тельно снижает среднюю частоту метафаз с аберрациями хромосом в клетках костного мозга мышей по отношению к действию мутагена на 55,56%, 66,70% и 74,08%. Мульти-аберрантных и полиплоидных клеток не наблюдалось. Во всех вариантах эксперимента в спектре аберраций хромосом выявлены только аберрации хромосом хроматидного типа с одиночными фрагментами.

Выраженность указанного эффекта имеет обратную дозовую зависимость: с понижением дозы Ивина цитогенетические эффекты Диоксидина снижаются в большей степени, чем при воздействии высокой дозы Ивина.

Подтвержден высокий антимутагенный эффект Ивина, который выражен в большей степени при совместном его действии с Диоксидином, чем с Циклофосфамидом. Выявленный эффект, по всей вероятности, связан с генопротекторным действием Ивина, вследствие стабилизации мембран, и его антиоксидантным действием.

რეზიუმე

2,6-დიმეთილპირიდინის-N-ოქსიდის გავლენა დიოქსიდინით ინდუცირებული ციტოგენეტიკური ეფექტების გამოხატვის ხარისხზე ვირთაგვების ძვლის ტვინის უჯრედებში

ო.ვასეცკაია,ე.ზუბკო,ნ.პროდანჩუკი,ა.კრავჩუკი,პ.ჟმინკო

აკად. ლ.მედვედევის სახ. პრევენციული ტოქსიკოლოგიის, კვებითი და ქიმიური უსაფრთხოების სამეცნიერო ცენტრი, უკრაინა

კვლევის მიზანს წარმოადგენდა 2,6-დიმეთილ-პირიდინის-N-ოქსიდის მამოდიფიცირებელი ციტოგენეტიკური ეფექტის შეფასება ვირთაგვების ძვლის ტვინის უჯრედებზე დიოქსიდინის მუტაგენური პროოქსიდაციური მოქმედების პირობებში.

შესწავლილია მცენარეების ზრდის რეგულატორის - 2,6-დიმეთილპირიდინის-N-ოქსიდის (ივინი) ციტოგენეტიკური აქტივობა და მუტაგენ-მამოდიფიცირებელი მოქმედება მამრი ვირთაგვების ძვლის ტვინის CD-1 უჯრედების ქრომოსომული აბერაციების გათვალისწინების მეთოდით, დიოქსიდინით ერთჯერადი ზემოქმედების თანხლებით.

ივინი შეჰყავდათ ერთჯერადად, პერორალურად, წყალხსნარის სახით დოზებით 710, 71 და 0.71 მგ/კგ, რაც შეესაბამება ლეტალური დოზის (ლდ$_{50}$) 1/2-, 1/20- და 1/2000-ს დიოქსიდინთან ერთად. დიოქსიდინი შეჰყავდათ ინტრაპერიტონეულად დოზით 100 მგ/კგ. ინტაქტურ ცხოველებში (უარყოფითი კონტროლის ჯგუფი) პერორალურად შეჰყავდათ გაწმენდილი, ულტრაიისფერი სხივებით სტერილიზებული, დეიონიზებული წყალი.

ნაჩვენებია, რომ დიოქსიდინთან ერთობლივი მოქმედებისას ივინი დოზებით 710, 71 და 0.71 მგ/კგ ვირთაგვების ძვლის ტვინის უჯრედებში მნიშვნელოვნად ამცირებს მეტაფაზების საშუალო სიხშირეს ქრომოსომული აბერაციებით მუტაგენის მოქმედებასთან მიმართებით (55,56%, 66,70% და 74,08%). მულტიაბერაციული და პოლიპლოიდური უჯრედები არ აღინიშნებოდა. ექსპერიმენტის ყველა ვარიანტში ქრომოსომების აბერაციების სპექტრში გამოვლინდა მხოლოდ ქრომატიდული ტიპის აბერაციები ერთეული ფრაგმენტებით.

აღნიშნული ეფექტის გამოხატვის ხარისხს აქვს უკუდამოკიდებულება დოზასთან: ივინის დოზის შემცირებისას დიოქსიდინის ციტოგენეტიკური ეფექტები მცირდება მეტი ხარისხით, ვიდრე ივინის დიდი დოზით ზემოქმედების პირობებში.

