

**How to Cite:**

Jwaad, B. U.- deen, & AL-Sallami, A. S. M. (2022). Effect of L-selectin and some blood physiological criteria in workers of LPG stations. *International Journal of Health Sciences*, 6(S4), 3243–3252. <https://doi.org/10.53730/ijhs.v6nS4.9014>

## **Effect of L-selectin and some blood physiological criteria in workers of LPG stations**

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**Abstract**--This study was conducted on workers of liquefied petroleum gas stations in the city of Najaf, Iraq, from December 2021 to January 2022. The workers (n=50) exposed to liquefied petroleum gas (LPG) were compared with individuals who were not exposed (the control group, n=38). The result showed a significant ( $P < 0.05$ ) and clear increase in the level of L-Selectin of workers ( $0.4845 \pm 0.1259$  ng/ml) compared to the control group ( $0.9816 \pm 0.01771$  ng/ml). The current study, after conducting a statistical analysis of physiological blood tests, showed a significant ( $P < 0.05$ ) and clear decrease in the number of red blood cells (RBC), blood platelets (PLT), hemoglobin (HGB), and the percentage of hematocrit (MCT), as it reached  $4.930 \pm 0.07 \times 10^6$  cell/ml,  $198.2 \pm 7.8 \times 10^3$  cell/ml,  $15.05 \pm 0.17$  g/dl, and  $46.04 \pm 0.41\%$  respectively compared to the control group ( $5.213 \pm 0.06 \times 10^6$  cell/ml,  $222.8 \pm 9.1 \times 10^3$  cell/ml,  $15.72 \pm 0.13$  g/dl, and  $49.14 \pm 1.64\%$  respectively). The study also showed a significant increase ( $P < 0.05$ ) in the number of white blood cells (WBC) and the percentage of lymphocytes (LYC %) among workers who inhaled gas at gas filling stations, which reached  $7.346 \pm 0.21 \times 10^3$  cell/ml and  $36.35 \pm 1.09\%$ , respectively, compared to the control group ( $6.652 \pm 0.15 \times 10^3$  cell/ml and  $32.20 \pm 1.7\%$  respectively). The study concluded that the presence of inverse relationships between lung capacity and L-selectin, as well as between the latter and the studied physiological blood parameters, may be indicative of one of them to the height of the other or vice versa, which delays the occurrence of lung diseases and their complications for these workers.

**Keywords**--effect L-selectin, blood, physiological criteria.

## Introduction

One third of the deaths that occur as a result of exposure to air pollutants are considered to be solid or gaseous pollutants that cause death or health effects and serious lung diseases for people exposed to these pollutants. Acute and chronic effects occur on all organ systems, or the deposition of these pollutants on tissues, and these effects are short or long-term on the human body. The majority of these evidences refer to respiratory, cardiovascular, and inflammatory diseases and their diseases were due to the exposure of these patients to polluted air that affected them psychologically, healthily, and physiologically (E, 2021). It results from the following major pathophysiological changes in the lungs Chronic infection, caused by inhaling smoke or other substances that irritate the bronchi and bronchioles. The chronic infection seriously deranges the normal protective mechanisms of the airways, including partial paralysis of the cilia of the respiratory epithelium (Hall & Hall, 2020). The Factors Affecting Rate of Gas Diffusion Through the Respiratory Membrane, one can apply the same principles to diffusion of gases through the respiratory membrane. Thus, the factors that determine how rapidly a gas will pass through the membrane are the following:

- (1) the thickness of the membrane.
- (2) the surface area of the membrane.
- (3) the diffusion coefficient of the gas in the substance of the membrane.
- (4) the partial pressure difference of the gas between the two sides of the membrane (Nicod, 2005).

