

How to Cite:

Hussein, M. A., Farman, K. S., & Ismail, M. M. (2022). The effect of pollution with a number of gases on patients with type 2 diabetes in gas stations. *International Journal of Health Sciences*, 6(S4), 7861–7867. <https://doi.org/10.53730/ijhs.v6nS4.10428>

The effect of pollution with a number of gases on patients with type 2 diabetes in gas stations

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Abstract---Diabetes is a metabolic disease characterized by elevated blood sugar levels for long periods. This disease is widely spread among the world's population, as it is currently observed that its incidence is increasing, and this is mainly due to a sedentary lifestyle and an excessive calorie diet. An increase in glucose uptake and a decrease in insulin resistance are One of the main factors that improve glycemic control is against diabetes. In order to know the role of gaseous air pollutants and their impact on type 2 diabetes, this study came as it included 90 people from Diyala Governorate / central Iraq (males only), their ages ranged between (24-60) years and they were distributed among 25 individuals with type 2 diabetes. 2 working in gas stations and 40 people working in gas stations also at risk of pollution and 25 people in a control group and for the period from January 2, 2021 to March 5, 2021 for the winter season, and for the period from July 15, 2021 to August 22 2021 for the summer, as the study was conducted in the winter and summer seasons. The results of the statistical analysis for the winter season showed a significant difference $P < 0.05$ between the three groups (diabetes, exposed to pollutants, control) in relation to the hormone insulin, the results also showed a significant difference between the three groups in relation to insulin resistance, and the results also indicated a significant difference in the percentage For fasting blood sugar between the values of the two groups (diabetes , exposed to pollutants) compared to the control group, there were also significant differences between the three groups for leptin, and significant differences were found between age levels between the two groups (diabetes, exposed to pollutants) with the control group. The results of the statistical analysis for the summer season showed a significant difference

P<0.05 between the three groups (diabetes, exposed to pollutants, control) in relation to insulin hormone. Among the leptin hormone values among the three groups, the results indicated that there was a significant difference in the age factor among the three groups.

Keywords---polluted gases, insulin, leptin.

Introduction

One of the major metabolic diseases of the 21st century, diabetes mellitus is a metabolic disorder characterized by elevated blood glucose in the context of insulin resistance and relative insulin deficiency (1). According to WHO estimates, diabetes is the seventh leading cause of death in 2016 (2). One of the reasons for fluctuations in physiological and metabolic factors may be related to temperature, which has a prominent role in reducing insulin sensitivity and weakening beta cells, as increased exposure to air pollution can lead to increased insulin resistance and thus a higher incidence of diabetes and heart disease. Physicians should consider the environmental exposure of patients when making screening and treatment decisions for them. Air pollution exposure can affect human health in many different ways, which can lead to a significant risk of morbidity and mortality. Air pollution has become the largest environmental risk factor for a variety of chronic diseases (3).) . Leptin is a hormone produced and secreted by adipose tissue, especially white adipose tissue, and it plays an important role in the expenditure of energy and regulation of its consumption, including regulating appetite, metabolism and metabolism. In some individuals, the effects of leptin are reversed through natural resistance. Environmental pollution is able to affect the balance of multiple endocrine axes in humans, and this negative result occurs due to the effects of synthetic chemicals that are widespread on a large scale, as these endocrine disruptors are present almost everywhere and are able to restrict the action of hormones, block or modify their structure Therefore, there is an increasing interest in the health effects on the endocrine glands due to the effectiveness and impact of these substances, the most important of which are (insulin resistance, obesity, type 2 and type 1 diabetes, thyroid diseases, reproductive abnormalities and cancer), as concern is due to the great burden And the increasing of these compounds in the basic environmental components (air, water, soil) (4) .

The aim of the study

To study the effect of exposure to chemical air pollutants, including gases (H₂S, CH₄, NO₂, CO and O₂), on some biomarkers associated with insulin resistance and secondary clinical infections during the winter and summer seasons.

Materials and working methods

Study totals: The study was conducted on 90 people (males only) and for two different seasons, winter and summer, where the same physiological tests and the same environmental tests were conducted on them at their workplace. The totals were divided into three groups: The first group: the 40 people exposed to the risk

of pollutants. The second group: the group of patients with diabetes, which numbered 25 people. The third group: the healthy group of 25 people. Samples were collected from three fuel stations in Diyala Governorate, inside Baquba city, which are (Oil Depot, Ashnona Fuel Station, Old Baquba Fuel Station) for the period from (2/January/2021) to (5/March/ 2021) for the winter season and for the period from (15 / July / 2021) until (22 / August / 2021) for the summer season.