კვლევით დადგენილია ივინის მაღალი ანტიმუტაგენური ეფექტი, რაც მეტად გამოიხატება დიოქსიდინთან ერთობლივი მოქმედებისას, ვიდრე ციკლოფოსფამიდთან ერთად. გამოვლენილი ეფექტი, როგორც ჩანს, დაკავშირებულია ივინის გენპროტექტორულ მოქმედებასთან მემბრანებზე მისი მასტაბილიზებელი და ანტიოქსიდაციური მოქმედების შედეგად.

REMODELING OF THE RAT DUODENAL WALL UNDER THE EFFECT OF COMPLEX FOOD ADDITIVES OF MONOSODIUM GLUTAMATE, SODIUM NITRITE AND PONCEAU 4R

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A food additive is any substance that is not normally considered a food product or its component, but is added to a food product for technological purposes in the production process, and finally becomes an integral part of the product.

Monosodium glutamate (E 621), sodium salt of glutamic acid, is the most common and widespread flavor enhancer. Monosodium glutamate, consumed in food and drink, has a narcotic effect on the body and does not contain nutrients; it is not a preservative, it is a toxin that excites the nervous system, a chemical that overexcites brain cells, sometimes to complete uncontrol and it deceives the brain [4]. Therefore, the growing use of monosodium glutamate, including for children's food and some components of some vaccines, is a matter of concern due to potential impact on human health [7].

Sodium nitrite (E 250) food additive is widely used as a preservative in the national and international technology of meat sausages production to give products certain properties and maintain quality. E-250 has been proved to be harmful to hu-

man health. This leads to a decrease in muscle tone, damage to the central nervous system, liver tissue [8]. Sodium nitrite is reported to have harmful toxic effects on various organs of the body. A study was conducted to evaluate the potential protective effects of thymoquinone against sodium nitrite-induced renal toxicity. Key findings of the study show that processing with sodium nitrite significantly increased markers of renal dysfunction, oxidative stress, inflammation and apoptosis [12].

Ponceau (Acid Red) is a food colorant of synthetic origin, which has a bright red color. It opens a whole palette of shades: when you add yellow or orange dyes, you get a brown color, and when mixed with blue dye, Ponceau gives a purple color. According to its chemical composition, the E124 food colorant is sodium salt in the form of granules or red powder [6] . Current scientific publications elucidate the impact of various food additives on organs and systems; however, insufficient data on this issue has been found to date. Thus, the effect of synthetic dyes (Sunset yellow and Ponceau 4R) on some biochemical and histopathological parameters of albino rats has been studied [11]. The effect of food colorants, in particular Ponceau 4R, on the secretion of cytokines by blood cells of patients with allergic diseases has been studied. Solutions of the studied food colorants and their mixtures in acceptable daily concentrations changed the immediate and delayed secretion of cytokines by blood leukocytes of patients with allergies [1].

Thus, the issue on the content of food additives in foods, the analysis of their danger to human health is relative to date.

The paper was aimed at establishing the dynamics of changes in morphometric parameters of the structural components of the duodenal wall of rats in long-term use of the complex food additives, namely, sodium nitrite, monosodium glutamate and Ponceau 4R.

Material and methods. 84 outbred mature male rats were involved into the study. Control rats consumed drinking water and received saline per os. The rats of the experimental group were given access to water ad libitum and, supplementary, consumed 10% sodium nitrite solution. Monosodium glutamate was administered at a dose of 20 mg/kg in 0.5 ml of distilled water; Ponceau 4R at a dose of 5 mg/kg in 0.5 ml of distilled water once daily per os. Doses of food additives were half lower the allowable normal rate in foods. To evaluate the adaptive behavior, the rat was placed into the corner of the box and its spontaneous locomotor behavior was recorded for 60 seconds. Parameters of motor and exploratory behavior of animals (number of outer edge square crossings and number of central square crossings), vertical activity (number of rearings), and vegetative activity (number of) were measured [13]. The resulting data have been processed quantitatively by the variance statistics using the Student's t-test and *Excel* software [5].

