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A. O. Savych, S. M. Marchyshyn, R. Yu. Basaraba

Determination of hypoglycemic activity of the herbal mixtures in screening study

I. Horbachevsky Ternopil National Medical University

Key words: herbal mixtures, hypoglycemic activity, diabetes mellitus, oral glucose tolerance test, intraperitoneal glucose tolerance test

Diabetes mellitus (DM) is one of WHO's priority issues. It requires immediate resolution as the epidemiological situation is gaining alarming proportions – the number of diabetic patients is increasing every year along with the number of deaths and disabilities due to the development of micro- and macroangiopathies [1]. According to the official information of International Diabetes Federation (2019), the number of patients is projected to increase to 642 million by 2040 [2].

An important problem of pharmacovigilance is that existing pharmacotherapy can effectively reduce hyperglycemia, but it is not always able to stabilize fluctuations in glycemic values during the day and maintain it at an optimal level. This leads to the development of the pathological processes cascade – excessive glycation and inactivation of the body's antioxidant defense system, triggering the processes of free radical oxidation of lipids and, as a consequently, the formation of oxidative stress, which leads to the development and progression of diabetic angiopathies [1, 3, 4].

Therefore, the optimization of pharmacotherapy, search and study of new drugs with hypoglycemic activity for the prevention and treatment of DM and its dangerous complications are a top issues of pharmacy and medicine.

One of these areas is using the herbal remedies, either as monotherapy for the prevention or at the mild stages of the disease or in the combination with traditional therapy at more severe forms of the disease. Phytotherapy is a justified method for the diseases prevention and treatment because it has some advantages, such as relatively low toxicity, mild pharmacological effects and possibility to be used for long periods without significant side-effects, and it can be combined with synthetic drugs, has a complex activity through a number of biologically active compounds [5, 6]. The combinations of different medicinal plants deserve particular attention, because they containe several biologically active substances that can affect various links of the pathogenetic mechanism of diabetes mellitus and its complications development [7–9]. In addition, Ukrainian pharmaceutical market is represented mainly by synthetic antidiabetic drugs, which account for over 92 % of all oral antidiabetic drugs. Today two antidiabetic herbal mixtures are registered in Ukraine – the herbal mixture «Arfazetin», which includes *Vaccinii myrtilli cormus, Phaseoli valvae fructum, Eleutherococci senticosi rhizomata et radices, Rosae fructus, Equiseti arvensis herba, Hyperici herba, Matricariae flores and the herbal mixture «Sadifit», which includes Helianthi tubera, Steviae folia, Vaccini myrtilli cormus, Phaseoli valvae fructum, Thea chinensis, Menthae piperitae folia*.

However, *Vaccinii myrtilli cormus, Eleutherococci senticosi rhizomata et radices* and *Hyperici herba* are potent plants that can be dangerous with prolonged use. In addition, *Eleutherococci senticosi rhizomata et radices* has a tonic effect and is contraindicated in coronary heart disease, heart failure and hypertension, which are frequent complications of diabetes.

Thus, the *aim of the study* was to evaluate the hypoglycemic activity of some herbal mixtures and to establish

their conditionally therapeutic doses on normoglycemic rats by glucose load tests.

Materials and methods. *Plant materials*. The herbal raw materials harvested in June to August 2019 in Ternopil region (Ukraine) and in Charpathians (Ukraine) (*Myrtilli folia*) were used. After harvesting, the raw materials were dried, crushed and standardized according to the general GACP requirements [10]. The plants were identified by Department of Pharmacognosy with Medical Botany, I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine. The voucher specimens of the herbal raw materials have been deposited in Departmental Herbarium for future record.

Five different herbal mixtures, which are traditionally used in folk medicine for the prevention and treatment of diabetes mellitus type 2 in Ukraine [11] without scientific evidences of their hypoglycemic activity were investigated. Compositions of the mixtures are given in Table 1.

