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The effect of work environment on the efficiency of lungs function in people infected with Corona virus among elderly workers in the factories of the southern region in Jordan

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Abstract: A typical instrument for determining blood gases and acid-base balance is a blood gas analysis. In order to monitor lung function and gas exchange with body cells, it detects the amounts of oxygen and carbon dioxide ina arterial blood. In this study, which looked at variables impacting the severity of COVID-19, 150 older men who worked in chemical plants in southern Jordan participated. The length of the shift, chemical exposure, smoking, and long-term conditions like diabetes affect symptom severity. Elderly COVID-19 patients frequently have lower amounts of oxygen and greater levels of carbon dioxide, which strains the lungs and increases the generation of red blood cells. In situations of hypoxia, underlying diseases may have an impact on hemoglobin levels. this study aims to provide valuable insights into the factors contributing to the severity of COVID-19 in elderly individuals, particularly those exposed to chemical environments, and the physiological responses involved in these cases.
Keyword: ABG, corona virus, oxygen, hemoglobin, carbon dioxide, lung.

1. Introduction:

Arterial blood gases (ABGs) is a collective term applied to three separate measurements—pH, Pco2, and Po2— generally made together to evaluate acid– base status, ventilation, and arterial oxygenation. Oxygen (O2) and carbon dioxide (CO2) are the most important respiratory gases, and their partial pressures in arterial blood reflect the overall adequacy of gas exchange (Trulock, 1990) . Blood gases is one of the most important common.examination that is used in both the emergency ward and the critical care in hospitals with regard to patients respiratory diseases, especially corona patients. The process of exchange of oxygen and carbon dioxide that occurs in the lungs and the balance of arterial blood gases Plays an important role in the processes of respiration and metabolism (Adisa & Alibiing, 2013). carbon dioxide and oxygen are transferred from and to the body cells and tissues by hemogloubin (Swardson,2022).

When a defect occurs in the function of the respiratory system, whether in the process of absorbing oxygen or removing carbon dioxide. An imbalance in the PH of the blood occurs and the body's organs. are affected (Kieninger et al.,2021) , the most important of which is the heart and brain. One of the most important causes that may lead to these disorders is infection with the Corona virus, mainly targets the lungs, and therefore the possibility of symptoms and problems with its main functions in the breathing process increases, by destroyingthe tissues of the lungs and alveoli.There are many factors that affect the risk of infection with the emerging corona virus and the severity of symptoms that he may suffer, such as the nature of the environment in which he may live or work.When the inhaled air is full of gases such as carbon monoxide and burning chemicals and the vapors resulting from them, it is considered unhealthy air for the normal breathing process, and thus may lead to a series of obstacles that affect the functions of the respiratory tissues, including the cilia of the lung and slow their movement whose function is to remove waste. And affected blood vessels, which in turn affect the process of oxygen transport. Thus, a lung defect may make it in a state of imbalance and thus increase the risk of infection with viruses.the standard way. Therefore, any small error in the process of drawing and collecting the blood sample, such as the occurrence of clots or air bubbles, greatly

affects the values of each of the blood gases.

Arterial blood samples were analyzed using the Gem Premier 3000 This fully automatic blood gas analyzer for laboratory use to measured analytes pH, O2, CO2 and hematocrit (Burnet et al.,2004). Without any delay and directly, an appropriate amount of heparin should be used, which is the appropriate anticoagulant for arterial blood to prevent blood clotting, as it has a pH close to the value of the air around us. Very little heparin is actually needed in the sample to prevent clotting; 0.05 to 0.10 ml of a dilute solution (1000 units/ml) will anticoagulate 1 ml of blood without affecting its pH PCO2, or PO2 (1) .

