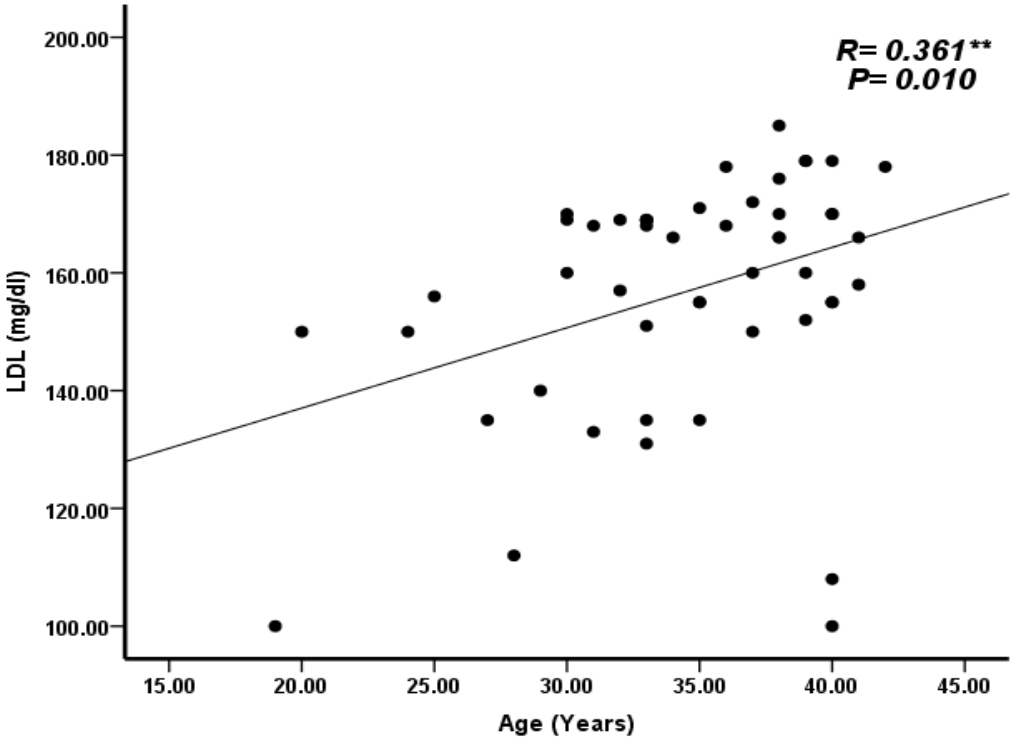
*****The significant difference is at p ≤ 0.001**



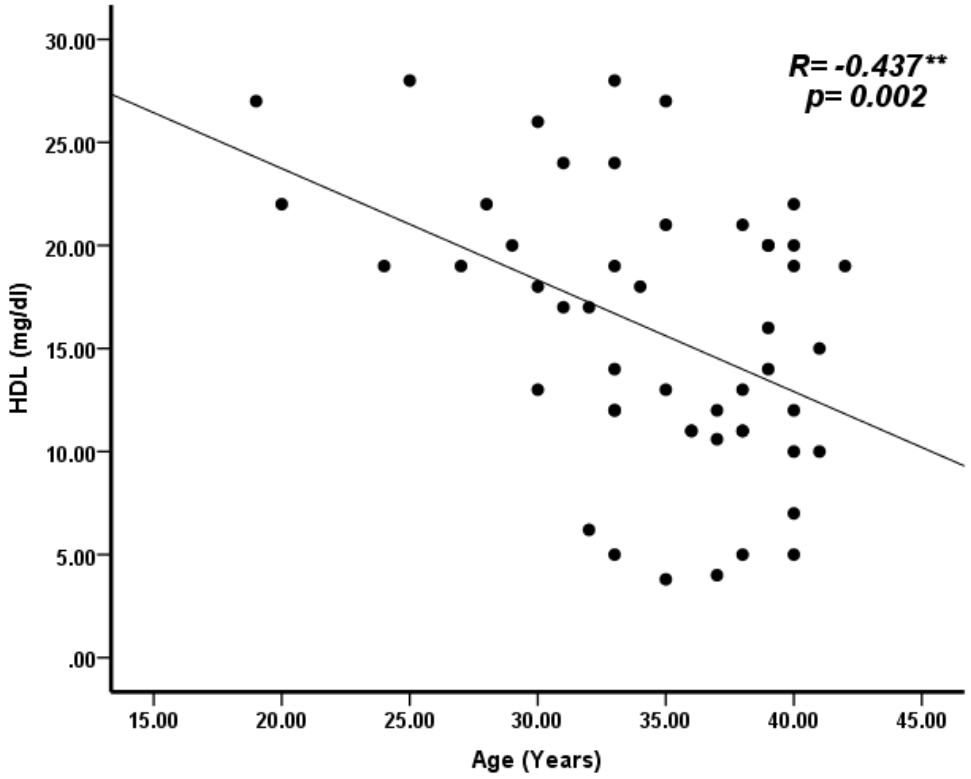
Scatter plot (1): Shows correlation of lead level with exposed subjects age2.