Extraction procedure. The samples of the herbal raw material were ground into a powder by laboratory mill. Then 10 g of each powdered herbal mixture was put into a 100 mL conical flask and 120 mL of distilled water was added to each. The aqueous extracts were obtained by heating in the boiling water bath for 30 min. The extracts were filtered using Whatmann

Table 1

Compositions of the herbal mixtures

Herbal mixtures	Herbals	Quantity of the herbals in the mixtures, g
№ 16	*Phaseoli pericarpium*	20,0
	Avenae sativae semina	20,0
	Myrtilli folia	20,0
	Lini semina	20,0
	Elymi repens rhizomata	20,0
		Total: 100,0
№ 17	*Taraxaci radices*	20,0
	Rosae fructus	20,0
	Lini semina	20,0
	Melissae folia	20,0
	Avenae sativae semina	20,0
		Total: 100,0
№ 18	*Veronicae herba*	20,0
	Betulae verrucosae folia	20,0
	Urticae folia	20,0
	Arctii lappae radices	20,0
	Lini semina	20,0
		Total: 100,0
№ 19	*Urticae folia*	20,0
	Taraxaci radices	20,0
	Myrtilli folia	20,0
	Rosae fructus	20,0
	Menthae folia	20,0
		Total: 100,0
№ 20	*Betulae verrucosae folia*	20,0
	Myrtilli folia	20,0
	Rosae fructus	20,0
	Menthae folia	20,0
	Phaseoli pericarpium	20,0
		Total: 100,0

filter paper № 1. Then the filtrates were evaporated by rotary evaporator and were lyophilized to dryness. The lyophilized powders of each herbal mixture were stored at 4 °C for further use.

The aqueous extract of the comparison preparation – the official herbal mixture «Arfazetin» was prepared using 5 g of dry raw material and 110 mL of distilled water (as indicated in the instructions for use) under the same conditions.

To prepare the metformin suspension, the metformin tablets were crushed and mixed with 2 mL of distilled water.

Drugs. The official herbal mixture «Arfazetin» was purchased from PJSC Pharmaceutical Factory «Viola» (Ukraine), the standard drug – metformin SANDOZ® from Lek S. A. (Poland).

Experimental Animals. The study was performed on male albino rats weighing between 180 g and 200 g, which were bred at the vivarium of the Central Research Laboratory of I. Horbachevsky Ternopil National Medical University, where they were kept under appropriate conditions (at a constant room temperature of (22 ± 1) °C, 40–70 % humidity conditions and a 12-h light/dark cycle). Throughout the experimental period, the animals received standard rat diet and water *ad libitum*. The animals were treated in accordance with the internationally accepted standard ethical guidelines for laboratory animal use and care as described in the European Community Guidelines [12]. All protocols for animals experiment were approved by ethical committee of I. Horbachevsky Ternopil National Medical University.

Experimental Protocol. Screening study of hypoglycemic activity of the herbal mixtures and determination of their conditionally therapeutic dose was performed on intact normoglycemic rats. Animals were randomly divided into eight groups of eight animals (n = 8) each and received different preventive treatment once daily during 20 days. Group I (Control) received *per os* (*p.o.*) distilled water (12 mL/kg/day), group II (HM «Arfazetin») – aqueous extract of the official herbal mixture «Arfazetin» (9 mL/kg/day, *p.o.*) [13], group III (MET) – suspension of metformin (60 mg/kg/day, *p.o.*) [14], group IV–VIII (HM) – aqueous extracts of the studied herbal mixtures № 16–20 in doses 6 mL/kg/day, 9 mL/kg/day and 12 mL/kg/day, *p.o.* Metformin was chosen as a comparison drug because according to the recommendations of the American Diabetes Association and the International Diabetes Federation, it is recognized as the «gold standard» in the treatment of diabetes mellitus type 2 [1, 2]. The official herbal mixture «Arfazetin» was chosen as a reference drug because it is similar to the studied mixtures in origin and mechanism of action. The last oral administration of the researched means was carried out 2 h before the glucose load tests.

Measurement of Oral Glucose Tolerance Test (OGTT). Fasting blood glucose (basal glycemia) was measured in tail blood samples after a 6-h fast on 20th day of the experiment using a glucose analyzer (glucometer Accuk-Check, Germany). OGTT was performed after measuring basal glycemia by glucose solution (3 g/kg, p. o.) administration. Blood glucose levels were determined at 0, 30th, 60th and 120th min after glucose loading [15].