The oxygen and carbon dioxide levels in arterial blood are the main subject of this study's, evaluation of blood gas analysis for blood gases and acid-base balance (Böning et al.,2021) . It examines its importance in keeping track of gas exchange and lung function. Additionally, it looks at characteristics including the length of the job, exposure to chemicals, smoking, and chronic illnesses like diabetes that may have an influence on the severity of COVID-19 in 150 senior guys who worked in chemical industries in southern Jordan. The study examines typical physiological responses in older COVID-19 patients, highlighting altered oxygen and carbon dioxide levels, their relationship to pulmonary stress, and elevated red blood cell formation. It also investigates the impact of underlying diseases on hemoglobin levels in COVID-19 hypoxia patients Care, D. (2021)

2. Methods and Materials

Several sample results were collected, approximately 150 subjects of different age groups for males over the age of 45 (**patients** working in Lafarge Cement Factory, Phosphate Mines, Jordan Potash Company, and Al-Obeid Company for Jordanian Fertilizers and Chemicals) And comparing it with results of 60 subjects of corona patients working in healthy environments. The results are taken from various hospitals in regions of southern Jordan, in addition to conducting personal interviews during the period 1/2/2021 until 1/2/2022.

The accurate results of the arterial blood gases test depend on the method and accuracy of sample collection and analysis and how to deal with it in the standard way. Therefore, any small error in the process of drawing and collecting the blood sample, such as the occurrence of clots or air bubbles, greatly affects the values of each of the blood gases.

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3. Results:

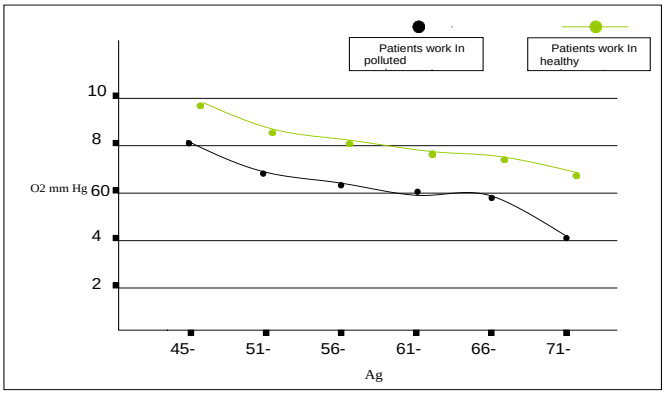
The collected results indicated that there is a discrepancy between patients according to severity of infection with the Corona virus, so that some patients managed to fight the virus and others died. A number of factors were found to influence the severity of symptoms, such as blood pressure, diabetes, smoking, and the work period length in polluted environment (Table 1). These factors have been studied and their relationship with each other and how their values are affected and deviated from their normal values and trying to correct this imbalance.

Table 1: shows the number of results collected for patients with corona virus who work in chemical factories and factors affecting the severity of symptoms.

NA: Not available.

Factors	Number of alive patients (137 patients)	Percentage of live patients	Number of deceased patients (13 patients)	Percentage of deceased patients
Smoking	127 smokers	92.7%	11 smokers	84.6%
Chronic diseases	125 abnormal	91.2%	13 Abnormal	100%
Symptoms period length	41 (more than 14 days)	29.9%	4 (more than 14 days)	30.7 %
Work period length	88 Retired (more than 30 years)	64.2%	13 Retired (more than 30 years)	100%
Hemoglobin	79 abnormal	57.6%	12 abnormal	92.3%
O2 level	126 abnormal	91.9%	13 abnormal	100%
CO2 level	72 abnormal (More than 45 mm Hg)	52.5%	12 abnormal (More than 45 mm Hg)	92.3%

Figure 1: Relationship between Age and Oxygen level in corona patients work in polluted environment and comparing with corona patients work in healthy environment.



It was found that there is a discrepancy between the values of oxygen with relation to age, the older the patient is the less amount of oxygen that can be delivered to body cells.

91.9 % of patients had less than normal oxygen level (figuer1).

In the long term and with advancing age of those patients who worked in a polluted factories environment, approximately (64%) of patients were exposed to inhaling polluted air for 30 years and (36%) were exposed for approximately 25 years, and with the occurrence of some chronic diseases (long term

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or recurring illness), so that the percentage of patient's diabetes or high blood pressure (91.2%), the severity of symptoms (extent of organ system derangement or physiologic decompensation) was more (figuer2)

