

# Complications of Sulfur Dioxide, Its Correlation and Treatment in Hyperglycemia

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## ABSTRACT

In the modern era of rapid scientific and technical progress, the development of production areas, especially the chemical industry and the production of various types of chemical products causes environmental pollution and disturbance of the ecological balance. Degradation processes occurring in the environment cause pollution of the biosphere, which poses a threat to living things. Diabetes Mellitus (DM)

is caused an abnormal increase of sugar (glucose) in the blood and also occurs as a result of resistance to the hormone insulin, which breaks down blood sugar and is synthesized in the pancreas, insulin deficiency or absence.

**Keywords:** Sulfur gas, Diabetes, Hyperglycemia

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## INTRODUCTION

Inhalation of Sulfur dioxide (SO<sub>2</sub>) is especially dangerous. In the modern era, when scientific and technical progress is rapid, the development of production areas, especially the chemical industry, and the production of various chemical products cause environmental pollution and disruption of life. Ecological balance (Yamskova VP, *et al.*, 2007). Carbon monoxide, hydrocarbons and nitrogen oxides are the main air pollutants resulting from the operation of motor vehicles. According to research, a car traveling 20,000 kilometers emits 0.775 kilograms of lead, 40.75 kilograms of nitrogen oxide, 234 kilograms of hydrocarbons and 765 kilograms of carbon dioxide. These harmful wastes undergo chemical changes under the influence of sunlight and their lists are enriched with low levels of tropospheric ozone and various toxins of photochemical origin. As a result, these toxic substances cause dangerous and uncontrollable consequences for human life (Zúñiga J, *et al.*, 2011). One of these gases that cause atmospheric pollution is SO<sub>2</sub>. SO<sub>2</sub> is mainly formed as a result of bacteriological decomposition of organic matter. It can enter the atmosphere with volcanic gases. Some scientists believe that some SO<sub>2</sub> may also occur in the oceans.

In recent years, SO<sub>2</sub> has begun to enter the atmosphere intensively in cities and industrial areas as a result of human activities as well as natural sources. Sulfur compounds, especially SO<sub>2</sub>, are among the most irritating and harmful air pollutants. SO<sub>2</sub> has a strong effect on the human respiratory tract. The presence of SO<sub>2</sub> in the atmosphere not only poses a danger to humans, but also exacerbates the corrosion of various devices and causes great material damage to the country's economy (Karimova RC, *et al.*, 2022; Karimova RC, *et al.*, 2022). The amount of sulfur in the human body is 400-700 Parts Per Million (PPM) of the mass of the human body. Sulfur is involved in the synthesis of proteins, amino acids, enzymes and vitamins. Sulfur is especially important for the synthesis of skin, nail and hair proteins. Sulfur is a component of active substances-vitamins and hormones (Example, insulin). Like all mercury compounds, sulfur dioxide is poisonous. The danger of this mineral intensifies when heated, since toxic substances are released into the air-Sulfur dioxide (SO<sub>2</sub>) mercury and its vapor. Inhalation of toxic vapors causes serious poisoning and

danger to health and life. Experiments with sulfur gas should be carried out using a fume hood, gloves, goggles and a gas mask (Zuniga J, *et al.*, 2011). Sulfur atoms are part of the molecules of essential amino acids (cystine, cysteine and methionine), hormones (insulin, calcitonin), vitamins (biotin, thiamine), glutathione, taurine and other compounds important for the body. Sulfur in its composition performs many important functions in oxidation-reduction reactions, respiration of tissues, energy production, transfer of genetic information and many more. Sulfur is a structural protein component of collagen. Sulfur-containing metabolites include hemoglobin, heparin, cytochromes, fibrinogen and sulpholipids (Yamskova VP, *et al.*, 2007).

Inhalation of Sulfur dioxide (SO<sub>2</sub>) is highly dangerous; inhalation of hydrogen sulfide vapors causes convulsive narrowing of the airways and there are cases when it causes sudden death due to respiratory arrest. After sulfur dioxide poisoning, the survivor's endocrine system, lungs, and gastrointestinal tract are severely damaged. People suffer from paralysis, mental disorders and severe headaches. Sulfur metabolism is controlled by factors that have a regulatory effect on protein metabolism (hormones of the pituitary gland, thyroid gland, adrenal glands and gonads).