Measurement of Intraperitoneal Glucose Tolerance Test (IPGTT). After overnight fasting (16–18 h) on 21th day of the experiment, rats were injected intraperitoneally with glucose solution (2 g/kg, i. p.) in the morning. The level of glucose in the blood obtained from the tail vein of animals was determined before the introduction of glucose and after 15, 45 and 60 min using a glucose analyzer [15].

Statistical Analysis. The values were expressed as mean ± SEM. The data were analysed by using GraphPad Prism software version 5.03. The results were compared by using the ANOVA-One-Way test followed by *Mann-Whitney U test*. The difference was considered statistically significant at $p < 0,05$. The value of the integrated glycemic index of the area under glycemic curve (AUC_{glu}, mM/L · min) was calculated using the statistical software package «MedCalk, v.9.3.7.0».

Result and discussion. At the first stage of the screening study, the effect of the herbal mixtures and the comparison drugs on basal glycemia and on glycemia after carbohydrate loading by OGTT after 20 days of preventive treatment was studied. This test allows simulate alimentary hyperglycemia that occurs after eating. Hypoglycemic activity of the herbal mixtures and reference drugs was manifested by their ability to reduce blood glucose levels at the 30th min of the test, during its maximum increase in response to oral carbohydrate load.

The results of the study (Table 2) showed that 20-day preventive administration of all five herbal mixtures № 16–20 at doses 6 mL/kg/day, 9 mL/kg/day and 12 mL/kg/day significantly ($p < 0,05$) reduced glycemia at the 30th min of OGTT compared with the Control group. However, the best results of hypoglycemic activity at the 30th min of the test showed the herbal mixture № 19 at dose 12 mL/kg/day, it reduced blood glucose level by 44 % compared with the Control group. Metformin showed a similar result in efficacy, as it reduced alimentary hyperglycemia by 46 % to the Control group of animals at 30th min. The official herbal mixtures «Arfazetin» was inferior in efficiency to the herbal mixture № 19 at dose 12 mL/kg/day and reduced glycemia by 32 % as to the Control group at the 30th minute of the test (Table 2).

During the determination of integrated glycemic index based on the results of OGTT, it was found that the area under glycemic curve (AUC_{glu}) of the herbal mixture № 19 (12 mL/kg/day) was 263,4 mM/L · min. Regarding the results of the comparison drugs, the AUC_{glu} of metformin (60 mg/kg/day) was lower and amounted to 256,8 mM/L · min, and the herbal mixture «Arfazetin» (9 mL/kg/day) was higher and amounted to 322,8 mM/L · min.

At the second stage of the screening study, the ability of the herbal mixtures

Table 2

Hypoglycemic effect of the herbal mixtures compared to the official herbal mixture «Arfazetin» and tablets metformin by oral glucose tolerance test after 20 days of preventive treatment of normoglycemic rats

Group of animals	Glucose level, mM/L			
	0 min	30 min	60 min	120 min
Control	4,17 ± 0,07	7,89 ± 0,09	7,62 ± 0,12	5,85 ± 0,13
HM «Arfazetin», 9 mL/kg	4,08 ± 0,08	5,38 ± 0,11*	5,33 ± 0,15*	4,92 ± 0,14*
MET, 60 mg/kg	3,91 ± 0,16	4,28 ± 0,17*, **	4,17 ± 0,18*,**	4,02 ± 0,14*,**
HM № 16; 6 mL/kg	3,93 ± 0,17	5,48 ± 0,16*	5,33 ± 0,18*	5,29 ± 0,18*
HM № 16; 9 mL/kg	4,01 ± 0,16	5,49 ± 0,17*	5,39 ± 0,13*	5,26 ± 0,17*
HM № 16; 12 mL/kg	4,04 ± 0,15	5,44 ± 0,17*	5,31 ± 0,18*	5,17 ± 0,19*
HM № 17; 6 mL/kg	4,03 ± 0,18	5,59 ± 0,16*	5,42 ± 0,14*	5,33 ± 0,11*
HM № 17; 9 mL/kg	4,06 ± 0,17	5,51 ± 0,18*	5,39 ± 0,18*	5,21 ± 0,19*
HM № 17; 12 mL/kg	4,04 ± 0,11	5,42 ± 0,19*	5,32 ± 0,13*	5,18 ± 0,11*
HM № 18; 6 mL/kg	4,02 ± 0,18	5,62 ± 0,15*	5,48 ± 0,13*	5,31 ± 0,18*
HM № 18; 9 mL/kg	4,07 ± 0,15	5,54 ± 0,15*	5,39 ± 0,10*	5,18 ± 0,17*
HM № 18; 12 mL/kg	4,08 ± 0,11	5,49 ± 0,16*	5,36 ± 0,14*	5,17 ± 0,15*
HM № 19; 6 mL/kg	3,92 ± 0,14	5,32 ± 0,15*	5,21 ± 0,18*	5,11 ± 0,18*
HM № 19; 9 mL/kg	4,02 ± 0,17	5,25 ± 0,13*	5,19 ± 0,18*	5,09 ± 0,14*
HM № 19; 12 mL/kg	4,05 ± 0,16	4,39 ± 0,15*, **	4,24 ± 0,16*, **	4,12 ± 0,18*
HM № 20; 6 mL/kg	4,09 ± 0,17	5,63 ± 0,20*	5,59 ± 0,18*	5,32 ± 0,18*
HM № 20; 9 mL/kg	4,03 ± 0,14	5,51 ± 0,17*	5,39 ± 0,19*	5,19 ± 0,19*
HM № 20; 12 mL/kg	4,06 ± 0,11	5,48 ± 0,28*	5,32 ± 0,18*	5,18 ± 0,11*