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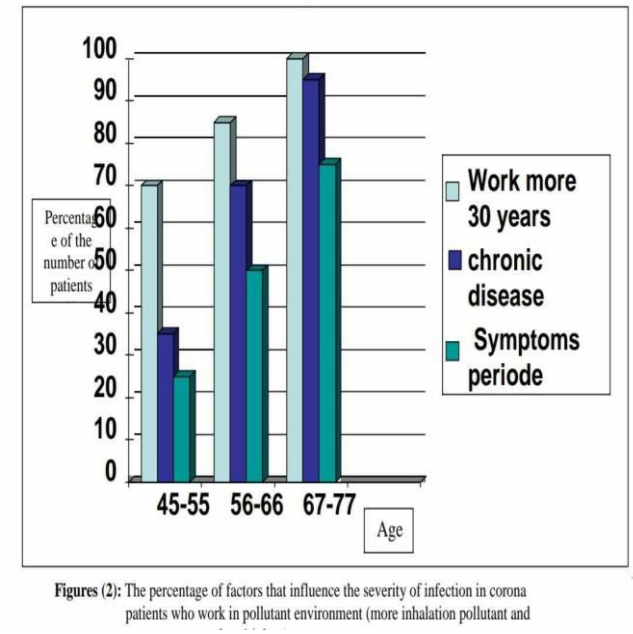
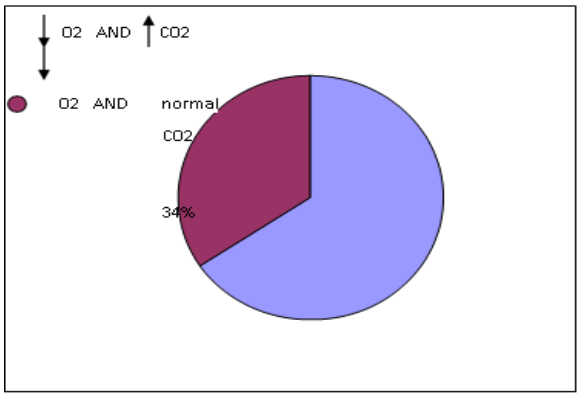
Figures (2): The percentage of factors that influence the severity of infection in corona patients who work in pollutant environment (more inhalation pollutant and symptoms more than 14 days).



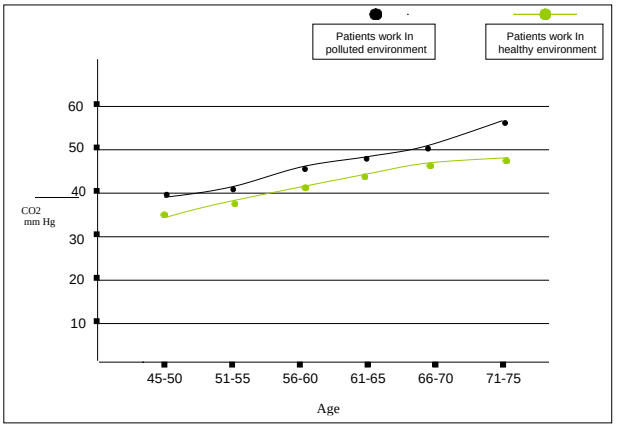
Figures (2): The percentage of factors that influence the severity of infection in corona patients who work in pollutant environment (more inhalation pollutant and

Figure 3: Percentage of corona patients that show efficiency of lung function, either from a lack of oxygen or an excess of carbon dioxide or both.



The decrease in oxygen may be accompanied by a high amount of carbon dioxide (Figure3). As a result, the brown color indicates a failure in one of the lungs' activities, excreting less oxygen, but the blue color indicates a defect in two of the lungs' functions, transporting less oxygen and inadequate carbon dioxide removal. It was found that there is a discrepancy between the values of carbon dioxide with relation to age, the older patient is more amount of carbon dioxide that can be delivered to body cells (Figure4).

Figure 4: Relationship between Age and carbon dioxid level in corona patients work in polluted environment and comparing with corona patients work in healthy environment**.**



The results of mean hemoglobin levels shown in (Table 2) indicates that there is a discrepancy in hemoglobin values. The figure below shows the arithmetic mean of hemoglobin level and the standard deviation of various results of samples collected (figure 5).

When studying relationship between oxygen level of people infected Corona virus with hemoglobin levels, it was found that there is a discrepancy in the results with age (figure**6**) and relationship between age of people infected with the Corona virus with level of hemoglobin (figure**7**).

Table 2: Number of patients infected with corona virus, the mean hemoglobin level for results and the variable deviation.