Sample collection

5 ml of venous blood was withdrawn from the three groups (diabetes patients, exposed to pollutants, and healthy subjects), then the blood was placed in clean, dry Gel tubes and left at a temperature of 37 °C for 30 minutes, then the blood serum was separated by centrifugation (3000 cycles/min) for 10 minutes. 10 minutes and then store the blood serum to measure the hormone insulin.

Estimation of blood pressure level

Systolic blood pressure and diastolic blood pressure were measured by a blood pressure monitor for all patients and healthy people.

Examination of fasting blood sugar

The fasting blood sugar of each person in the study was measured by the enzymatic colorimetric method and using the examination kit of German origin from Accue check company, and insulin resistance was calculated by the equation: $HOMA-IR = (Glucose\ mg/dl \times Insulin\ \mu IU/ml) / 405$

Insulin hormone measurement

This test is based on the principle of enzyme-linked immunosorbent adsorption (ELISA) and by the (solid phase sandwich) method, where the holes are covered with monoclonal antibody.

Leptin assay

The basis of leptin assay is enzyme-linked immunosorbent adsorption (ELISA) technique by sandwich method.

Environmental checks/measuring gaseous air pollutants

Gaseous pollutants in the air were measured by the Dräger X-am 5000 detector, a mobile-sized device used by station workers, factories and relief teams and was developed specifically for personal monitoring. It is resistant to water and dust, and the detector remains fully functional and ready for use even after falling into the water. The device detects 5 gases (H₂S, SO₂, CH₄, CO₂, and CO). The device reliably detects combustible gases and vapors.

Statistical Analysis

The statistical program SPSS version 20 was used to analyze the data to study the effect of different factors on the studied traits and the significant differences between the means were compared with the least significant difference (LSD) test, and the chi-square test (2x) was used to compare the significant differences between the studied proportions.

Results and Discussion

The relationship between diabetes and exposure to air pollution has been studied, which includes the emission of smoke from cars, factory smoke and other types of fine particles, which are believed to have an important role in raising the incidence of type 2 diabetes, as continuous exposure to several types of gases, including (CH₄ H₂S, SO₂, CO , O₂) , These pollutants were compared with risk factors for diabetes, including in season winter and summer (insulin hormone, leptin hormone, insulin resistance, age, fasting blood sugar , number of year services) .

Table (1-1) shows the variables included in the study

Diabetic Patients Mean ± SD	exposed to pollutants Number Mean ± SD	Control Number Mean ± SD	Variable
25	40	25	Number (male)
12	12	-	Number of hours of daily exposure (hour)
5.283± 48.800 *	8.259± 43.075 *	5.303± 31.280 *	Age (year)
20.416±6.822	15.901±7.983	-	Number of years of service
3.949± 18.531 *	5.134± 14.917 *	1.771± 7.790 *	Insulin hormone Winter
3.157±19.746*	3.344±16.038*	1.920±8.869*	Insulin hormone Summer
57.039± 209.720 *	17.995± 116.825	8.740± 102.680	Fasting blood glucose (mg/dL) Winter
69.143±242.000*	38.602±129.850*	6.082±99.600*	Fasting blood glucose (mg/dL) Summer
3.259± 9.572*	1.822± 4.371*	0.470± 1.974*	Insulin resistance Winter
3.571±11.722*	2.373±5.216*	0.554±2.194*	Insulin resistance Summer
17.663± 163.627*	17.358± 117.699*	11.624± 109.408*	Hormone lipten Winter
*157.297±20.841	*120.253 ±16.617	*105.865±11.380	Hormone lipten Summer