*Notes. Values are expressed as mean ± SEM, n = 8; *p < 0,05 to Control group; **p < 0,05 to the herbal mixture «Arfazetin».*

№ 16–20 and comparison drugs to improve carbohydrate tolerance was determined using IPGTT. The hypoglycemic effect of the herbal mixtures and comparison drugs was assessed by their ability to reduce hyperglycemia at 15th min of IPGTT during the maximum rise of blood glucose in the animals in response to intraperitoneal carbohydrate load (Table 3).

During the study, a significant ($p < 0,05$) increase in blood glucose levels was observed in animals from the Control group at the 15th min of the test (peak hyperglycemic), exceeding the initial data by 2,0 times. The best ability to reduce the hyperglycemic peak of IPGTT showed the herbal mixture № 19 (12 mL/kg/day) because blood glucose level was lower by 26 % as compared with the Control group. Metformin showed a similar effect and reduced hyperglycemia at the 15th min of the test by 27 % against the Control group, and the official herbal mixture «Arfazetin» was slightly inferior to the effectiveness of the herbal mixture № 19 at dose 12 mL/kg/day and reduced hyperglycemia by 21 %. By the end of the experiment at the 60th min of IPGTT, the blood glucose level returned to baseline in all groups of animals (Table 3).

The results of a screening study of the herbal mixtures № 16–20 using OGTT and IPGTT indicated dose-dependent hypoglycemic activity. All studied mixtures demonstrated the best hypoglycemic effect at a dose of 12 mL/kg/day.

The study using glucose load tests showed that the herbal mixtures № 16, № 17, № 18 and № 20 at doses 6 mL/kg/day, 9 mL/kg/day and 12 mL/kg/day showed hypoglycemic activity, but it was slightly lower compared with the herbal mixture № 19 (12 mL/kg/day) and comparison drugs – the official herbal mixture «Arfazetin» (9 mL/kg/day) and tablets metformin (60 mg/kg/day) (Tables 2, 3).

Hypoglycemic activity of the studied herbal mixtures is quite predictable,

Table 3

Hypoglycemic effect of the herbal mixtures compared to the official herbal mixture «Arfazetin» and tablets metformin by intraperitoneal glucose tolerance test after 20 days of preventive treatment of normoglycemic rats