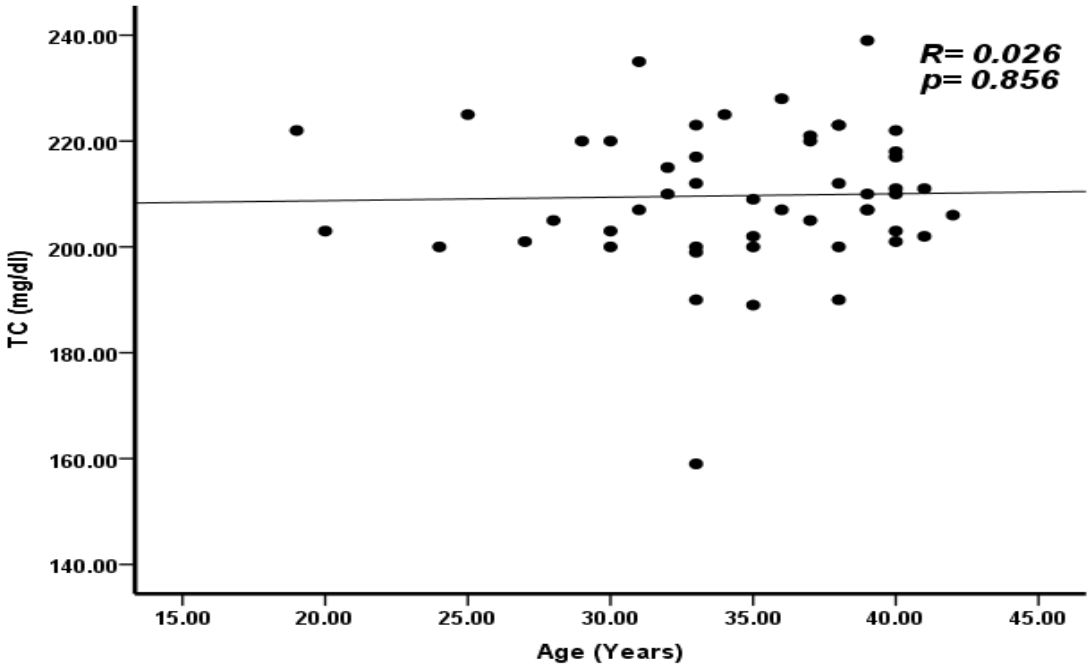
Scoter plot (2): Shows correlation between age and triglyceride level in the test group.



Scoter plot (3): Shows correlation between age and LDL level in the test group.



Scoter plot (4): Shows correlation between age and HDL level in the test group.



Scatter plot (5): Shows correlation of age with total cholesterol level in the study group.

DISCUSSION

In the past decade, numerous researchs has confirmed that elevated lipid and lipoprotein have critical role in the pathogenesis and progression of atherosclerosis and cardiovascular diseases.[19,20,21] These chronic degenerative disorders have become a growing health problem worldwide. Dyslipidemia is leading causes of death worldwide. Furthermore large evidence suggested that environmental factors including occupational exposure to gasoline is contribute to this dyslipidemia.[22,23]

In the current study plasma lead level was significantly higher in gasoline station workers when compared to non exposed subjects. This finding is consistent with study by Laith et al (2010).[24] who revealed a prevalence of elevated blood lead levels among many fuel stations workers in Basrah, and it is higher than the limit permitted by the World Health Organization. John et al (2014),[25] reported that occupation significantly predicts cumulative lead exposure in a community-dwelling population, and accounts for a large proportion of the association between education and bone lead.

In the present study the levels of triglyceride, total cholesterol, and LDL were significantly increased, where as HDL level is significantly decreased in exposed subjects when compared with nonexposed control group,in accordance to Shyam et al (2012).[26] whom suggests that the lead exposed persons having altered lipid profile, increased total cholesterol and

decreased HDL cholesterol. Rajiv et al (2018).[27] performed systematic review and meta-analysis and concluded that exposure to arsenic, lead, cadmium, and copper is associated with an increased risk of cardiovascular disease and coronary heart disease.

In our study plasma lead level is significantly positively correlated with DBP and duration of exposure. In accordance to liath et al (2010).[24] who deduced that in fuel station workers, the duration of exposure to leaded fuel was significantly correlated with the blood lead level. Furthermore plasma lead level showed insignificant correlation with lipid panel and study subjects' age, which disagree with Oladipo et al (2005),[28] who reported a significant positive correlation between blood lead and total cholesterol on one hand and blood lead and LDL cholesterol on the other hand among exposure subjects.

In this present study triglyceride and cholesterol were insignificantly correlated with exposed subjects age. In contrast exposed subjects age is significantly positively correlated with LDL, and significantly inversely correlated with HDL. LDL and HDL are lipoproteins participate in lipid metabolism and exchange of cholesterol, cholesterol ester and triglycerides between tissues[29,30,31] an inverse relation exist between HDL levels and risk of cardiovascular disease, HDL have anti-oxidant and anti-inflammatory effects that protect against atherosclerosis in addition to accelerate reverse cholesterol transport to the liver and steroidognic organs.[32,33] Furthermore elevated concentrations of total or LDL cholesterol are powerful risk factors for coronary disease.[34]

CONCLUSION

Results of this study demonstrated that exposure to lead is associated with increased risk of cardiovascular diseases and coronary heart diseases.

Consent

As per international standard or university standard, workers written consent has been collected and preserved by the authors.

Ethical Approval

AS per international standard or university standard, written approved of ethical committee has been collected and preserved by the authors.

Competing Interests

Authors have declared that no competing interests exist.

Authors' contribution

This work was carried out in collaboration between all authors. Author HKAH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript.

Authors HKAH and AMA managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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