The rats were sacrificed within 1, 4, 8 and 16 weeks under thiopentone anesthesia overdose. After euthanasia of the animals, fragments of the wall of the duodenum were fixed in 10% neutral formalin solution for three days. Subsequently, the pieces of the duodenal wall, fixed in formalin, were embedded into paraffin [2]. Sections of the 5-10 μm thick were obtained using the sledge microtome and mounted on slides by stenciling. After staining with hematoxylin and eosin, the sections were encapsulated in polystyrene and examined under the light microscope. Microimaging and morphometric study were performed using the digital microscope equipped with DCM 900 digital microphoto attachment with software adapted for the research. Statistical processing of morphometric data was performed using the *Exel* software [5].

Results and discussion. The morphometric study of the components of the rats duodenal wall has established that its overall thickness in control group of animals was 738,31±0,29 μm; the thickness of the mucous membrane was 449,08±0,16 μm; the thickness of the submucosal layer was 94,01±0,14 μm; the mean thickness of the muscular layer was 77,84±0,21 μm and thickness of the serous membrane was 1,74±0,02 μm (Table).

The duodenal wall of rats had a typical structure and consisted of a mucous membrane, submucosal layer, muscular layer and serous membrane. The foliate villi, covered with a single layer columnar coated epithelium, the basis of which was the lamina propria, were clearly visible. On the cross section, the crypts with a pronounced lumen inside were well visualized. Glands and blood vessels were localized in the submucosal layer filled with loose fibrous unformed connective tissue. The muscular layer consisted of the inner oblique circular and outer oblique longitudinal layers with interlayers of connective tissue with the elements of the vascular and muscular nerve plexus between them, covered with a thin layer of the serous membrane (Fig. 1).

After one week of consumption the complex food additives, the overall thickness of the wall significantly decreased by 10.97% and accounted for 657.34±0.61 μm ($p < 0.05$). The thickness of the mucous membrane was significantly reduced by 12.96% and had a value of 390.87±0.21 μm ($p < 0.05$). The submucosal layer was 62.19±0.16 μm, which was by 33.85% significantly lower than its values in the control group ($p < 0.05$). The thickness of the muscular layer significantly increased by 21.53%, accounting for 94.60±0.32 μm ($p < 0.05$). The serous membrane was significantly reduced by 25.85% and had a value of 1.29±0.02 μm ($p < 0.05$) (Table).

Table .Morphometric parameters of the components of rat duodenal wall (in μm)

Parameters	Overall thickness of the wall (μm)	Thickness of the mucous membrane (μm)	Thickness of the submucosal layer (μm)	Thickness of the muscular layer (μm)	Thickness of the serous membrane (μm)
Controls (n=14)	738,31±0,29	449,08±0,16	94,01±0,14	77,84±0,21	1,74±0,02
1 week (n=14)	657,34±0,61*	390,87±0,21*	62,19±0,16*	94,60±0,32*	1,29±0,02*
4 weeks (n=14)	1022,70±1,09*,**	479,13±0,42*,**	110,82±0,40*,**	81,47±0,21*,**	2,10±0,03*,**
8 weeks (n=14)	542,05±0,45*,**	365,52±0,39*,**	92,92±0,19*,**	72,87±0,15*,**	1,93±0,03*,**
12 weeks (n=14)	692,06±0,69*,**	354,78±0,34*,**	117,83±0,24*,**	45,83±0,10*,**	2,22±0,02*,**
16 weeks (n=14)	772,98±1,43*,**	324,63±0,25*,**	74,05±0,22*,**	63,98±0,23*,**	1,80±0,02*,**

*notes: * – $p < 0,05$ compared to control group; ** – $p < 0,05$ compared to the previous time period of the observation.*