Group of animals	Glucose level, mM/L			
	0 min	15 min	45 min	60 min
Control	4,21 ± 0,11	8,62 ± 0,17	5,23 ± 0,18	4,42 ± 0,11
HM «Arfazetin», 9 ml/kg	4,19 ± 0,18	6,82 ± 0,19*	5,01 ± 0,17	4,43 ± 0,15
MET, 60 mg/kg	4,14 ± 0,19	6,32 ± 0,17*,**	4,92 ± 0,18	4,21 ± 0,13
HM № 16; 6 mL/kg	4,18 ± 0,15	7,37 ± 0,12*	5,36 ± 0,15	4,31 ± 0,18
HM № 16; 9 mL/kg	4,13 ± 0,14	7,26 ± 0,18*	5,21 ± 0,17	4,23 ± 0,14
HM № 16; 12 mL/kg	4,16 ± 0,19	7,19 ± 0,14*	5,19 ± 0,13	4,27 ± 0,21
HM № 17; 6 mL/kg	4,20 ± 0,22	7,39 ± 0,17*	5,38 ± 0,11	4,31 ± 0,11
HM № 17; 9 mL/kg	4,12 ± 0,17	7,25 ± 0,13*	5,22 ± 0,18	4,23 ± 0,17
HM № 17; 12 mL/kg	4,17 ± 0,21	7,09 ± 0,15*	5,17 ± 0,16	4,25 ± 0,13
HM № 18; 6 mL/kg	4,18 ± 0,17	7,36 ± 0,15*	5,39 ± 0,16	4,34 ± 0,17
HM № 18; 9 mL/kg	4,23 ± 0,16	7,21 ± 0,12*	5,28 ± 0,13	4,36 ± 0,22
HM № 18; 12 mL/kg	4,17 ± 0,15	7,17 ± 0,15*	5,15 ± 0,16	4,28 ± 0,15
HM № 19; 6 mL/kg	4,16 ± 0,15	7,08 ± 0,16*	5,14 ± 0,13	4,26 ± 0,19
HM № 19; 9 mL/kg	4,09 ± 0,16	7,07 ± 0,22*	5,07 ± 0,15	4,18 ± 0,15
HM № 19; 12 mL/kg	4,18 ± 0,13	6,35 ± 0,15*,**	4,93 ± 0,14*	4,24 ± 0,19
HM № 20; 6 mL/kg	4,17 ± 0,16	7,34 ± 0,16*	5,37 ± 0,15	4,28 ± 0,12
HM № 20; 9 mL/kg	4,18 ± 0,13	7,23 ± 0,19*	5,26 ± 0,16	4,31 ± 0,11
HM № 20; 12 mL/kg	4,09 ± 0,16	7,13 ± 0,17*	5,16 ± 0,18	4,23 ± 0,21

*Notes. Values are expressed as mean ± SEM, n = 8; *p < 0,05 to Control group; **p < 0,05 to the herbal mixture «Arfazetin».*

because they include medicinal plant raw materials containing biologically active substances with proven hypoglycemic action. The main groups of biologically active substances that can lower blood glucose are polysaccharides, especially inulin that has the ability to increase glucagon-like peptide-1 (GLP-1) and insulin secretion, to inhibit the glucagon secretion, to stimulate the β-cells proliferation and neogenesis [16, 17]. Presented herbal mixtures contain herbal raw materials that are rich in carbohydrates, such as *Avenae sativae semina* (the herbal mixtures № 16 and № 17), *Taraxaci radices* (the herbal mixtures № 17 and № 19), *Elymi repens rhizomata* (the herbal mixture № 16), *Lini semina* (the herbal mixtures № 16, № 17 and № 18), *Arctii lappae radices* (the herbal mixture № 18).

In addition, medicinal plants that are parts of the studied herbal mixtures contain polyphenolic compounds, which exhibit antidiabetic activity by different mechanisms of action, including stimulation of insulin secretion, improvement of pancreatic β-cell functionality, inhibition of gluconeogenesis, intensification of glucose uptake, delay of carbohydrate digestion and glucose absorption, inhibition of protein glycation and insulin fibrillation [18–20]. No less important is their antioxidant activity in the treatment and prevention of diabetes and its complications, because they can suppress reactive oxygen species (ROS) formation either by inhibition of enzymes or by chelating trace elements involved in free radical generation; scavenging ROS; inhibition the enzymes involved in ROS generation – microsomal monooxygenase, glutathione S-transferase, mitochondrial succinoxidase, nicotinamide adenine dinucleotide phosphate (NADH) oxidase, and so forth [20–22]. Medicinal plant raw materials containing phenolic compounds are *Phaseoli pericarpium* (the herbal mixtures № 16 and № 20), *Myrtilli folia* (the herbal mixtures № 16, and № 19 and № 20), *Rosae fructus* (the herbal mixtures № 17, and № 19 and № 20), *Melissae folia* (the herbal mixture № 17), *Veronicae herba* (the herbal mixture № 18), *Betulae verrucosae folia* (the herbal mixtures № 18 and № 20), *Urticae folia* (the herbal mixtures № 18 and № 19), *Menthae folia* (the herbal mixtures № 19 and № 20).