Number of patients	MEAN	SD	2 SD	3SD
137	13.50755	3.01211	6.02422	9.03633

Figure 5: Result of Hemoglobin**..**

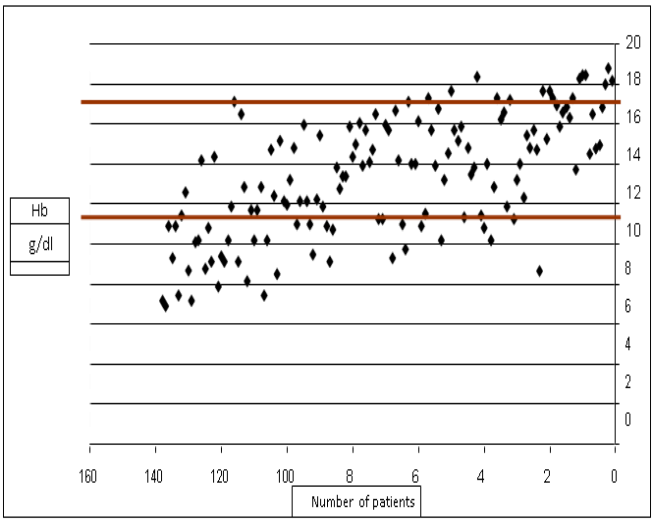


Figure 6: Relationship between oxygen level with Hemoglobin**.**

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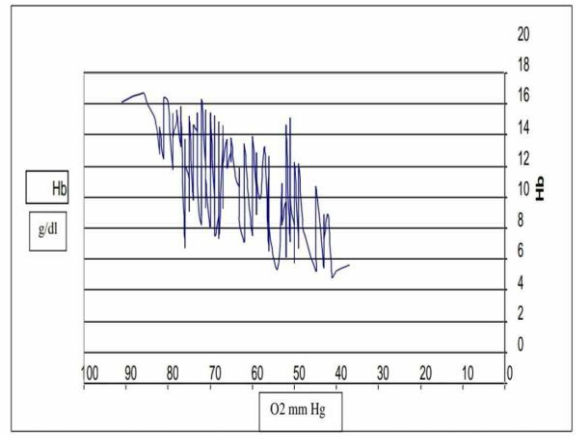
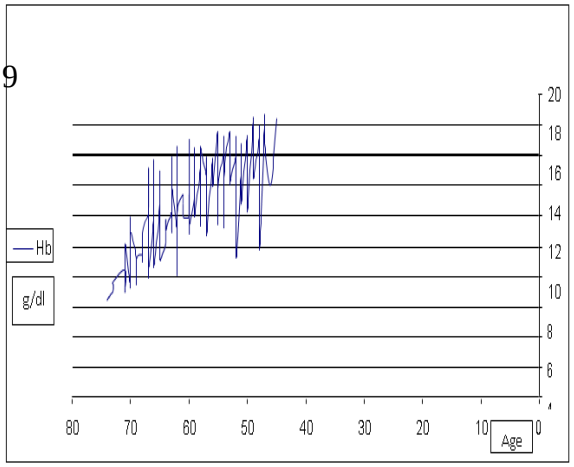


Figure 6: Relationship between oxygen level with Hemoglobin

Figure 7: Relationship between age of patients with Hemoglobin**.**



4. Discussion:

Arterial blood gases exchange is the delivery of oxygen to body cells and removal of carbon dioxide with aid of hemoglobin (Bezuidenhout et al., 2021). There are several factors that affect the normal function of gas exchange process in the lungs. The quality of inhaled air polluted with chemicals, gases and dust has an effective role in affecting on function of lungs.

When pollutants enter the lungs, they begin to accumulate over time and work to narrow the alveoli and reduce the movement of gas exchange. so that the older the person, the greater amount of inhaled polluted air (more working period), becomes difficult to transfer adequate amounts of oxygen through the inhalation process, and thus the saturation of body cells with oxygen necessary for them to perform their vital function decreases in an inverse relationship in corona patients working in chemical; factories (Kashan, (2020). But when compared to patients working in healthy environments, quality of the inhaled air was better, and therefore amount of oxygen transferred to body cells is greater than that of patients working in polluted environments. On the other hand, it is difficult for body cell to get rid of carbon dioxide through the exhalation process (Sarwar et al, 2021). But for corona patients who work in healthy
environments, efficiency of the lung function was better in getting rid of carbon dioxide.