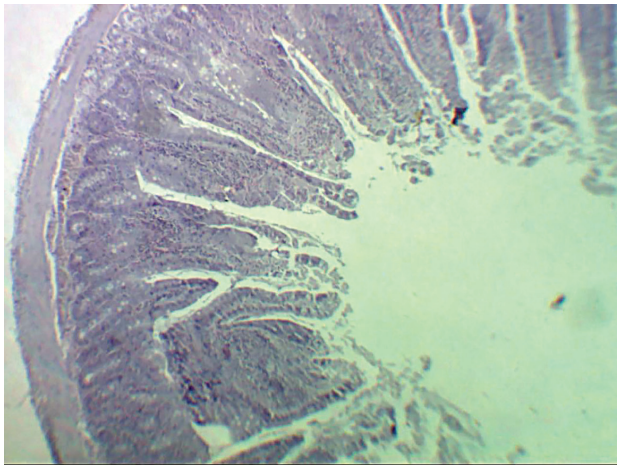

Fig. 1. The duodenal wall of rats of the control group. H&E stain. Lens: 10×magnification, ocular lens: 10×magnification

On week 1 of the experiment, a thinning of the bases of the villi in the mucosa was detected with a marked thinning of the submucosal layer, which was visualized by a thin strip between the almost invisible muscle plate and the muscular layer of the intestinal wall (Fig. 2).

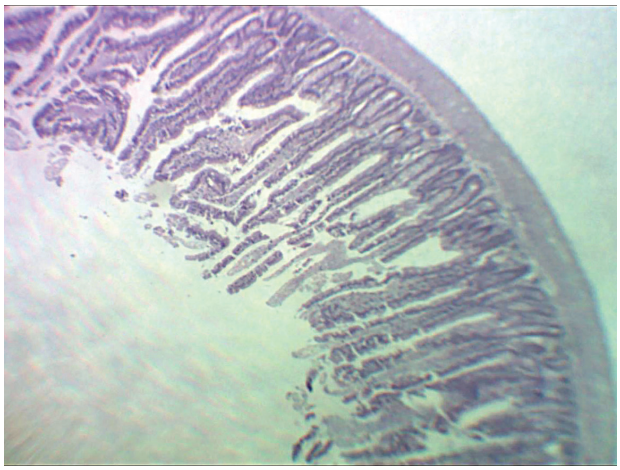

Fig. 2. The rat duodenal wall within week 1 of consumption the complex food additives. H&E stain. Lens: 10×magnification, ocular lens: 10×magnification

After 4 weeks of the experiment, the overall thickness of the duodenal wall was 1022.70±1.09 μm, which was by 55.58% significantly greater than on the first week of the study and by 38.52% greater than its values in the control group of rats ($p < 0.05$). The mean values of the thickness of the mucous membrane significantly increased by 22.58% compared to the values of the previous period of the experiment, accounting for 479.13±0.42 μm, which was also by 6.69% significantly greater compared to the control group ($p < 0.05$). Within 4 weeks, the submucosal layer was 110.82±0.40 μm, which was by 78.20% significantly greater than on week 1of the study and by 17.88% significantly greater than the value of the control group ($p < 0.05$). The thickness of the muscular layer significantly decreased by 13.88% compared to the previous period of study, and its mean values were 81.47±0.21 μm, though they were by 4.66% significantly greater than the values in the control group ($p < 0.05$). The thickness of the serous membrane was by 62.79% significantly greater than the value at week 1 of the experiment and by 20.69% greater than its values in the control group; its mean values were 2.10±0.03 μm (g <0.05) (Table).

In the mucous membrane, the villi were elongated; the crypts were numerous with enlarged lumens. In the muscular layer, a thinning of the oblique longitudinal layer and thickening of the layer of loose fibrous connective tissue between the oblique circular and oblique longitudinal layers were clearly visible. The serous membrane was thickened (Fig. 3).

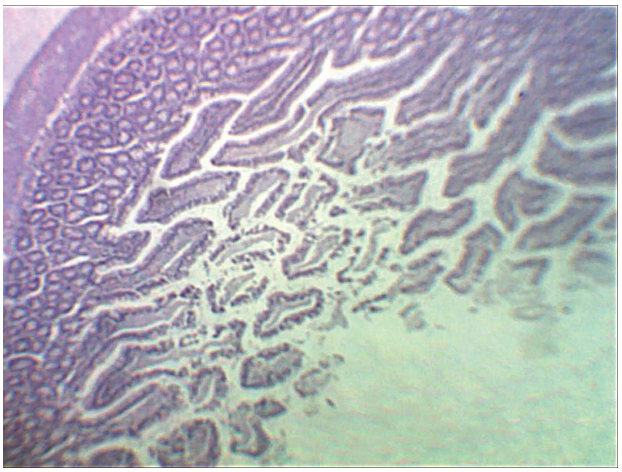

Fig. 3. The rat duodenum on week 4 of consumption sodium nitrite, monosodium glutamate and Ponceau 4R. H&E stain. Lens: 10×magnification, ocular lens: 10×magnification

