

THE INFLUENCE OF THE APPLE PECTIN ON SOME BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS OF ALCOHOLATED ANIMALS

Introduction. *The problem of acute and chronic alcohol intoxications is worldwide because of related injury and high mortality. Medical record protocols include absorbents among other medicines used in treatment of such poisonings.*

The aim of the study – *to investigate the effect of apple pectin on hematological and some biochemical parameters of blood serum in acutely alcoholated rats and compare it with standard enterosorbents used in the clinic for acute alcohol poisoning.*

Research Methods. *Experiments were conducted on 65 white outbred rats weighing 180–200 g, which were modeled acute alcohol intoxication by introducing into the stomach 40 % solution of ethanol in a dose of 2 ml/100 g body weight. The influence of apple pectin (in dose 0.2 g/100 g of body weight), and reference agents (activated charcoal and silicon dioxide – 0.25 g and 0.05 g/100 g respectively) on biochemical and hematological parameters was estimated by changes in hemoglobin levels and the number of erythrocytes, glucose, cholesterol, and transaminase activity in serum.*

Results and Discussion. *It was found that apple pectin when given in the stomach 30 min. before and an hour after the introduction of ethanol normalizes the level of red blood cells and hemoglobin ($p > 0.05$ compared to intact and other treated groups, but exceeded the level of those indicators by 18.5 % and 15.6 % in untreated animals respectively), improves the lipid (cholesterol) and hydrocarbon (glucose) metabolism and reduces the hepatocytolysis: the use of apple pectin in alcoholated rats lowered the activity of AsAT by 19.4 % and activity of AlAT by 16.6 % versus in treated with activated charcoal animals. At the same time mentioned effects were equated with those for the use of "white coal".*

Conclusion. *According to the determined indicators, the efficiency of pectin is equal to standard adsorbents used as reference products, and in some cases, predominates them.*

KEY WORDS: **apple pectin; acute alcohol intoxication; biochemical and hematological parameters.**

INTRODUCTION. The problem of alcohol abuse, intoxication and injuries associated with it, alcoholism, as well as high mortality from alcohol intoxication, is a global problem. In Ukraine, according to WHO, one of the highest alcohol consumption per capita is 15 liters of pure alcohol a year, and is consumed only in Hungary, Scotland, Russia and Moldova. The causes of death in 2012, about one-third of men in Ukraine aged 18–29 were alcohol related [1]. In the United States, almost 88.000 people die every year from excessive alcohol consumption [2]. Taking into account the scale and relevance of the issue, there are and periodically updated protocols for the provision of medical care for acute alcoholic poisoning and the treatment of chronic alcoholism in all developed countries. According to home protocols, it is recommended the introduction of enterosorbents into the toxicogenic stage of poisoning, namely during the period of resorption, for the withdrawal of a non-soaked toxin in the gastrointestinal tract [3, 4]. The list of enterosorbents contains classical activated carbon, © L. M. Sheremeta, M. B. Haynuk, 2018.

enterosgel, white coal (silicon dioxide), polyfepan and other substances of natural and synthetic origin [5], but the "Unified Protocol for Emergency Medical Services with Ethanol Poisoning" includes activated carbon [6]. In view of the sorption properties of pectins, the drugs to which they are included are also used for acute poisoning, in particular heavy metal salts and other toxicants [7].

The aim of the study – to determine the effect of apple pectin on hematological and some biochemical parameters of blood serum in acutely alcoholated rats and compare it with standard enterosorbents used for treatment of acute alcohol poisoning.

RESEARCH METHODS. Experiments with animals were carried out according to the European Convention for the Protection of backboned animals intended for research and other scientific purposes (1986). Acute intoxication with alcohol was simulated on 65 white outbred rats of both sexes weighing 180–200 g, which was injected 40 % ethanol solution into the stomach with a probe

at a rate of 2 ml/100 g body weight. Powder of apple pectin was used in the amount of 0.2 g/100 g of body weight, and the comparison preparations – powder of activated charcoal and powder of silicon dioxide (“white coal”) of 0.25 g and 0.05 g/100 g respectively, calculations of doses were carried out following [8]. The investigated and reference substances were introduced into the animal’s stomach for 30 min. before ethanol and 1 hour after it. Animals were divided into experimental groups: intact; alcoholic: 1 – without treatment; 2 – with the introduction of pectin; 3 – with the introduction of activated carbon; 5 – injected with silicon dioxide. The animals were tested from the experiment under thiopental anesthesia at the 3rd day of the experiment and examined the number of red blood cells and hemoglobin; the content of cholesterol and glucose, ALAT and AsAT activity in serum. The data received were statistically processed using the Microsoft Exel program.