## LITERATURE REVIEW

### Diabetes

Diabetes Mellitus (DM) is characterized by an increase in blood sugar. This disease occurs as a result of resistance to the insulin hormone, which breaks down blood sugar and is synthesized in the pancreas and insulin deficiency or absence. Normally, the upper level of fasting blood sugar in venous blood is 100 mg/dl and the upper level of saturated blood sugar is 140 mg/dl. Diagnosis of prediabetes or latent diabetes is explained by the level of fasting blood sugar levels. If fasting blood sugar is 100-125 mg/dl and 140-199 mg/dl, then it is diagnosed as prediabetes. DM diagnostic procedure is carried out if fasting blood sugar is 126 mg/dl and above, if glucose is 200 mg/dl and above in the 2<sup>nd</sup> hour after the 75 g sugar loading test, if blood sugar is measured at any time and if it is 200 mg/dl and above, If HbA1c (3-month sugar) is higher than 6.5% (Karimova RC, *et al.*, 2022; Karimova RC, *et al.*, 2022). All diabetes-related complications are caused by high blood sugar

levels. If the patient can control the amount of sugar in the blood, diabetes does not become a disease, but lifestyle that can prevent complications. The most common symptoms of the disease include dry mouth due to high blood sugar, feeling of thirst (polydipsia), hunger, frequent urination (polyuria), weight loss and fatigue. Meanwhile, the body loses a lot of water and sugar. For this reason, the body cannot use sugar as an energy source and begins to melt its own fat. As a result, the patient loses weight. Several types of diabetes are distinguished according to the factors that cause the disease like type 1 DM or insulin-dependent diabetes, type 2 DM or non-insulin-independent diabetes and gestational diabetes. There are other specific types (Zhang Y, *et al.*, 2005).

### **Type 1 Diabetes Mellitus (DM)**

There is a deficiency of insulin and in some cases no insulin is synthesized. In 90% of cases it is an autoimmune disease and in the remaining 10% it is associated with the destruction of pancreatic cells. This type usually begins before age 30. There are three peak periods; preschool (age 6), adolescence (age 13) and youth (age 20). Dry mouth, a symptom of high blood sugar, occurs suddenly. The patient is either at normal weight or losing weight. If left untreated, the patient may fall into a diabetic coma and die. Coma symptoms include nausea, vomiting, pain in the abdomen or chest, weakness, shortness of breath, hot and dry skin, fast heartbeat, etc. with acetone-like breath smell. The patient with this condition must be hospitalized because if insulin and appropriate treatment are not taken, the patient falls into a coma, which can result in death. Treatment of type 1 DM requires insulin injections and medical guidance. They must also be physically active, fully educated about diabetes and able to measure their own blood sugar at home Self-Monitoring of Blood Sugar (SMBG) (Zúñiga J, *et al.*, 2011).

### **Type 2 Diabetes Mellitus (DM)**

Type 2 DM caused by insulin resistance or decreased insulin secretion. It is more common in people over 30 years of age and overweight. Genetic factor plays an important role in this disease. In other words, if both parents have DM, the risk of DM in children increases to 38%. The onset of the disease is slow and the patient has almost no complaints. Some patients experience blurred vision, numbness in the hands and feet, leg pain, recurrent fungal infections, or delayed wound healing. If these patients do not receive appropriate treatment, arteriosclerosis occurs as they get older and non-healing wounds or gangrene occurs as a result of cardiovascular diseases. In a patient who is not treated for a long time, eye problems due to uremia and kidney failure may develop leading to death as a result of coma (Yamskova VP, *et al.*, 2007).

If the amount of sugar in the blood is constantly high, it can cause damage to the cardiovascular, digestive system, nervous system, liver, kidneys, eyes and brain. The process will accelerate as the injured organs cannot fulfill their duties. As a result, it will be difficult or impossible to treat existing complications. If the amount of sugar in the blood increases pathologically, the patient should take medication at the dose prescribed by the doctor for such a situation, so that the amount decreases. Within the norm, during diabetes, the amount of sugar in the blood can sometimes drop sharply. This usually happens when you starve, delay food intake, overdose on medication, engage in strenuous physical activity, or skip meals while taking medication. The patient should know that a sharp drop in blood sugar is dangerous for his life. There are symptoms that appear immediately when the amount of sugar in the blood drops sharply. It is very important to know these signs in order to take timely action (Karimova RC, *et al.*, 2022).