At week 8 of consumption the complex of sodium nitrite, monosodium glutamate and Ponceau 4R, a decrease in the mean values of the overall wall thickness to 542.05±0.45 μm in rats of the experimental group was noted, which were by 47.00% lower than those established at week 4 of the experiment and by 26.58% lower compared to its values in the control group ($p < 0,05$). The thickness of the mucous membrane was significantly lower by 23.71% than the value of the previous period of the experiment, and also by 18.61% lower than the values in the control group, accounting for 365.52±0.39 μm ($p < 0.05$). At week 8, the submucosal layer was 92.92±0.19 μm, which was by16.15% significantly lower than the values on week 4 and by 1.16% lower compared to the control group of rats ($p < 0, 05$). The thickness of the muscular layer was 72.87±0.15 μm, which was by 14.56% significantly lower than the values of the previous study period and by 6.38% lower compared to the mean values of the control group ($p < 0.05$). The serous membrane responded with a significant decrease in its mean values by 8.10% compared to the previous study period, where the mean values at week 8 were 1.93±0.03 μm, though were by10.92% significantly greater than its mean values in the control group of animals ($p < 0,05$) (Table).

In the mucous membrane, the villi were short, scanty and reduced in size; they had an uneven course; the epithelium was with signs of desquamation; the crypts were shallow, their lumen was pronounced, the submucosal layer was thin with almost invisible glands inside. The interlayer of loose connective tissue between the layers of smooth myocytes, the thickness of which was markedly reduced, was poorly visualized (Fig. 4).

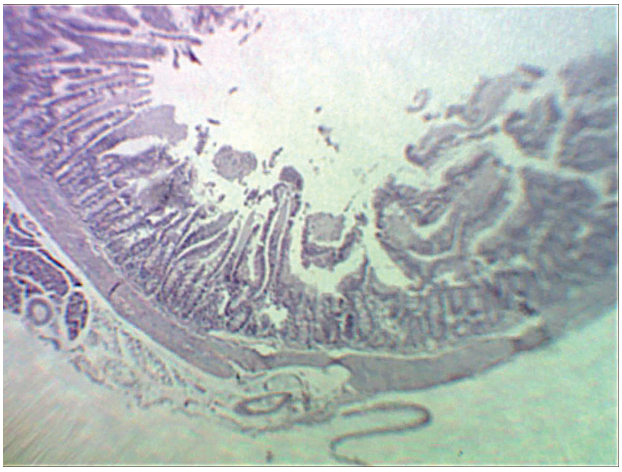

Fig. 4. The rat duodenum with the phenomena of epithelial desquamation on week 8 of the experiment. H&E stain. Lens: 10×magnification, ocular lens: 10×magnification

At week 12, the mean thickness of the duodenal wall in rats of the experimental group was 692.06±0.69 μm that was by 27.67% significantly greater than the values on week 8, which was by 6.26% significantly lower than the value of the control group ($p < 0.05$). The mean values of the thickness of the mucous membrane significantly decreased by 2.94% compared to the previous period of the experiment, and were by 21% lower than the values of the control group, accounting for 354.78±0.34 μm ($p < 0.05$). The submucosal layer was 117.83±0.24 μm, which was by 26.81% significantly greater than the value on week 8 and by 25.34% greater than in the control group ($p < 0.05$). The muscular layer was significantly reduced both in comparison with the previous study period (by 37.11%) and the control group (by 41.12%) with the mean values of 45.83±0.10 μm ($p < 0.05$). Consumption of the complex food additives led to a significant increase in the thickness of the serous membrane on week 12 by 15.03% compared to week 8, which was also by 27.59% significantly greater compared to the control group; the mean value was 2.22±0.02 μm ($p < 0.05$) (Table).