RESULTS AND DISCUSSION. The influence of alcohol on hematological parameters was manifested by a decrease in the number of red blood cells and a hemoglobin in rats (Fig. 1).

This is explained by the fact that ethanol and acetaldehyde, formed during its metabolism, are

membranotropic substances. The apparent difference between the indices of the groups receiving adsorbents and untreated animals in our experiment indicates a decrease in ethanol absorption. Metabolism of ethanol in the liver occurs by dehydrogenation, is accompanied by a significant decrease in the level of oxidized and an increase in the level of the reduced form of pyridine nucleotides (reduction of the ratio NAD/NADH) that weakens the passing of other oxidation-reducing processes that are carried out with NAD (metabolism of carbohydrates, triglycerides, fatty acids, hormones, various biological processes of synthesis, etc.) [9, 10]. Changing the ratio of NAD/NADH in the liver extends to other cellular systems and organs. This is primarily due to an increase in the ratio of lactate / pyruvate, concentration of glycerin-3-phosphate, and a decrease in the stationary concentration of pyruvate that is accompanied by inhibition of gluconeogenesis from a number of substrates, which in turn leads to depletion of glycogen stores in the liver, hypoglycemia, development of metabolic acidosis and lipid metabolism in the liver (accumulation of triglycerides) [11, 12]. Investigation of glucose and cholesterol content in blood serum showed in Figure 2.

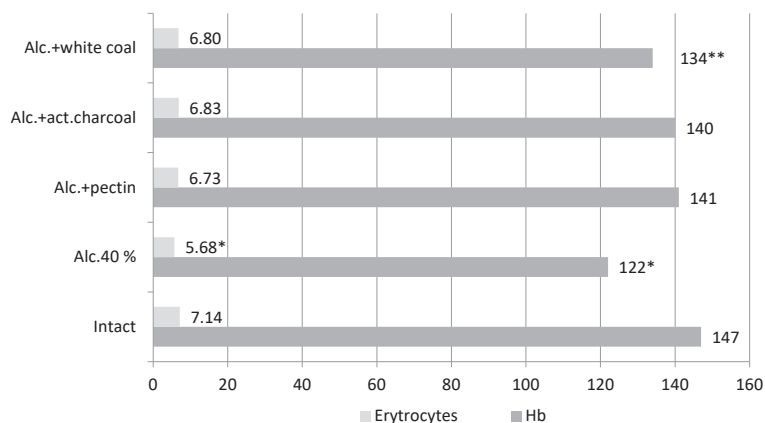


Figure 1. Indicators of the number of erythrocytes ($\times 10^{12}/l$) and hemoglobin (g/l) in alcoholated animals. Note. * – $p < 0.05$ compared to intact and treated animals; ** – $p < 0.05$ compared to intact animals.

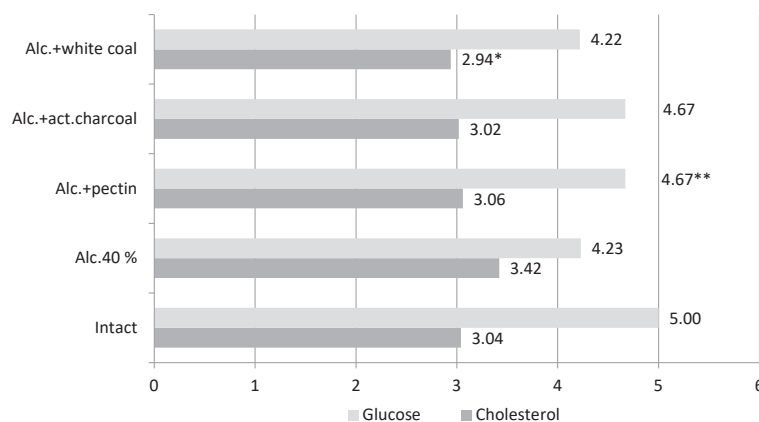


Figure 2. The content of glucose and cholesterol in blood serum in alcoholated animals, $n=7$ (mmoles/l). Note. * – $p < 0.05$ compared to intact animals; ** – $p < 0.05$ compared to untreated animals.

