

# Influence of Blood Insulin Levels on The Daily Life and Health of Patients with COPD

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**Abstract:** The study examines hyperinsulinemia in patients with COPD and its impact on their lives. Clinical data and biochemical indicators were analyzed, including blood insulin levels and CAT questionnaire outcomes. A high frequency of hyperinsulinemia was identified, which has clinical significance for treatment and improving prognosis and quality of life for patients.

**Key words:** COPD, Chronic obstructive pulmonary disease, metabolic syndrome, insulin, hyperinsulinemia, insulin resistance, CAT, quality of life

**Introduction.** Chronic obstructive pulmonary disease (COPD) and metabolic syndrome (MS), with various manifestations including hyperinsulinemia, are conditions with a pandemic prevalence worldwide [3]. Chronic obstructive pulmonary disease (COPD) is a progressive airway disease characterized by persistent airflow obstruction.

The Global Strategy for the Diagnosis, Treatment and Prevention of Chronic Obstructive Pulmonary Disease focuses on the impact of comorbidities on COPD severity, quality of life and survival [5]. Currently, much attention is paid to the study of the mutual negative influence of chronic obstructive pulmonary disease and metabolic syndrome [8].

Insulin resistance is an essential component of the metabolic syndrome and precedes the development of diabetes, cardiovascular diseases (including coronary heart disease and arterial hypertension), and heart failure. It may also be associated with the development of Alzheimer's disease, pulmonary dysfunction, chronic kidney disease, liver cirrhosis, rheumatoid arthritis, gout, trauma, burns, sepsis and cancer cachexia [4].

Insulin resistance is an integral indicator of cardiometabolic risk in patients with chronic obstructive pulmonary disease [1]. However, despite this, little is known about the incidence of hyperinsulinemia in patients with COPD and its clinical significance.

You should also pay attention to the problem of insulin resistance, which is common in patients with COPD and can aggravate the course of the disease [2]. Although exact prevalence data varies across studies [6], the general trend indicates that people with chronic obstructive pulmonary disease (COPD) are more likely to experience insulin resistance and type 2 diabetes. The prevailing prevalence rate is 18.7% among patients with COPD, compared with 10.5% in the general population [9].

Patients suffering from insulin resistance and COPD may experience a significant decline in their quality of life, manifested by increased symptoms such as difficulty breathing, increased fatigue and limited physical activity. These factors can reduce the patient's ability to self-care and overall functional activity [7].

**Aim:** to determine the incidence of blood hyperinsulinemia and its impact on the daily life and health of patients with COPD.

**Materials and methods.** The study included 100 COPD patients, including 15% COPD III and 85% stage IV COPD who were hospitalized in the pulmonology department of the Republican Specialized Medical Scientific and Practical Center for Phthisiology and Pulmonology.

To confirm the diagnosis and determine the severity of the disease, spirometry was performed using the SMP-21/01-R-D device (Monitor, Russia). The average age of the patients was  $66 \pm 8$  years.

Fasting serum insulin levels were measured using an Immulite 2000 XPi automated immunochemical analyzer. The reference insulin value ranged from 2.7 to 10.4  $\mu$ IU/ml.

The impact on daily life and health of COPD patients was assessed using the CAT questionnaire. The results were interpreted according to the following parameters: from 0 to 10 was regarded as a slight influence, from

11 to 20 as a moderate influence, from 21 to 30 as a strong influence, from 31 to 40 as an extremely strong influence on the patient's life.

Data analysis was performed using statistical software, and values with  $p < 0.05$  and 95% confidence level were used for statistical significance.

**Results and discussions:** The average blood insulin level among all examined patients was  $34.19 \pm 33.98$   $\mu\text{IU/ml}$  (95% CI 27.45 – 40.93).

Elevated insulin levels were detected in 88% of patients. At the same time, only 11% of patients had a normal insulin level, and 1% of patients had an insulin level below normal (Table 1).

**Table 1.**

Index	Categories	%
Insulin	Increased level	88,0
	Norm	11,0
	Deficiency	1,0

The difference in insulin levels depending on the stage of COPD is presented in Table 2. The results of the study noted that as the severity of the disease increases, there is a tendency for insulin levels to increase.