Table (1-1) indicates that there is a significant difference in the service period rates (exposure duration) among patients with type II diabetes who work at gas stations compared to workers at gas stations who are exposed to pollutants. Study (5) found that it confirmed the harmful effects of exposure to air pollutants. The environment affects diabetic patients and that diabetic patients may be more likely to be exposed to the complications of air pollutants. The study which confirmed the increase in the prevalence of metabolic syndrome (Mets) with age, as well as the increase in the prevalence of diabetes, as metabolic syndrome (Mets) was associated with an increased risk of type 2 diabetes and cardiovascular disease (CVD). . As for the insulin hormone, a study (6) showed that there is a link between air pollution and the risk of diabetes, including insulin resistance (IR), fat accumulation, and impaired glucose metabolism. Emerging evidence supports that exposure to surrounding microparticles (PM2.5) is associated with insulin resistance (IR) and fat accumulation in the liver, as the exposure also led to the manifestation of hepatic fat metabolism disorder, which led to the occurrence of pollution-induced fat metabolism disorders (7). Monitoring of metabolic indicators such as fasting glucose, blood pressure, body weight, blood lipids, and Hba1c is essential in the clinical control of patients with diabetes because high blood pressure, obesity, and dyslipidemia are known risk factors for atherosclerosis and are common in diabetic patients (8). Prolonged fasting releases the hormone glucagon, which is produced by the pancreas and causes the liver to release glucose (blood sugar) into the bloodstream. However, if the body cannot produce enough insulin or cannot respond adequately to insulin, blood sugar levels will remain high. In the blood, as there is strict control of the levels of glucose in the blood during fasting (FBG), as the pancreatic islets maintain it within a certain range by secreting different hormones, especially insulin and glucagon (9). Insulin resistance has been defined as a disorder in which a combination of genetic factors, inactivity, diet and obesity lead to a range of metabolic dysregulation, causing conditions including diabetes, hypertension, malignancy, atherosclerosis, dyslipidemia, alcohol-induced steatohepatitis and polycystic syndrome. Ovaries: Insulin resistance occurs when muscle, fat, and liver cells do not respond well to insulin and cannot use glucose from the blood for energy to compensate for this, which helps the pancreas produce more insulin. Over time, blood sugar levels rise. Insulin resistance syndrome includes a range of problems such as obesity High blood pressure, high cholesterol and type 2 diabetes called metabolic syndrome because over time the pancreas will not be able to keep up with growth.

Polluted gases emitted from fuel at filling stations

A group of gases were measured in this study, including (H₂S, SO₂, CH₄, CO, O₂) among the other emitted gases in order to ensure that there is a higher percentage of pollutants in gas stations than the rest of the other natural places that do not have a high pollution rate. Another group of particulates is (PM₁, PM_{2.5}, PM₇, PM₁₀, TSP), which is believed to have a role in causing a group of diseases, especially type 2 diabetes. The occurrence of many diseases, including diabetes, and thus poses a threat to the health of the individual within these stations.

Table (2-1) shows the values of gases emitted from gasoline at gas stations

Benzene	Summer Mean \pm SD	Winter Mean \pm SD
H ₂ S	3.533 \pm 2.247	1.033 \pm 0.351
SO ₂	5.133 \pm 2.914	2.233 \pm 0.850
CH ₄	2.966 \pm 0.208	1.333 \pm 0.650
CO	1.040 \pm 1.697	0.200 \pm 0.346
O ₂	19.366 \pm 0.450	20.900 \pm 0.000

The levels of the five gases were measured in the three stations included in the study (the oil depot, Ashnona filling station, and old Baquba filling station). (10) About the toxicity and danger of hydrogen sulfide gas, which is a highly toxic gas and ranks second after carbon monoxide as a cause of death resulting from inhalation, and it is a gas that is easily soluble in water and at physiological pH. In several cell types including neurons induced by pluripotent stem cells. Sulfur dioxide is one of the oxides of sulfur, and it is a chemical compound that is produced naturally from volcanoes and industrially in many industrial processes, as confirmed by the results of study (11) which indicated that exposure to air pollutants with sulfur dioxide and carbon dioxide results in an increase in the incidence of type diabetes. The second and thus increase the economic losses associated with this disease. Methane gas is the simplest chemical compound, a member of the family of hydrocarbons. It is a pure gas that has no odor, but when used commercially, it is mixed with small amounts of sulfur compounds with a distinctive smell so that the traces of methane can be traced in the event of a leak, as methane is extracted from geological deposits where it is associated with For other types of hydrocarbon fuels as it can be obtained from natural sources (12). Carbon monoxide (CO) is a colorless, tasteless, and odorless gas that results from the partial oxidation process (incomplete combustion) of carbon and organic compounds such as coal, and this occurs when oxygen is scarce or when burning at a very high temperature. Heterogeneous diatomic because it contains two different elements, carbon and oxygen, and carbon monoxide attaches itself to red blood cells, which prevents the absorption of oxygen (13) .

A study (14) confirmed that the low percentage of oxygen gas poses a threat to human health and that the lack of oxygen at the cellular level may be one of the factors causing the development of type 2 diabetes, as in mice fed a diet rich in fats, excess fatty acids led to Activation of the mitochondrial protein in the membranes of fat cells, causing an increase in oxygen consumption, which leads to a decrease in O₂ in the rest of the cell. Inhaling oxygen reduces it.

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