### **Symptoms of kidney failure in diabetic patients**

Bad sense of taste in the mouth, discomfort in the legs, swelling, loss of appetite, sleep, indigestion, depression, fatigue, nausea, vomiting, etc. In case

of severe kidney failure that develops on the basis of diabetes, the patient must undergo dialysis; otherwise the patient's condition will worsen and would be impossible to save the life. Against the background of diabetes, sexual weakness may develop gradually in long term. It is usually caused by physical and psychoneurological factors. If the amount of sugar in the blood is high, the patient will feel tired and weak. In this case, their senses are weakened. However, if the amount of sugar in the blood is regulated, problems that may occur can be prevented. The constant presence of infection in the urinary tract also accelerates the development of sexual weakness. Symptoms of infection in the urinary tract include increased urination, pain during urination, burning sensation, cloudy or dark red color of urine, back and abdominal pain, sometimes high temperature and chills, etc., (Zúñiga J, *et al.*, 2011). Pain in the legs during diabetes also causes weakening of sexual sensation. Usually, these problems develop in men who do not take adequate care of themselves. Diabetes is one of the incurable diseases; the patient should know that it is not possible to live for many years without diet and treatment against the disease. Every patient needs to follow a diet and receive regular treatment to prolong one's life. The patient should not forget how serious the disease is and the importance of the treatment. The doctor must take the medicine prescribed by the specialist on time in accordance with the prescription. Otherwise, the disease may worsen. Treating complications of diabetes are not easy because for an effective treatment, the patient's blood sugar must be within the normal range. As a rule, the amount of sugar in the blood of healthy people is 3.3-6.5 mmol/l. In patients, the normal limit may be up to 7.0 on an empty stomach and 9.9 mmol/l after a meal. The existence of such a difference prevents the treatment from being sufficiently effective. For this reason, the amount of sugar in the patient's blood should be kept under strict control during intensive treatment. Diabetic patients should regularly do light physical work or sports. Sudden physical activity can cause a sharp drop in blood sugar. It will be difficult to regulate the amount of sugar due to prolonged physical inactivity. Patients are sensitive to stressful situations, and every time a patient experiences stress, their internal organs are damaged. Therefore, try not to react to events occurring around. Diabetics should know that it is important to receive basic treatment twice a year. Preventive measures should be continued after treatment. Therefore, treatment and prevention must be tailored to your lifestyle. Treatment is carried out as a complex the functional work of important organs is restored. Food diet, which is the quality of food products, is as important and indispensable for patients as medicine. Therefore, it is necessary to add food products that are beneficial for the body to the daily diet.

### **Useful food products for diabetics**

Foods made from buckwheat, green peas, mung beans and lentils should be included frequently in the diet. This includes rice, beans, etc. It is advised not to take them in large quantities at once. Other vegetables can be taken in relatively small amounts. Among melon products, you can only use borane (Xia XY, *et al.*, 2003). Patients are instructed not to take too many fruits at the same time and to avoid fruits with high sweetness such as grapes and dates. Using 15-20 g of butter a day will have a positive effect on the functioning of the gastrointestinal system. Further, during the day it is allowed to take up to 200 ml of juice without additional additives. The natural sweetness of the fruit juice you use should not be high (Xia XY, *et al.*, 2003).

### **Food products prohibited in diabetes**

All kinds of desserts containing high amounts of sugar, honey, sweet waters with added sugar, fruit juices, compotes, etc., sausages, canned meats, fish, smoked meats, fish and poultry including milk, sour cream, cream, mayonnaise, fatty cheeses, margarine, melted oils, alcoholic beverages were avoided. However, the ban is not strict, but small amounts of the mentioned foods can be taken as alternative food sources. Dieting and

extending the quality of life depends on the patient's personal desire (Wu DN, *et al.*, 2006).

## DISCUSSION

### Principle of treatment and prevention

It includes, prescription of medicinal preparations, medicinal herbal teas, food diet (the patient's diet is designed according to her nature), lifestyle instructions.