Thus, screening study of the herbal mixtures № 16–20 showed their hypoglycemic activity by OGTT, IPGTT and confirmed the effectiveness of their using in folk medicine for the prevention and treatment of diabetes mellitus type 2.

Conclusions

1. It was conducted the screening study of hypoglycemic activity of the herbal mixtures № 16–20, which are used in folk medicine for the prevention and treatment of diabetes mellitus type 2.
2. It was determined that the greatest effectiveness in terms of the ability to reduce alimentary hyperglycemia during OGTT and reduce impaired carbohydrate tolerance during IPGTT showed the herbal mixture № 19, which includes *Urticae folia, Taraxaci radice, Myrtilli folia, Rosae fructus and Menthae folia*. It was established its conditional therapeutic dose 12 mL/kg/day.

Conflict of interests. There are no conflicts of interest regarding this study.

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A. O. Savych, S. M. Marchyshyn, R. Yu. Basaraba

Determination of hypoglycemic activity of the herbal mixtures in screening study

Diabetes mellitus is an important social and medical problem, as it causes the development of dangerous complications that lead to disability and mortality. This disease is characterized by a multi-vector pathogenesis that requires a comprehensive approach to treatment. Due to the using of medicinal plants mixtures in the treatment of diabetes, it is possible to cover many aspects of the development of this disease and its complications.

The aim of the study was to evaluate the hypoglycemic activity of some herbal mixtures and to establish their conditionally therapeutic doses on normoglycemic rats by glucose load tests.

The study was performed on male albino rats weighing 180–200 g, which for preventive treatment during 20 days orally received aqueous extracts (1:10) of the studied herbal mixtures at a dose 6 mL/kg/day, 9 mL/kg/day and 12 mL/kg/day and comparison drugs – the official herbal mixtures «Arfazetin» at a dose 9 mL/kg/day and metformin tablets at a dose 60 mg/kg/day. The study of hypoglycemic properties and the establishment of a conditional therapeutic doses was carried out using glucose loading tests (OGTT and IPGTT). All experiments were performed in accordance with general ethical principles and the recommendations of the EEC Council directive 2010/63/EU about the protection of animals, which are used for scientific purposes.

The results of the study showed that the 20-day preventive administration of the herbal mixtures reduced alimentary hyperglycemia at the 30th min of OGTT and helped regulate carbohydrate tolerance disorders by reducing hyperglycemia at the 15th min of IPGTT. The highest hypoglycemic activity showed the herbal mixture № 19 (*Urticae folia, Taraxaci radice, Myrtilli folia, Rosae fructus* and *Menthae folia*) at a dose 12 mL/kg/day, which was almost on a par with the comparison drug – metformin tablets, but exceeded the official herbal mixture «Arfazetin». In addition, the dose-dependence of the effectiveness of all five studied herbal mixtures was established.

Key words: herbal mixtures, hypoglycemic activity, diabetes mellitus, oral glucose tolerance test, intraperitoneal glucose tolerance test

А. О. Савич, С. М. Марчишин, Р. Ю. Басараба

Визначення гіпоглікемічної активності рослинних зборів у скринінговому дослідженні

Цукровий діабет є важливою соціальною та медичною проблемою, адже спричиняє розвиток небезпечних ускладнень, що призводять до інвалідизації та смертності населення. Це захворювання характеризується багатовекторним патогенезом, що потребує комплексного підходу до лікування. Завдяки застосуванню зборів лікарських рослин у терапії цукрового діабету можна охопити всі ланки розвитку даного захворювання та його ускладнень.

Мета дослідження – вивчення гіпоглікемічних властивостей рослинних зборів для лікування цукрового діабету 2 типу та встановлення їх умовно терапевтичних доз на нормоглікемічних щурах за тестами глюкозного навантаження.

