Volume 2, Issue 6, June - 2024 **ISSN (E):** 2938-379X

INFLUENCE OF QUERCETIN ON THE LEVEL OF GLUCOSE AND GLYCED HEMOGLOBIN IN AN EXPERIMENTAL ALLOXAN MODEL

(TYPE I DIABETES MELLITUS)

Lenara Serverovna Seit-Asan
Chirchik State Pedagogical University
E-mail: seitasanlenara@gmail.com

Abstract

Type 1 diabetes mellitus, according to modern concepts, is an autoimmune disease in which changes in the humoral and cellular immunity play a key role. This leads to infiltration of the islets of Langerhans by immunocompetent cells (insulitis) and, ultimately, causes the destruction of β-cells with the development of absolute insulin deficiency. In childhood, the loss of β-cells occurs rapidly and by the end of the first year of the disease the residual endocrine function of the pancreas fades. Quercetin is one of the most common flavonoids in plants and exhibits a wide range of biological activity, which makes it promising for the development of drugs based on it and the synthesis of new pharmacologically active molecules. The most common forms of quercetin are quercetin glucuronide, quercetin sulfate, and methylated quercetin [1,4]. It is worth noting that most often this flavonoid is found in plants in the form of compounds, which, as a rule, contain sugars in their structure. For example, rutin is a glycoside consisting of quercetin and the disaccharide rutinose. When glycone is replaced by galactose, a well-known phenolic compound, hyperoside, is formed. The introduction of sugars into the structure of quercetin, in addition to affecting its absorption and pharmacological effect, also changes its solubility. Based on this, it should be considered relevant to study the effect of the flavonoid quercetin when administered orally in order to create various forms of drugs for the treatment of diabetes. [3.5].

Introduction

Materials and methods: The studies were carried out on 12 white outbred mature male rats weighing 180-250 g, kept in standard conditions of the vivarium of the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan, Laboratory of Pharmacology. The animals were kept and cared for in compliance with the principles of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes [2]

The alloxan diabetes model was reproduced by a single subcutaneous injection of a 5% solution of alloxan hydrochloride at a dose of 140 mg/kg body weight. The development of diabetes was monitored by measuring glucose levels in the blood serum of rats. Diabetes was diagnosed when the fasting serum glucose level was greater than 14 mmol/L. Changes in biochemical parameters were studied on the 7th, 14th and 21st days of the experiment.

Monitoring of the reproduction of diabetes was carried out weekly by measuring the weight of animals and determining individual biochemical parameters of carbohydrate, protein and lipid metabolism. Quercetin at a dose of 40 mg per kg of body weight for 21 days. After 21 days, the animals were decapitated, observing international rules for the humane treatment of animals, and biological materials were removed.

Study results: When quercetin was administered to rats with diabetes at a dose of 40 mg/kg, a decrease in the absolute glucose level was observed by 14.7% on the 7th and 27.5% on the 14th day of illness compared with the control group. On the 21st day of the experiment, glucose levels were 29.6% lower than in the control group. However, even during this period, the glucose level in experimental animals was 29.8% higher than in intact animals.

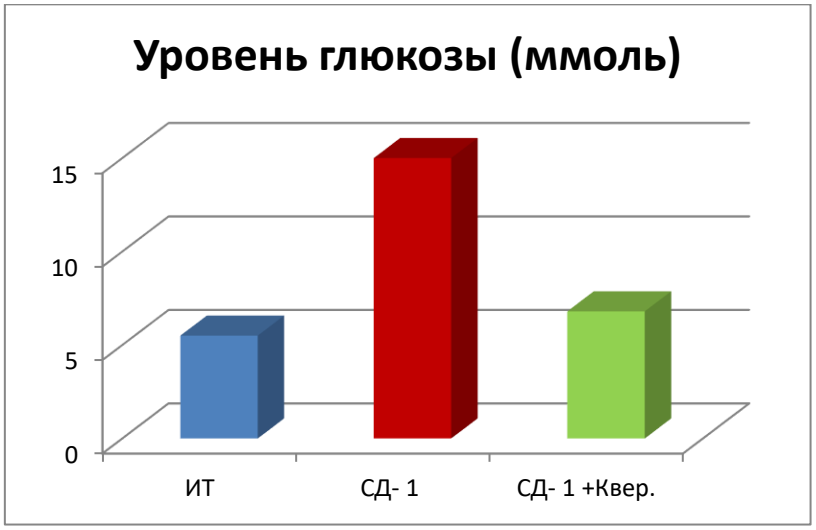
Studies conducted in rats with an experimental alloxan model of type I diabetes mellitus have shown that quercetin can reduce blood glucose levels and improve glucose tolerance.

For 21 days, every 7 days, the amount of glucose and glycated hemoglobin in the blood serum of the animals was determined. After the blood glucose level reached 7-8 mmol/l and glycated hemoglobin more than 7%, as well as changes in the behavioral activity of the animals, characteristic symptoms of type 1 diabetes, the animals were decapitated, in compliance with the rules of humane treatment of animals. For the study, blood was taken from the tail vein of rats.