Glucose level in treated with pectin animals was 10.4 % higher than in untreated and not significantly different from other groups that were treated.

The determination of the activity of transaminases as markers of hepatocyte cytolysis showed the following: in all groups of animals receiving alcohol, the activity of AsAT and AIAT was significantly higher than in the intact group, but lower than that of untreated animals (Table).

At the same time, differences between the groups treated rats were also observed. The activity of AIAT and AsAT among treated animals was the highest in the group with the use of activated charcoal. The results obtained in the use of apple pectin in alcoholic rats was 19.4 % lower on the activity of AsAT, and 16.6 % versus activity of AIAT in treated with activated charcoal animals. At the same time mentioned effects were equated with those for the use of "white coal".

Table – Indicators of activity of transaminases in serum of the blood in experimental animals, M±m

Animal Groups (n=7)	AsAT, mkkat/l	AIAT, mkkat/l
Intact	0.99±0.06	2.9±0.14
Alcohol	2.57±0.2 ¹	4.34±0.19 ¹
Alcohol+pectin	1.67±0.1 ^{1,2}	3.21±0.21 ^{1,2}
Alcohol+activated charcoal	2.07±0.06 ^{1,2,3}	3.85±0.14 ^{1,3}
Alcohol+white coal	2.02±0.09 ^{1,2}	3.32±0.12 ^{1,2}

Note. ¹ – p<0.05 compared to intact; ² – p<0.05 compared to the group receiving only alcohol; ³ – p<0.05 is compared to a group treated with pectin.

CONCLUSIONS. 1. Apple pectin and reference drugs reduce the effect of alcohol and normalize the level of hemoglobin and the number of erythrocytes in experimental animals with acute alcohol intoxication in the level equal to standard adsorbents.

2. Apple pectin in a dose of 0.2 g/100 g body weight, administered before and after ethanol in the stomach promotes the restoration of lipid (cholesterol) and hydrocarbon (glucose) metabolism and reduces the hepatocyte cytolysis.

3. The influence of apple pectin upon the activity of AIAT and AsAT is reliably more pronounced than of activated charcoal (p<0.05) and equal to silicon dioxide (p>0.1).

Under conditions of acute alcohol intoxication, apple pectin exhibits a detoxifying effect equal to the reference adsorbents and since any adverse reactions in oral introduction were not recorded in the existing data that means a perspective direction of further research.

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ІВАНО-ФРАНКІВСЬКИЙ НАЦІОНАЛЬНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ

ВПЛИВ ЯБЛУЧНОГО ПЕКТИНУ НА ОКРЕМІ БІОХІМІЧНІ ТА ГЕМАТОЛОГІЧНІ ПОКАЗНИКИ АЛКОГОЛІЗОВАНИХ ТВАРИН

Резюме

Вступ. Проблема гострих і хронічних алкогольних інтоксикацій є глобальною через пов'язані з ними травми та високу смертність. Протоколи надання медичної допомоги включають, серед інших лікарських засобів, адсорбенти, які використовують для лікування таких отруєнь.

Мета дослідження – вивчити вплив яблучного пектину на гематологічні та деякі біохімічні показники сироватки крові щурів з гострою алкогольною інтоксикацією і порівняти його з впливом стандартних ентеросорбентів, які застосовують у клініці для лікування гострого отруєння алкоголем.

Методи дослідження. Експерименти проводили на 65 білих безпородних щурах масою 180–200 г, в яких моделювали гостру алкогольну інтоксикацію шляхом введення в шлунок 40 % розчину етанолу в дозі 2 мл/100 г маси тіла. Вплив яблучного пектину і референтних препаратів (активованого вугілля та діоксиду кремнію) на біохімічні й гематологічні показники оцінювали за змінами рівня гемоглобіну та кількості еритроцитів, вмістом глюкози, холестерину, активністю трансаміназ у сироватці крові. Яблучний

пектин вводили у дозі 0,2 г/100 г маси тіла, препарати порівняння (активоване вугілля та діоксид кремнію) – 0,25 і 0,05 г/100 г відповідно.