Дослідження проводилися на інтактних нормоглікемічних білих щурах самцях масою 180–200 г, які попередньо впродовж 20 днів перорально отримували водні екстракти (1:10) досліджуваних зборів у дозі 6 мл/кг/день, 9 мл/кг/день і 12 мл/кг/день і препарати порівняння – офіцинальний збір «Арфазетин» у дозі 9 мл/кг/день і метформін у дозі 60 мг/кг/день. Вивчення гіпоглікемічних властивостей і встановлення умовно терапевтичної дози досліджуваних засобів здійснювали за допомогою тестів глюкозного навантаження, орального (ОТТГ) і внутрішньоочеревинного (ВОТТГ).

Результати дослідження показали, що 20-денне введення рослинних зборів знижувало аліментарну гіперглікемію на 30-й хв ОТТГ і сприяло зменшенню порушень толерантності до вуглеводів, а саме зниження гіперглікемії на 15-й хв ВОТТГ. Найбільшу гіпоглікемічну активність виявив рослинний збір № 19 (кропиви листя, кульбаби корені, чорниці листя, шипшини плоди, м'яти перцевої листя) у дозі 12 мл/кг/день, який був практично на рівні з препаратом порівняння – метформіном, але перевищував за ефективністю офіцинальний збір «Арфазетин». Окрім цього, було встановлено залежність ефективності від дози всіх п'яти досліджуваних рослинних зборів.

Ключові слова: рослинні збори, гіпоглікемічна активність, цукровий діабет, оральний тест толерантності до глюкози, внутрішньоочеревинний тест толерантності до глюкози

А. А. Савич, С. М. Марчишин, Р. Ю. Басараба

Определение гипогликемической активности растительных сборов в скрининговом исследовании

Сахарный диабет является важной социальной и медицинской проблемой, поскольку приводит к развитию опасных осложнений, приводящих к инвалидизации и смертности населения. Это заболевание характеризуется многовекторным патогенезом и требует комплексного подхода к лечению. Благодаря применению в терапии сахарного диабета сборов лекарственных растений можно охватить многие звенья развития данного заболевания и его осложнений.

Цель исследования – изучение гипогликемических свойств растительных сборов для профилактики и лечения сахарного диабета 2 типа, и установление их условно терапевтической дозы на нормогликемических крысах по тестам глюкозной нагрузки.

Исследования проводили на интактных нормогликемических белых крысах-самцах массой 180–200 г, которые предварительно в течение 20 дней перорально получали водные экстракты (1:10) исследуемых сборов в дозе 6 мл/кг/день, 9 мл/кг/день и 12 мл/кг/день и препараты сравнения – официнальный сбор «Арфазетин» в дозе 9 мл/кг/день и метформин в дозе 60 мг/кг/день. Изучение гипогликемических свойств и установление условно терапевтических доз исследуемых сборов осуществляли с помощью тестов глюкозной нагрузки, орального (ОТТГ) и внутрибрюшинного (ВБТТГ) тестов толерантности к глюкозе.

Результаты исследования показали, что предварительное 20-дневное применение растительных сборов снижало алиментарную гипергликемию на 30-й минуте ОТТГ и способствовало уменьшению нарушений толерантности к углеводам, на что указывало снижение гипергликемии на 15-й минуте ВБТТГ. Наибольшую гипогликемическую активность проявил растительный сбор № 19 (крапивы листья, одуванчика корни, черники листья, шиповника плоды, мяты перечной листья) в дозе 12 мл/кг/день, который был на уровне препарата сравнения – таблеток метформина, но превышал по эффективности официнальный сбор «Арфазетин». Кроме этого, была установлена зависимость эффективности от дозы для всех пяти исследуемых растительных сборов.

Ключевые слова: растительные сборы, гипогликемическая активность, сахарный диабет, оральный тест толерантности к глюкозе, внутрибрюшинный тест толерантности к глюкозе

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Контактна особа: Савич Альона Олександрівна, Тернопільський національний медичний університет імені І. Горбачевського, буд. 1, майдан Волі, м. Тернопіль, 46001. Тел.: + 38 0 68 639 51 17. Електронна пошта: alonasavych@gmail.com