LPG plant workers are exposed to a number of these hydrocarbons in fuel vapors during dispensing and gases emanating from vehicle exhausts. In the LPG work stations (Jo et al., 2013). It is obvious that LPG attendants in filling stations, drivers of gasoline trucks, service station attendants and refinery workers are more susceptible to the harms of LPG due to chronic work-related exposure (B.N. et al., 2020). Biogas is a mixture of gases mainly hydrocarbon and carbon dioxide used in domestic cooking (Austin, 1984). The normal ingredients for (LPG) a mixture of propane ( $C_3H_8$ ) and butane ( $C_4H_{10}$ ) gas. The LPG is stored as a liquefied gas under pressure at ambient temperature. The percentage composition of the mixture depends upon the season, as a higher percentage of propane is kept in winter and the same for butane in summer (Thompson, 2015). (Thompson, L. M. (2015). Liquefied petroleum gas (LPG) is produced as a by-product of the oil and gas refinery process or obtained during the natural gas production process. LPG is conceivably hazardous if mishandled, and therefore promotion of good safety practices in its retail is key. There's therefore need for simple practical advice on eliminating or reducing the risks associated with LPG cylinder retailing (Nyabuto, Mburu and Gichuhi, 2020). Assessment of hazards posed by LPG bottling plant operations to the environment and business continuity is critical for regulatory agencies, current LPG plant operators and intending operators (Olamigoke, 2019). Cytokines, their signals and their migration into the bloodstream, are indicative of many diseases (such as infertility, kidney failure, etc.) (Al-Msaid & Al-Sallam, 2018; Al-Masoodi, et al., 2019; Al-Sallami & Al-Shimerty, 2021). L-selectin: Is a Type-I transmembrane glycoprotein and cell adhesion molecule that is expressed on most circulating leukocytes. Since its identification in 1983, L-selectin has been extensively

characterized as a tethering/rolling receptor. There is now mounting evidence in the literature to suggest that L-selectin plays a role in regulating monocyte protrusion during trans endothelial migration (TEM). (Rainer, 2002). L-selectin has also been shown to mediate leukocyte recruitment during chronic inflammatory and autoimmune diseases and thus is a potential therapeutic target for drug development (Grailer et al., 2009). The selectin family of adhesion molecules mediates the initial attachment of leukocytes to venular endothelial cells before their firm adhesion and diapedesis at sites of tissue injury and inflammation. The selectin family consists of three closely related cell-surface molecules with differential expression by leukocytes (L-selectin), platelets (P-selectin), and vascular endothelium (E- and P-selectin) (Steeber et al., 2022). L-selectin expressed by granulocytes, lymphocytes, and monocytes is responsible for initial leukocyte attachment to inflamed endothelium and high endothelial venules of peripheral lymph nodes. After leukocyte activation in vitro, L-selectin is rapidly shed from the cell surface (Schleiffenbaum et al., 1992).

## Materials and Methods

Fifty samples collected from males workers at the LPG gas station their mean age ( $32.04 \pm 1.289$ ) years in Najaf Province, Iraq. And thirty eight samples collected volunteers of males as a control group their mean age ( $33.39 \pm 1.680$ ) year which had no exposed to gas LPG. Five ml of venous blood was collected from all participants and then we divided the sample into 1 ml into tubes containing EDTA for CBC (measured by automated hematological equipment using Abbot TDX analyzer -U.S.A), 3.5 ml into a gel tube and centrifuged to separate the serum and stored in deep freezer until analyze biomarker (IL-8, its measured by ELISA technology). Lung capacity was estimated by Spirometry and statistical analysis was performed using GraphPad Prism V.5 programs for Data are expressed as mean  $\pm$  SE (standard error). Using unpaired T- tests to compare between groups (Workers & control) and Mega- state with Excel programs for correlation among all the studied significant standards for workers only.

## Results and Discussion

### Hematological parameters

The results revealed significant difference ( $P$ -value $<0.05$ ) decreased with the mean  $\pm$  SD of RBCs, HGB, PLT as well as MCT [ (RBC), ( $4.930 \pm 0.07 \times 10^6$  cell/ml)], [(HGB) ( $15.05 \pm 0.17$  g/dl)] [(PLT) ( $198.2 \pm 7.8 \times 10^3$  cell/ml)] [(MCT) ( $46.04 \pm 0.41\%$ )], of the workers in gas filling stations as compared with control groups [(RBC) ( $5.213 \pm 0.06 \times 10^6$  cell/ml)], [(PLT) ( $222.8 \pm 9.1 \times 10^3$  cell/ml)], [(HGB) ( $15.72 \pm 0.13$  g/dl)], and [ (MCT) ( $49.14 \pm 1.64\%$ )]. These were in no agreement with prior research conducted by Sirdah *et al.* (2013) They found that changes in hematological parameters tests and a significant decrease in HB, RBCs, MCT, in all workers compared with control group. Also The present study showed a significant effect of LPG exposure on the hematological laboratory tests of the LPG workers as compared with controls and these results non agree with studies of subjects exposed to natural gas (Saadat et al., 2004) . It should be noted that there are very limited published data about the effects of long-term environmental exposure to LPG on hematological and bio- chemical parameters. A