**Table 2**

**Insulin level depending on the stage of COPD**

Index	Categories	Insulin ( $\mu\text{IU/ml}$ )		
		M $\pm$ SD	95% CI	n
COPD stage	COPD III	$29,82 \pm 11,22$	23,61 – 36,03	15
	COPD IV	$34,96 \pm 36,55$	27,08 – 42,85	85

The average insulin level in patients with COPD stage 3 was  $29.82 \pm 11.22$   $\mu\text{IU/ml}$ , which is higher than normal.

In COPD stage 4, the average level was  $34.96 \pm 36.55$   $\mu\text{IU/ml}$ , which is also interpreted as an increased level.

When considering the results of the CAT questionnaires, it was revealed that patients with COPD stage 3 averaged  $23.00 \pm 5.67$  points (19.86 – 26.14 95% CI), and in patients with stage 4 COPD it was  $25.59 \pm 4.55$  points (24.61 – 26.57 95% CI).

We also analyzed insulin levels depending on the CAT scale scores.

It was found that in patients with a CAT level of 31-40 points (extremely strong impact on quality of life), blood insulin averaged  $55.44$   $\mu\text{IU/ml}$ , and with a range of 21-30 points (strong impact on quality of life) it was  $30.16$   $\mu\text{IU/ml}$ .

When studying the relationship between blood insulin levels and the CAT questionnaire (Table 3), a tendency was identified for an increase in blood insulin levels with an increased impact of COPD on the daily life of patients. So, in 86.8% of patients with the results of the CAT questionnaire as “a strong influence of COPD on the patient’s life”, elevated insulin levels were detected, similarly, in 86.7% of patients with the results of the CAT questionnaire as “a very strong influence of COPD on the patient’s life”

**Table 3**

**Correlation between blood insulin levels and CAT questionnaire scores**

CAT  Insulin level	Impact on daily life	
	The profound impact of COPD on a patient's life	The extreme impact of COPD on a patient's life
Deficiency	1 (1,5)	0 (0,0)
Norm	8 (11,8)	2 (13,3)
Increased level	59 (86,8)	13 (86,7)

When comparing data from the total number of patients with CAT at the level of 31-40 points, it was found that out of 16 patients in this category, 13 (81.25%) patients had elevated blood insulin levels. Among the total number of patients with CAT data at the level of 21-30 points, of which there were 68 people, elevated insulin levels were found in 59 (86.76%) patients.

**Conclusions.** The study examined the correlation between blood insulin levels and the impact on daily life in patients with chronic obstructive pulmonary disease. The results showed that 88% of patients with COPD had elevated insulin levels, the mean value of which was  $34.19 \pm 33.98 \mu\text{IU/ml}$ . Particularly pronounced hyperinsulinemia was noted in patients with stage 4 COPD, which occurs in an extremely severe form.

Analysis of the CAT questionnaire indicators revealed that the maximum values are also typical for patients with stage 4 COPD. Based on the CAT, it was found that extremely high impact on daily life was reported in 16.5% of cases, while severe impact was reported in 69.4%.

A detailed analysis of the relationship between blood insulin levels and CAT data found that the average insulin level in patients with an extremely high impact on quality of life was  $55.44 \mu\text{IU/ml}$ , and in those with a strong impact on quality of life it was  $30.16 \mu\text{IU/ml}$ . A comparative analysis showed that of 16 patients with an extremely strong impact of COPD on quality of life, 13 (81.25%) had an increase in insulin levels. Among 68 patients with a strong impact on quality of life, hyperinsulinemia was recorded in 59 (86.76%) cases.

A connection was also found between elevated insulin levels and the increased impact of COPD on the daily life of patients. In 86.8% and 86.7% of patients with CAT questionnaire results at the level of “high impact of COPD on daily life” and “very high impact of COPD on the patient’s life,” respectively, an increase in blood insulin levels was detected.

Thus, these studies demonstrate a direct relationship between insulin resistance, the severity of COPD and the deterioration in the quality of daily life of patients with this disease. These results suggest that adjusting insulin levels may have a positive impact on quality of life in patients with COPD.

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