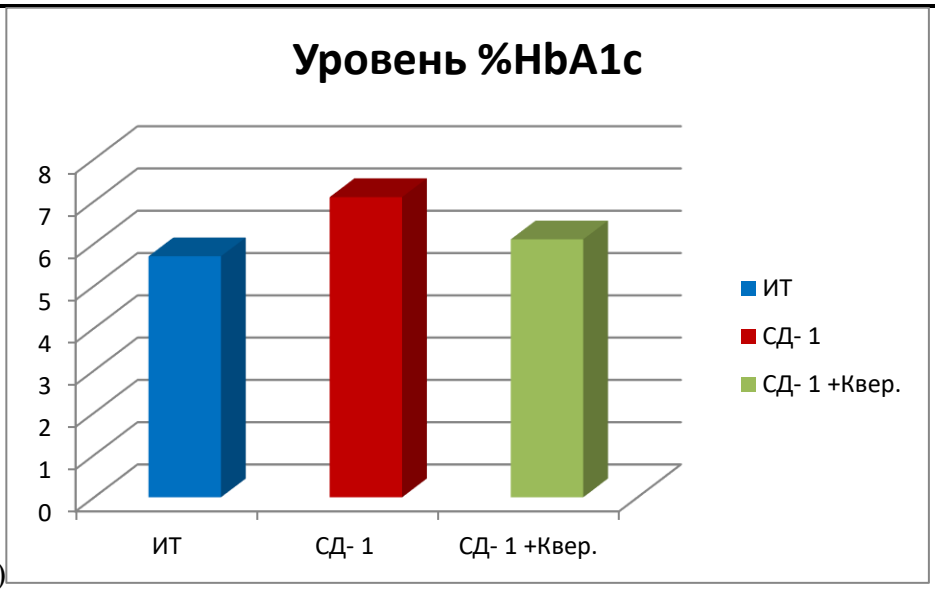
Table 1 Study of the content of some biochemical parameters in the blood of animals with diabetes (M±m), n=3

Группа животных	Уровень глюкозы		Уровень HbA_{1c}, %
	ммоль/л	%	
ИТ	5,5±0,05	**100**	5,7
СД- 1	15,0±0,07	**272,7**	7,1
СД- 1 + кверцетин	6,8±0,06	**123,6**	6,4

The table shows that there is a 3-fold increase in glucose levels, and with the introduction of quercetin this figure approached normal, and the level of glycated hemoglobin was 7%; with the introduction of quercetin, the level of glycated hemoglobin normalized to 6.4%.



А)



Б)

Figure 1. Study of the content of some biochemical parameters in the blood of animals with type 1 diabetes (M±m), n=3: a) Glucose level, mmol/l b) HbA1c level, %

Table 2 The effect of quercetin on the level of glucose (mmol/l) in the blood during the experimental dynamics of diabetes (M±m; n=3)

Группы		Контроль	Кверцетин
			40 мг/кг
Интактные		4,26±0,10	
СД	7 сут	12,08±0,87	7,75±0,41
	14 сут	13,91±0,68	6,46±0,22
	21 сут	14,85±0,51	6,53±0,24

When quercetin was administered to rats with diabetes at a dose of 40 mg/kg, a decrease in the absolute glucose level was observed by 14.7% on the 7th and 27.5% on the 14th day of illness compared with the control group. On the 21st day of the experiment, glucose levels were 29.6% lower than in the control group. However, even during this period, the glucose level in experimental animals was 29.8% higher than in intact animals.

Studies conducted in rats with an experimental alloxan model of type I diabetes mellitus have shown that quercetin can reduce blood glucose levels and improve glucose tolerance.

Conclusion

When modeling type 1 diabetes mellitus using alloxan, experimental animals - outbred rats - show pronounced variability in individual sensitivity to the diabetogenic effect of cytotoxic analogues of glucose. This may be due primarily to differences in the state of pro- and antioxidant balance, which determines the degree of damage to the islet apparatus, to the activity of the processes of restoring the structure and function of the pancreas, as well as to the degree of activation of the glucocorticoid function of the adrenal glands.

Список использованной литературы:

1. А. С. Чиряпкин , Д. С. Золотых , Д. И. Поздняков // Обзор биологической активности флавоноидов: кверцетина и кемпферола // DOI: 10.32415/jscientia_2023_9_2 с.5-20
2. Арипов А.Н., Фесенко Л.М. Клиническая биохимия. Методы. Т.-2000-78-79с.
3. В. М. Шейбак // Биохимические механизмы синтеза и секреции инсулина // УДК 577.175.722:612.349.8.015.36 с.213-221.
4. В. М. Шейбак //Биохимические механизмы синтеза и секреции инсулина // / Журнал Гродненского государственного медицинского университета. – 2017. – № 1. – с. 22-27.
5. Доркина, Е.Г. Изучение гепатозащитного действия природных флавоноидных соединений / Е.Г. Доркина // Эксперим. и клинич. фармакология. - 2004. -Т.67, №6. - С. 41- 45.
6. Европейская конвенция о защите позвоночных животных, используемых для экспериментов или в иных научных целях 1986 года [Электронный ресурс] — Доступ из справ.-правовой системы КонсультантПлюс. С.314-320.