few studies have addressed this issue in terms of different petroleum products (Ukajeifo et al., 2006).

### **Estimation of Lung Capacity and functions**

Lung capacity was estimated and measured by performing an exhaled examination of the lung using a lung capacity test device (spirometer), for workers and control group. With the availability of a portable spirometer was performed in the workplace and with appropriate training detection of the presence or absence of lung disease, measurement of lung impairment, monitoring of the effects of occupational exposure / exposure workers to LPG at the gas station. Spirometry for workers and control group was carried out as follows. N Forced expiratory volume in one second (FEV1). N Forced vital capacity (FVC), the maximum amount of air that can be exhaled when inflated as fast as possible N Vital capacity (VC) .The results in table (1) shows significant difference at (p-value<0.05) to the workers the LPG gas station [(485.9 ± 19.90)l/min]and for control group [(382.8 ± 14.48) l/min ] Scientific studies in different settings showed similar results as our study, especially concerning health complaints related to respiratory system efficiency (Sirdah, *et al.*, 2013).These health-related complaints of LPG workers are likely to be due to the pharmacological effect of LPG. Inhalation of gaseous propane (the major component of LPG) is known to cause dizziness, nausea, vomiting, confusion, hallucinations and a feeling of euphoria (Wu et al., 2003). Our results also agree with to the results obtained from other settings for LPG Two autopsy cases of men who died while connecting a liquefied petroleum gas (LPG). Their blood concentrations of propane (the main content of LPG) were higher. The cause of death after exposure of LPG has generally been considered to be asphyxia from hypoxia. The large differences in the blood propane levels found here and reported in the literature, however, suggest that direct toxic effects of propane poisoning may be the cause of death in some cases (Fukunagaa and Yamamoto, 1996).(Sugie et al., 2004)

### **Biomarker L-Selectin**

The results in table (1) shows significant ( p-value<0.05) increase with mean± SE of L-Selectin to the workers [(0.4854 ± 0.1259 )(pg/ml)] as compared with control group[ (0.09816 ± 0.01771)(ng/ml)].The results of the current study showed negative significant relationships between L-selectin and lung capacity, WBC, LYM%, Hb and PLT (figures 1 to 5). study revealed negative correlation between immune biomarker L-selectin and Lung capacity.from others studies have shown L-selectin is the only selectin expressed on leukocytes, and mediates a number of leukocyte-endothelial interactions, including the binding of lymphocytes to HEV of peripheral lymph node high endothelial venues (HEV), neutrophil rolling, and leukocyte attachment to cytokine-treated endothelium in vitro (Kansas, 1992). from others studies have shown L-selectin is constitutively expressed on the surface of most leucocytes and is important for tethering and subsequent rolling of leucocytes on endothelial cells, facilitating their migration into secondary lymphoid organs (e.g. naive T cells) and sites of inflammation (e.g. neutrophils)(Ivetic & Ridley, 2004).

Also from others studies have shown in pulmonary diseases L-selectin contributes to both the early adhesive events as well as the later stages of chemotaxis and cell migration. L-selectin ligand expression at sites of inflammation results in L-selectin playing an important role in the development of autoimmune and chronic inflammatory diseases (Venturi et al., 2003; Grailer et al., 2009). Also from others studies have shown L-selectin mediates the initial capture and subsequent rolling of leukocytes along inflamed vascular endothelium and mediates lymphocyte migration to peripheral lymphoid tissues. Leukocyte activation induces rapid endoproteolytic cleavage of L-selectin from the cell surface, generating soluble L-selectin (sL-selectin). L-selectin is constitutively expressed on the surface of all classes of leukocytes. Subsequent selectin-mediated rolling is stabilized through leukocyte integrin's interacting with their endothelial ligands. During rolling, arrest, and firm adhesion, progressive leukocyte activation occurs as a result of integrated selectin-, integrin and chemoattractant/chemokine-mediated signals (Tu et al., 2022). The study concluded that the presence of inverse relationships between lung capacity and L-selectin, as well as between the latter and the studied physiological blood parameters, may be indicative of one of them to the height of the other or vice versa, which delays the occurrence of lung diseases and their complications for these workers (Suryasa et al., 2021).