When lungs efficiency is poor, it may fail to deliver oxygen to the body cells or get rid of carbon dioxide or both. The decrease in oxygen may be accompanied by a high amount of carbon dioxide. Quality of inhaled air plays an important role in the breathing process, when exposed for long periods of time to large amounts of toxic gases chemical and organic fumes, which leads to their accumulation inside the lungs and weaken their movement and thus poor efficiency of their work, so leads to a rise in carbon dioxide due to the inability to get rid of it. (Swardson, 2022).

When studying the group of factors affecting the increase in the symptoms of infection with the Corona virus among workers and retirees from chemical factories, it was Found that smoking (Reddy & Charles, 2021), duration of work in polluted environments for many years, and presence of chronic diseases such as diabetes (Delhaize, 2021), blood pressure and some allergic pulmonary diseases, all of this contributed to the symptoms being severe and Dangerous
which may lead to death. Theoretically, infection corona virus supposed to increase the Hemoglobin level to provide the necessary level of O2. Hemoglobin is the only mean for blood gases exchange (Knight et al.,2004). When less oxygen is delivered, the bone marrow tries to produce more RBC to transport more oxygen which leads to an elevated Hb level. When studying hemoglobin levels in the case of hypoxia in corona patients, a deviation in the results was observed due to smoking, anemia and other underling illnesses that has also have an effect on hemoglobin level (Gille et al, 2021). Many factors affect hemoglobin levels in the blood, including a lack of vitamin absorption, which causes anemia, a lack of erythropoietin production due to some renal diseases, age, hemorrhagic diseases, and a variety of malignancies not simply the level of oxygen (He et al.,2020; Singhal, 2020; Iglesias et al., year).The severity of symptoms when infected with corona virus varies from one person to another, depending on presence of some factors that influence severity of the infection that sometimes leads to death. level of infection severity of the Corona virus has been affected by poor lung function due to presence of chronic diseases (Du et al., 2021), smoking and accumulation of chemicals in it due to inhaling polluted air for many years during working life, and thus leads to a decrease in transfer of oxygen to body cells and disposal of carbon dioxide, and thus can lead to death, especially in the elderly (Jinjun et al., 2021).

5. Conclusion

Corona virus mainly affect the lungs. When the virus enters the lungs, the severity of infection varies depending on the nature of a person's lifestyle. Some infections may be very mild and others may lead to death. Thus, when a person's lungs encounter large amounts of smoke, dust and other pollutants, the lungs alveoli narrow making it difficult for O2 and CO2 exchange process to work probably.

6. Acknowledgments

In the first place, I would like to thank God for being able to complete this project. Then I would like to express my special thanks to Dr. Mayas' Al- Sheathe. I also extend my thanks to

the governmental and military hospitals in the southern Jordan region for providing me with the results of the samples needed to complete this project.

Recommendations

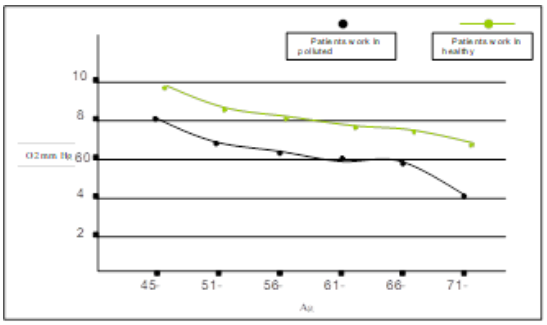
The increase in inhalation of air polluted with chemicals and vapors leads to an effect on the efficiency of lungs function. There is a need for government institutions efforts to import the best types of filters and supply them to factories in order to raise air quality and reduce pollutant content. The researchers also recommended for a more in-depth investigation of the factors that influence the extent of the relationship between oxygen and hemoglobin levels in patients with corona.