An increase in the number of goblet cells and signs of desquamation were observed in the epithelium of the villi. The villi have become wider; the lumen of the crypts was narrowed. The submucosal layer was enlarged, with the signs of edema (Fig. 5).

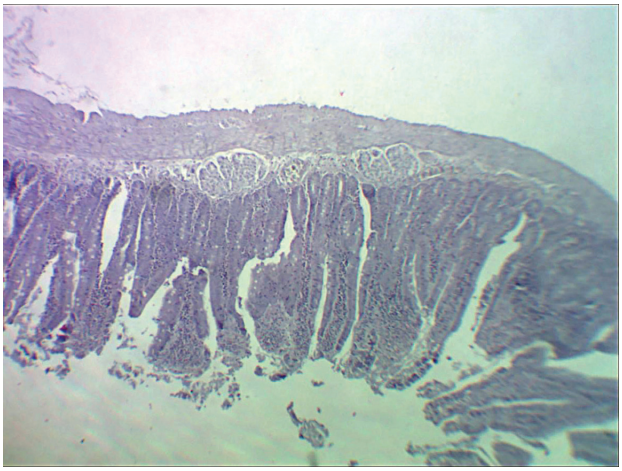

Fig. 5. The rat duodenum on week 12 of consumption of the food additives. H&E stain. Lens: 10×magnification, ocular lens: 10×magnification

On week16 of the experiment, the mean values of the overall thickness of the wall in rats of the experimental group was 772.98±1.43 μm, which was by 11.69% significantly greater compared to week 12 of the experiment, and by 4.70% greater than the control values ($g < 0.05$). The mean values of the thickness of the mucous membrane significantly decreased by 8.50% compared to the values of week 12 and accounted for 324.63±0.25 μm, which was also by 27.71 % lower than the values in the control group of rats ($p < 0.05$). The submucosal layer was 74.05±0.22 μm, which was by 37.16% significantly lower than the values of week 12 of the experiment and by 21.23% lower compared to the control group ($p < 0.05$). The value of muscular layer thickness also significantly decreased on week 16, which was 63.98±0.23 μm and was by 39.60% lower than the previous time period of the experiment, which was also lower than the value in the control group by 17.81% ($p < 0.05$). The serous membrane significantly decreased by 18.92% compared to the previous period of study, though by 3.45% increased compared to the control group and its average values were 1.80±0.02 μm ($p < 0.05$) (Table).

At large magnification, dystrophic and destructive changes in the epithelial cells of the crypts and glands of the submucosal layer were observed in the duodenal wall of rats. The nuclei were polymorphic in shape and structural features; the cytoplasm was heterogenous with areas of compaction and destruction in which a large number of vacuole-like structures were found. The arteries of the submucosal layer were with the signs of spasm. A significant number of leukocyte-type cells, with a predominant number of macrophages, were found in the connective tissue of the lamina propria and submucosal layer (Fig. 6).

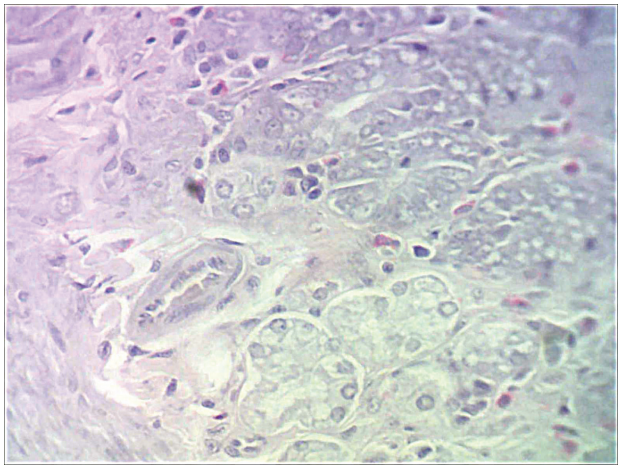

Fig. 6. Leukocyte infiltration of the mucous membrane and submucosal layer of the rat duodenum on week 16 of consumption the complex food additives.
H&E stain. Lens: 40×magnification, ocular lens: 10×magnification