Table 1: L-Selectin biomarker and hematological parameters in workers compared with the control

Parameters	Workers M SE n=50	Control M SE n=38	P -value
L-Selectin (ng/ml)	0.4845 ±0.1259 *	0.09816 ±0.01771	0.0094
Lung capacity (L/min)	382.8 ±14.48 *	485.9 ±19.90	< 0.0001
WBC (10 <sup>3</sup> cell/ml)	7.346 ±0.2128 *	6.652 ± 0.1522	0.0145
Neutrophile%	61.54 ± 1.326	59.63 ± 2.299	0.4496
Mid %(mono+Baso+Esino)	3.804 ± 0.2349	4.939 ± 1.377	0.3579
Lymphocytes %	36.35 ± 1.087 *	32.20 ± 1.720	0.0364
RBC ( x10 <sup>6</sup> cell/ml)	4.930 ± 0.07 *	5.213 ± 0.06	0.0152
MCH (pg)	30.95 ± 0.2508	30.82 ± 0.2612	0.7302
MCV (fl)	92.17 ±1.379	91.23 ±1.806	0.6743
HGB g/dl	15.05 ± 0.17 *	15.72 ± 0.13	0.0043
HCT (%)	46.04 ± 0.41 *	49.14 ± 1.64	0.0424
PLT (x10 <sup>3</sup> cell/ml)	198.2 ± 7.8 *	222.8 ± 9.1	0.0427

\* significant difference at P<0.05.

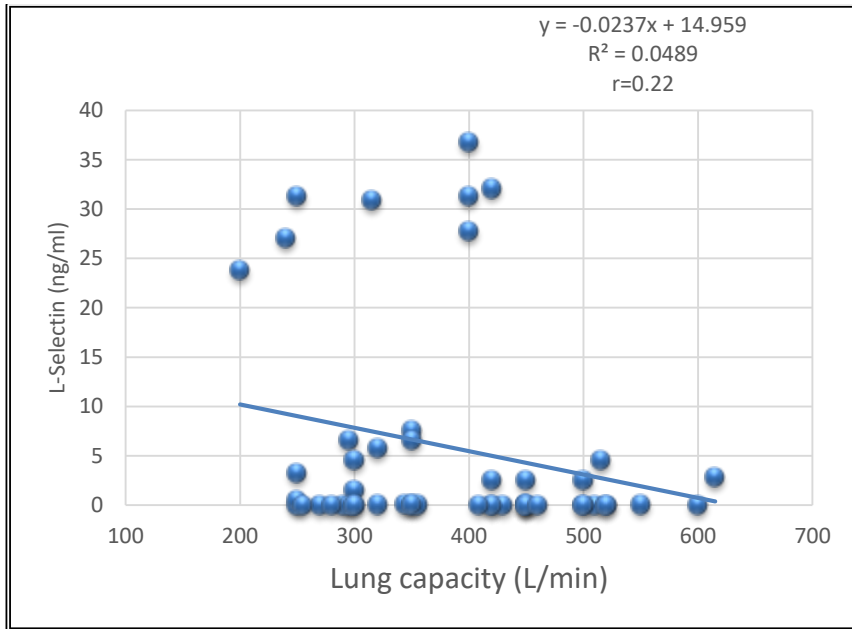


Figure 1: The relationship between lung capacity and L-Selectin level among workers who inhale gas at gas filling stations.