7. References:

1. Trulock, E. P. III. (1990). Arterial blood gases. In Clinical Methods, The History, Physical, and Laboratory Examinations (3rd ed.). National Library of Medicine.
2. Adisa, A., & Alibiing, M. (2013). Disorders of Blood Gases, Electrolytes, Magnesium, Albumin and Calcium Metabolism in SARS-CoV-2-infected Patients. Taxila International Journal of Public Health, 2013.
3. Swardson Lover, C. (2022). Erythrocyte Structure and Function. In Schisms Veterinary Edition: The Hematology (pp. 158-165).
4. Burnet, B. B., Bosque, M. C., Loran, A., & Martin, C. (2004). Evaluation of the blood gas analyzer GEM (r) PREMIER (tm) 3000. Clinical Chemistry and Laboratory Medicine, 96-101.
5. Bezuidenhout, M. C., Wiese, O. J., Moodley, D., Masdar, E., David's, M. R., & Kelkenberg, E. R. (2021). Correlating arterial blood gas, acid–base, and blood pressure abnormalities with outcomes in COVID-19 intensive care patients. Annals of Clinical Biochemistry: International Journal of Laboratory Medicine, 95-101.
6. Kashan, K. B. (2020). Hypoxia in COVID-19: Sign of severity or cause for poor outcomes. In Mayo Clinic Proceedings (pp. 1094-1096).
7. Sarwar, V. S., Reichert, A., Jeremias, M., & Manovich, V. (2021). COVID-19 pandemic and global carbon dioxide emissions. Science of the Total Environment, 794.
8. Reddy, R. K., & Charles, W. N. (2021). The effect of smoking on COVID-19 severity: A systematic review and meta-analysis. Journal of Medical Virology, 1045-1056.
9. Delhaize, A., Emmerton, D., & Sinclair, A. J. (2021). Diabetes in COVID-19 pandemic: Prevalence, patient characteristics, and adverse outcomes. International Journal of Clinical Practice, 75.
10. Gille, T., Sese, L., Aubourg, E., & Fabre, E. E. (2021). The Affinity of Hemoglobin for Oxygen Is Not Altered During COVID-19. Frontiers in Physiology, 12-459.
11. He, F., Deng, Y., & Li, W. (2020). Coronavirus disease: What we know? Journal of Medical Virology, 719-725.
12. Singhal, T. (2020). A review of coronavirus disease (COVID-19). The Indian Journal of Pediatrics, 281-286.
13. Iglesias Osores, S., Saavedra-Camacho, J. L., Acosta-Quiroz, D. M., & Heredia, R. (Year). Arterial blood.
14. Du, Y., Zhou, N., & Zha, W. (2021). Hypertension is a clinically important risk factor for critical illness and mortality in COVID-19. Nutrition, Metabolism and Cardiovascular Diseases, 745-755.
15. Jinjun, R., Zhao, S., Han, L., Ge, Y., & Chong, M. (2021). Increase in Diabetes Mortality Associated With COVID-19 Pandemic in the U.S. Diabetes Care, 146-147.
16. Kieninger, M., Sinning, A., Vadász, T., Gruber, M., Gronwald, W., Zeman, F., ... & Kieninger, B. (2021). Lower blood pH as a strong prognostic factor for fatal outcomes in critically ill COVID-19 patients at an intensive care unit: A multivariable analysis. PLoS One, 16(9), e0258018.
17. Böning, D., Kuebler, W. M., & Bloch, W. (2021). The oxygen dissociation curve of blood in COVID-19. American journal of physiology-lung cellular and molecular physiology.
18. Hasan, H. M., & Abdoon, F. M. (2023). A Novel Coated Pencil-Shaped Graphite Electrode for Potentiometric Determination of Metoclopramide-HCl in Pure and Pharmaceutical Commercial Products. Tamjeed Journal of Healthcare Engineering and Science Technology, 1(2), 44–51. https://doi.org/10.59785/tjhest.v1i2.43.
19. Knight, K., Wade, S., & Balducci, L. (2004). Prevalence and outcomes of anemia in cancer: a systematic review of the literature. The American journal of medicine, 116(7), 11-26.

https://doi.org/10.59785/tjhest.v2i1.31

8. Figures:



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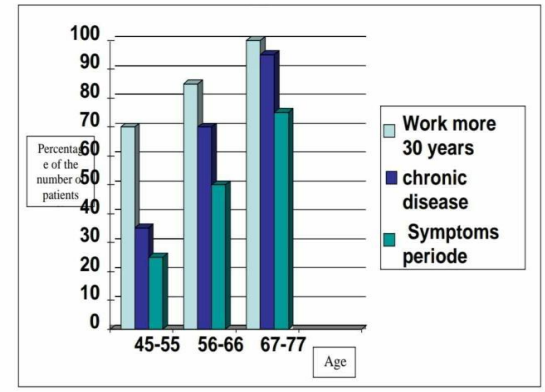