### Effect of SO<sub>2</sub> gas on the respiratory system, structural changes in lung physiology

Toxic compounds that cause functional disorders in the respiratory system or respiratory organs enter the body through respiration. Pathological changes in the respiratory system can also be caused by chemical compounds carried through the blood. Respiratory toxicology refers to routes of exposure, while respiratory system or respiratory toxicology refers to target organ toxicity. Various toxic gases and aerosols in the air can have a damaging effect on the respiratory system organs. Compounds that have a strong irritating and toxic effect on the respiratory system organs generally have a short-term effect (Xu X, *et al.*, 2022). Meanwhile, major damage occurs in the respiratory tract epithelium and lung parenchyma cells. Due to the action of such irritants, inflammation of the upper and lower respiratory tract develops. Many volatile toxic compounds are pre-stimulated by the body due to their bad odor, nose and throat irritation, and cough-increasing properties. Toxic fumes and inhalation poisons such as carbon monoxide can be fatal. Damage to the respiratory system can manifest itself as acute damage to the upper respiratory tract, acute toxic bronchitis, acute toxic pneumonia, acute edema of the lungs, pneumonia with alveolitis or fibrosis, etc. During acute chemical pneumonia, acute damage to the lung parenchyma occurs, which can be very dangerous for the patient's life. There are many highly toxic chemical compounds that directly cause systemic toxicity without causing organ toxicity. At this time, the inflammatory process in the lungs may not be observed. For example, carbon oxides such as SO<sub>2</sub>, CO, CO<sub>2</sub> and hydrogen cyanide, etc., (Keller H, 2019).

Sulfur dioxide is a compound consisting of one sulfur and two oxygen molecules. There is a covalent-polar bond between sulfur and oxygen. It is used in the sugar industry. Sulfur dioxide, a colorless, pungent reactive gas, is formed during the combustion of sulfur fuels such as coal, fuel oil, metal smelting and other industrial processes. Sulfur dioxide is a colorless, non-flammable gas that causes air pollution and acid rain. Sulfur dioxide is formed when sulfur burns in liquid or solid fuels. Since it can stay in the air for two to four days, it can be transported over long distances depending on air movements. Therefore, the effects cause serious consequences not only in the region where it occurs, but also in distant places. When sulfur dioxide is inhaled by humans, it causes very dangerous consequences for healthy people, from respiratory and lung diseases to death, depending on its concentration (Maftai C, *et al.*, 2022). Sulfur dioxide, to which children and asthmatics are particularly sensitive, causes narrowing of the respiratory tract and symptoms such as wheezing, chest tightness and shortness of breath (Xu X, *et al.*, 2022). Long-term exposure to sulfur dioxide causes respiratory diseases, changes in the defense mechanism of the lungs and worsening of existing heart diseases. Sulfur dioxide is used in the production of sulfuric acid. Long-term exposure to sulfur dioxide causes respiratory diseases, changes in the defense mechanism of the lungs and worsening of existing heart diseases (Maftai C, *et al.*, 2022; Karimova RC, *et al.*, 2022).

### Diagnostic methods

Diagnosis of respiratory system pathologies is based on laboratory and instrumental examinations. Laboratory analyzes are divided into two groups, screening and special tests.

**Screening analysis:** General analysis of blood, general analysis of urine, biochemical analysis of blood.

**Special tests:** general analysis of sputum, sputum for tuberculous mycobacteria, sputum for atypical cells, sputum for bacterial culture, examination of pleural fluid.

**Instrumental examinations include:** Functional diagnostic methods, X-ray and X-ray contrast examination methods, ultrasound examination, and radioisotope method.

### Endoscopic method

Laboratory diagnostic screening methods are carried out in clinical and biochemical laboratories. Currently, a general analysis of blood reveals, leukocytosis, toxic granularity of neutrophils, increase in EHS-signs of microbial inflammation eosinophilia, increase in EHS-signs of allergic inflammation, parasitic diseases anemia, increase in EHS-are signs of tumor processes, bleeding and chronic intoxication. Erythrocytosis, increase in the number of hemarrhitis (Xu X, *et al.*, 2022). Decrease in EHS-signs of chronic respiratory failure. Urine, oliguria, saturated yellow color of urine, hyperstenuria, low or moderate proteinuria are observed. In biochemical analysis, dysproteinemia, Alpha (α) 2 and Gamma (γ) globulins, sialic acids, seromuroid, fibrinogen, C-reactive protein are detected (Keller H, 2019; Karimova RC, *et al.*, 2022; Varfolomeev S, 2007).

## CONCLUSION

In conclusion, rapid advancements in scientific and technical fields, particularly in the chemical industry, have significantly contributed to environmental pollution and the disruption of ecological balance. These degradation processes in the environment are alarming as they pose severe threats to the biosphere and, consequently, to all living organisms. Among the numerous health issues exacerbated by environmental pollution, Diabetes Mellitus (DM) stands out as a critical concern. This chronic condition, characterized by elevated blood sugar levels due to insulin resistance or deficiency, underscores the intricate link between environmental health and human diseases. Addressing the environmental factors contributing to such health conditions is imperative for safeguarding both ecological and human health.

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