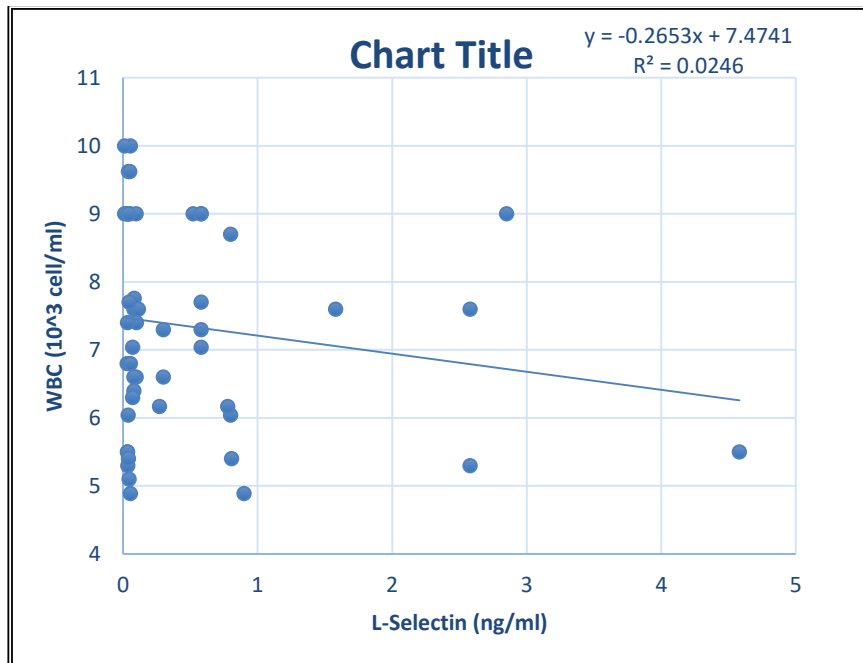


Figure 2: The relationship between WBC and L-Selectin level among workers who inhale gas at gas filling stations.

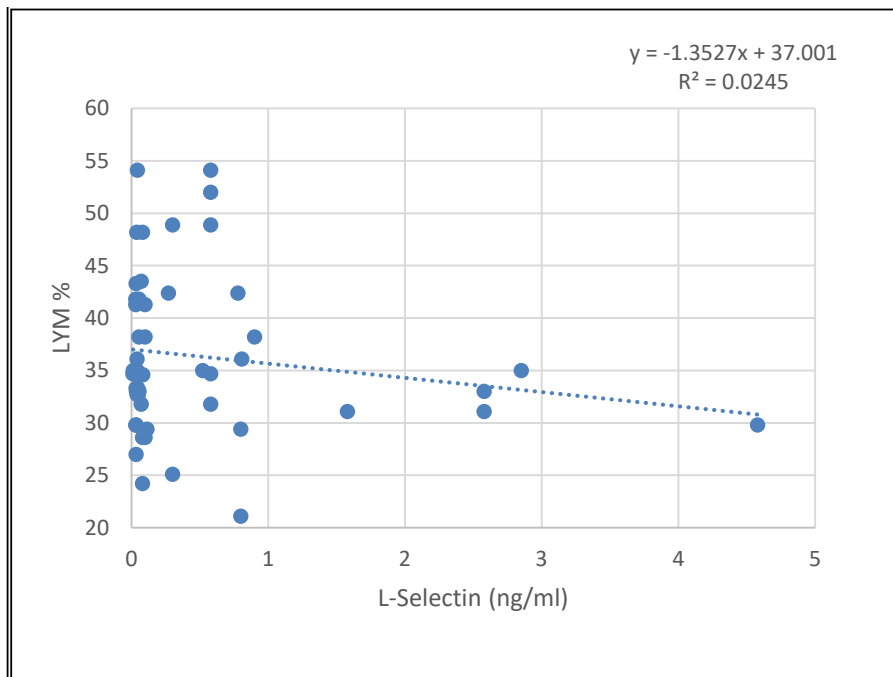


Figure 3: The relationship between LYM % and L-Selectin level among workers who inhale gas at gas filling stations.