Thus, the use of the complex food additives of sodium nitrite, monosodium glutamate and Ponceau 4R led to general changes in the rat duodenal wall, which triggered the morphological mechanisms of inflammation, which at the early stages was manifested by a decrease in all morphometric parameters due, primarily, to direct effect of the food additives, leading to alterations in the microvasculature. Consequently, at week 4 of the experiment the phenomena of edema, developed in the connective tissue, were detected, which first responded to various factors and led to an increase in morphometric parameters, which

was further reflected in the appearance of signs of dystrophic changes with subsequent atrophy of the wall with a significant decrease in the total thickness of the wall and the appearance of adaptive mechanisms, which, however, did not lead to complete restoration of the morphological structure, which was morphometrically confirmed by an increase in the total thickness of rat duodenal wall on week 16 of the experiment and observation of manifestations of leukocyte infiltration of the mucous membrane and submucosal layer, which in our opinion, occurred primarily due to the constant negative effect of a complex of food additives, which, by their strength, outweigh the adaptive and protective capabilities of tissue and cellular components of the small intestine.

Previous studies on the changes, observed in the duodenum with the signs of inflammation showed the same type of intestinal wall reactions and general trends in changes of morphometric parameters of the structural components of the rat duodenum. Thus, acute aseptic inflammation of the peritoneum leads to an increase in the total thickness of the intestinal wall from day 1 to day 21 of the experiment, and starting from day 3 a significant increase in this parameter with the highest rate on day 10-14 was established. On day 30, the total thickness of the intestinal wall decreased. The thickness of the mucous membrane increased within day 2-14, and from day 21 to day 30 the thickness of the mucous membrane was decreasing. The mean values of the thickness of the submucosal layer showed an increase with a maximum value on day 7 of the experiment, which began to decrease by day 30. Morphometric analysis of the thickness of the muscular layer showed that from day 7 to day 30 the thickness of the muscular layer was increasing. The thickness of the serous membrane was decreasing from day 1 to day 3 and reached a minimum value on day10-14 [9,10], typical changes were revealed in the inflammation of the rat gastric wall [3].

Perspectives of further research will encompass the subsequent detailed study of the cellular composition of the structural components of the duodenum and reaction of the micrivasculature on the action of complex food additives.

Conclusion: consumption of the complex food additives of sodium nitrite, monosodium glutamate and Ponceau 4R develops a complicated, complex, local vascular-tissue reaction, which leads to changes in morphometric parameters of all structural components of the rat duodenal wall, to neutralize the alternative factor and restoration of the morphofunctional state of the small intestine, though does not lead to complete recovery of structural components, due to the predominance of constant negative effects of the stimulus with the occurence of dystrophic-destructive changes and manifestations of leukocyte infiltration during the experiment.

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SUMMARY

REMODELING OF THE RAT DUODENAL WALL UNDER THE EFFECT OF COMPLEX FOOD ADDITIVES OF MONOSODIUM GLUTAMATE, SODIUM NITRITE AND PONCEAU 4R

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The purpose of the study was to establish the dynamics of changes in morphometric parameters of the structural components of the rats' duodenal wall with long-term use of a complex of food additives: sodium nitrite, sodium glutamate and Ponceau 4R. The work was performed on 84 adult nonlinear male rats,

which were given to drink 10% sodium nitrite solution, sodium glutamate was administered at a dose of 20 mg/kg in 0.5 ml of distilled water, Ponceau 4R – at a dose of 5 mg/kg in 0.5 ml distilled water 1 time per day orally. Thus, the use of a complex of dietary additives of sodium nitrite, sodium glutamate and Ponceau 4R led to changes in the morphometric parameters of all structural components of the rats' duodenal wall. This reaction is aimed at neutralizing the alterative factor and restoring the morphofunctional state of the duodenum. By the end of the observation, complete recovery of structural components was not established due to the predominance of constant negative influence of the stimulus with the occurrence of dystophic-destructive changes.

Keywords: sodium nitrite, sodium glutamate, Ponceau 4R, duodenum, rats.