Результати й обговорення. Яблучний пектин при введенні в шлунок за 30 хв до і через годину після введення етанолу нормалізував рівень еритроцитів і гемоглобіну ($p > 0,05$ порівняно з інтактними та іншими групами щурів, які отримували лікування, але перевищував рівень цих показників, відповідно, на 18,5 і 15,6 % у нелікованих тварин), поліпшував показники ліпідного (холестерину) та вуглеводного (глюкози) метаболізму і зменшував цитоліз гепатоцитів. У результаті впливу досліджуваного та референтних засобів на активність аспаратамінотрансферази вона знизилась на 19,4 %, а активність аланінамінотрансферази – на 16,6 % порівняно з тваринами, яким вводили активоване вугілля. Водночас згадані ефекти прирівнювались до тих, які отримано в щурів, лікованих діоксидом кремнію.

Висновок. Згідно з визначеними показниками, ефективність яблучного пектину відповідає ефективності стандартних адсорбентів, які використовують як еталонні препарати, та в деяких випадках переважає їх.

КЛЮЧОВІ СЛОВА: яблучний пектин; гостра алкогольна інтоксикація; біохімічні та гематологічні показники.

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ИВАНО-ФРАНКОВСКИЙ НАЦИОНАЛЬНЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ

ВЛИЯНИЕ ЯБЛОЧНОГО ПЕКТИНА НА НЕКОТОРЫЕ БИОХИМИЧЕСКИЕ И ГЕМАТОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ АЛКОГОЛИЗИРОВАННЫХ ЖИВОТНЫХ

Резюме

Вступление. Проблема острых и хронических алкогольных интоксикаций глобальная из-за связанных с ними травм и высокой смертности. Протоколы оказания медицинской помощи включают, среди других лекарств, адсорбенты, которые используют для лечения таких отравлений.

Цель исследования – изучить влияние яблочного пектина на гематологические и некоторые биохимические показатели сыворотки крови крыс с острой алкогольной интоксикацией и сравнить его с влиянием стандартных энтеросорбентов, которые применяют в клинике для лечения острого отравления алкоголем.

Методы исследования. Эксперименты проводили на 65 белых беспородных крысах массой 180–200 г, у которых моделировали острую алкогольную интоксикацию путем введения в желудок 40 % раствора этанола в дозе 2 мл/100 г массы тела. Влияние яблочного пектина и референтных препаратов (активированного угля и диоксида кремния) на биохимические и гематологические показатели оценивали по изменениям уровня гемоглобина и количества эритроцитов, содержанию глюкозы, холестерина, активности трансаминаз в сыворотке крови. Яблочный пектин вводили в дозе 0,2 г/100 г массы тела, препараты сравнения (активированный уголь и диоксид кремния) – 0,25 и 0,05 г/100 г соответственно.

Результаты и обсуждение. Яблочный пектин при введении в желудок за 30 мин до и через час после введения этанола нормализовал уровень эритроцитов и гемоглобина ($p > 0,05$ по сравнению с интактными и другими группами крыс, получавших лечение, но превышал уровень этих показателей, соответственно, на 18,5 и 15,6 % у нелеченных животных), улучшал показатели липидного (холестерина) и углеводного (глюкозы) метаболизма и уменьшал цитоліз гепатоцитов. В результате влияния исследуемого и референтных средств на активность аспаратамінотрансферазы она снизилась на 19,4 %, а активность аланінамінотрансферазы – на 16,6 % по сравнению с животными, которым вводили активированный уголь. В то же время упомянутые эффекты приравнивались к полученным у крыс, которых лечили диоксидом кремния.

Вывод. Согласно определенным показателям, эффективность яблочного пектина соответствует эффективности стандартных адсорбентов, используемых в качестве эталонных препаратов, и в некоторых случаях преобладает над ними.

КЛЮЧЕВЫЕ СЛОВА: яблочный пектин; острая алкогольная интоксикация; биохимические и гематологические показатели.

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