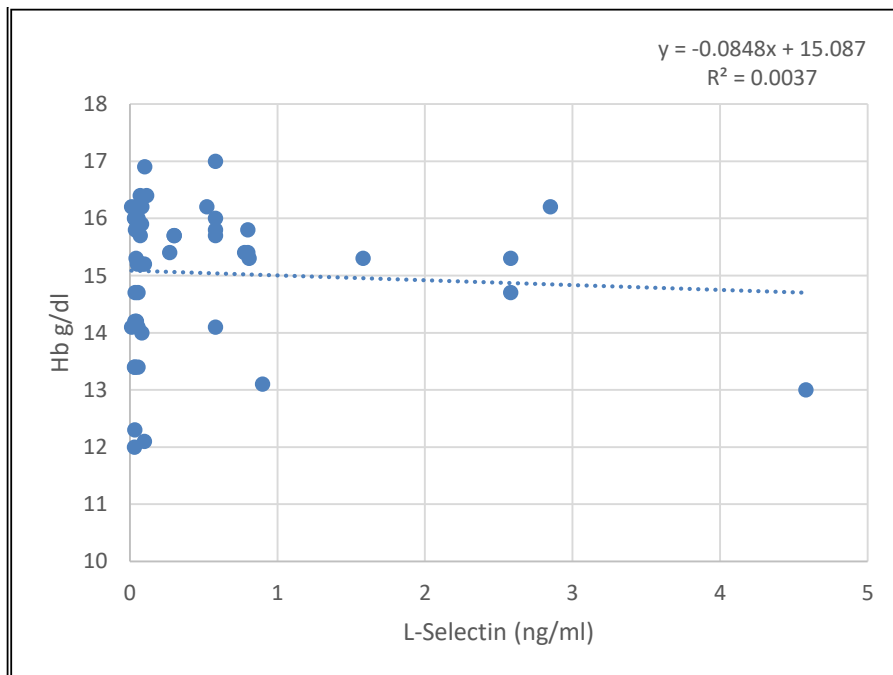


Figure 4: The relationship between HB and L-Selectin level among workers who inhale gas at gas filling stations.

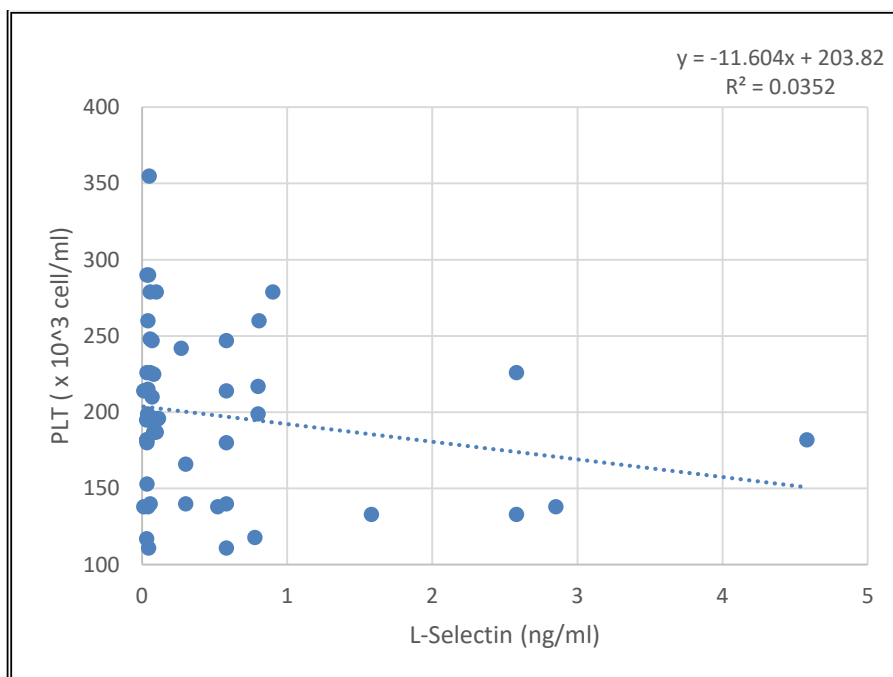


Figure 5: The relationship between PLT and L-Selectin level among workers who inhale gas at gas filling stations.

## Conclusion

The presence of inverse relationships between lung capacity and L-selectin, as well as between the latter and the studied physiological blood parameters, may be indicative of one of them to the height of the other or vice versa, which delays the occurrence of lung diseases and their complications for these workers.

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