РЕЗЮМЕ

РЕМОДЕЛИРОВАНИЕ ДУОДЕНАЛЬНОЙ СТЕНКИ КРЫС ПОД ВОЗДЕЙСТВИЕМ КОМПЛЕКСНЫХ ПИЩЕВЫХ ДОБАВОК - ГЛУТАМАТА НАТРИЯ, НИТРИТА НАТРИЯ И PONCEAU 4R

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Целью исследования явилось установить динамику изменений морфометрических показателей структурных компонентов стенки двенадцатиперстной кишки крыс при длительном применении комплекса пищевых добавок: нитрита натрия, глутамата натрия и Ponceau 4R.

Работа проведена на 84 половозрелых нелинейных крысах-самцах, которым давали пить 10% раствор нитрита натрия; раствор глутамата натрия в дозе 20 мг/кг в 0,5 мл дистиллированной воды, Ponceau 4R - в дозе 5 мг/кг в 0,5 мл дистиллированной воды, 1 раз в сутки перорально.

Применение комплекса пищевых добавок нитрита натрия, глутамата натрия и Ponceau 4R привело к изменениям морфометрических показателей всех структурных компонентов стенки двенадцатиперстной кишки крыс в результате реакции, направленной на обезвреживание альтеративного фактора и восстановление морфофункционального состояния двенадцатиперсной кишки. Однако, это не приводит к полному восстановлению структурных компонентов, ввиду преобладания постоянного негативного воздействия раздражителя и появления дистрофических-деструктивных изменений.

რეზიუმე

ვირთაგვას დუოდენური კედლის რემოდელირება კომპლექსური საკვები დანამატების - ნატრიუმის გლუტამატის, ნატრიუმის ნიტრიტის და PONCEAU 4R ზემოქმედებით

ა.გრიგორენკო, გ.ეროშენკო, კ.შევჩენკო, ო.ლისაჩენკო, ნ.პერედერი

უკრაინის სამედიცინო სტომატოლოგიური აკადემია, პოლტავა, უკრაინა

კვლევის მიზანს წარმოადგენდა ვირთაგვას თორმეტგოჯა ნაწლავის კედლის სტრუქტურული კომპონენტების მორფომეტრიული ცვლილებების დინამიკის ანალიზი საკვები დანამატების კომპლექსის ხანგრძლივად გამოყენების პირობებში: ნატრიუმის ნიტრიტი, ნატრიუმის გლუტამატი და PONCEAU 4R. კვლევა ჩატარდა 84 ზრდასრულ არახაზოვან მამრ თეორ ვირთაგვაზე, რომელთაც ეძლეოდა ნატრიუმის ნიტრიტის 10%-იანი ხსნარი, ნატრიუმის გლუტამატი - დოზით 20 მგ/კგ დისტილირებული წყლის 0,5 მლ-ში, PONCEAU 4R - დოზით 5 მგ/კგ დისტილირებული წყლის 0,5 მლ-ში, დღეში ერთხელ, პერორალურად.

საკვები დანამატების - ნატრიუმის ნიტრიტის, ნატრიუმის გლუტამატის და PONCEAU 4R, გამოყენებამ განაპირობა ვირთაგვების თორმეტგოჯა ნაწლავის კედლის ყველა სტრუქტურული კომპონენტის მორფომეტრიული მაჩვენებლების ცვლილებები, მიმართული ალტერნატიული ფაქტორის გაუვნებელყოფაზე და თორმეტგოჯა ნაწლავის მორფოფუნქციური მდგომარეობის აღდგენაზე. თუმცა, გამღიზიანებლის მუდმივი ნეგატიური მოქმედების სიჭარბისა და დისტროფიულ-დესტრუქციული ცვლილებების გამო, აღნიშნული ვერ უზრუნველყოფს სტრუქტურული კომპონენტების სრულ აღდგენას.

CHANGES IN THE KIDNEY AND LIVER STRUCTURE AND FUNCTIONS DURING THE EXPERIMENTAL, NON-LETHAL LOAD OF CARBON TETRACHLORIDE (CCL_4)

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Currently, there is a steady tendency for the growth of diseases of the hepatobiliary system, which is caused by a whole set of factors, both endogenous and exogenous. One of these factors is the entry into the human body of a large group of unnatural compounds that are not used by the body for life or energy. Such compounds are called xenobiotics. Elimination of xenobiotics is carried out in different organs (lungs, skin, gastrointestinal tract), but it is most actively carried out in the liver. Transformed