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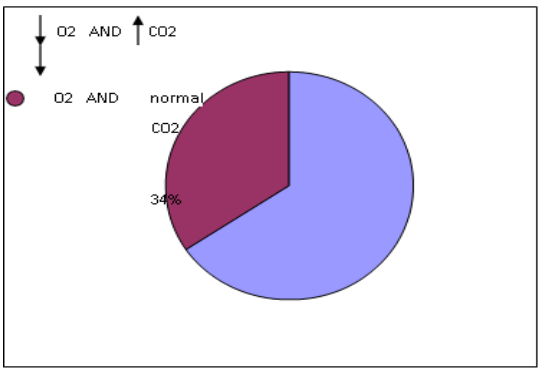

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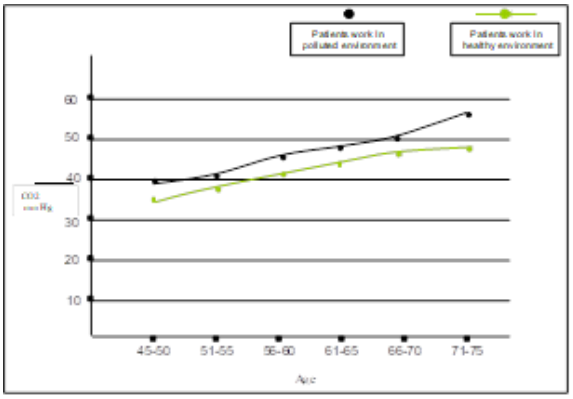

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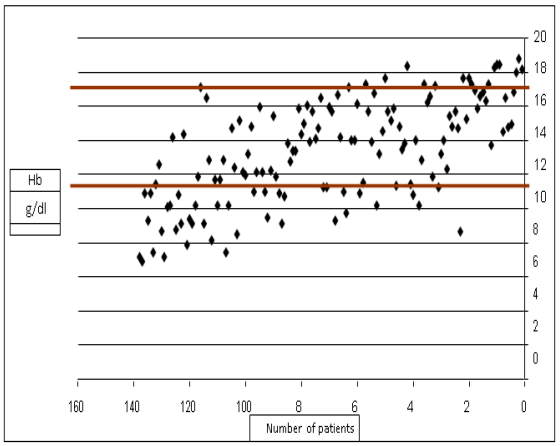

Figure 5: Result of Hemoglobin

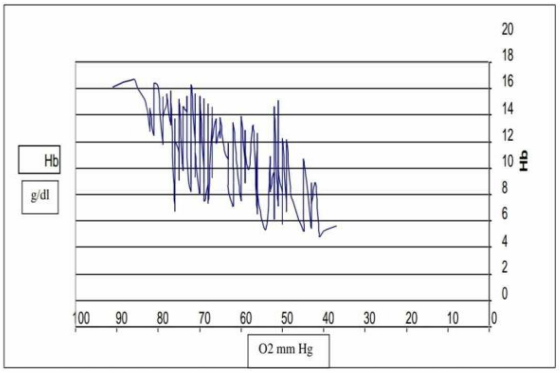

Figure 6: Relationship between oxygen level with Hemoglobin

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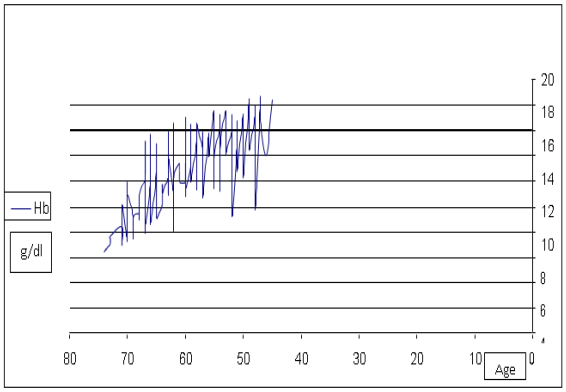

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