Western European Journal of Medicine and Medical Science
Volume 2, Issue 11, November 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

STRUCTURAL CHANGES IN THE THYMUS OF RATS IN THE EXPERIMENTAL GROUP WHEN EXPOSED TO AN ENERGY DRINK AFTER CORRECTION WITH FLAX OIL.

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Abstract: This article presents structural and functional changes in rats 1-3-6 months of age with EN poisoning and their detoxification with flax oil in the experiment and their changes in the histological structure, the size of the capsule wall, the thickness of the collagen fiber bundles and changes in the trabeculae in the structural -functional units.

Key words: flax oil, rat thymus, postnatal ontogenesis, Energy drinks, medulla, cortex.

Introduction. Many people associate the emergence of EN in Europe, the USA and Asia with the appearance on the market of a product with a very sonorous, catchy and menacing trade name EN, for example, Red Bull-an angry bull., Gorilla Energy-a formidable monkey., Burn-a blazing fire., Black Monster-The black monster [Pilate, T. L. 2011].

To date, the exact motives for drinking energy drinks have also not been determined, although according to some data, the main reasons for their use are the desire to overcome fatigue and improve the feeling of the effect of alcohol [Attila S, 2011].

Over the past 10-15 years, smart products have become popular on the market, and among them the so-called EN have become especially widespread. [Rakhmonova K.E. 2024].

The abuse of energy drinks is becoming a new source of disorders and diseases on the part of the immune system [Ilyasov A. Since 2024].

As previously conducted studies have shown, with regular consumption of energy drinks, they can cause anxiety, nervousness, irritability, insomnia, depression, tachycardia or cardiac arrhythmia, psychomotor agitation. In addition to severe changes in the nervous system, doctors identify other diseases associated with the use of energy drinks: kidney failure, liver disease, impaired respiratory function, heart failure. That is why the sale of tonic drinks in retail chains is prohibited in many countries [Hasler Clare M.2019].

In the study of energy drinks, we used linseed oil to correct or detoxify this product.

Flaxseed is considered a functional component in the production of innovative food products, with a high content of physiologically active components, in particular α-linolenic

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acid (ALA), which contributes to the implementation of important biological functions in the human body [Potyukov S.D. 2013].

The most important feature of ALA is its ability to partially convert into other omega-3 acids and docosahexaenoic acid. [Averyanova E. In 2015]

The technological properties of flaxseed protein are comparable to those of widely used soy protein. Hydrocolloidal flax seeds, represented by the polysaccharide complex of flax mucus, have a significant effect on the formation of rheological properties of food systems [Merenkova S.P. 2018].It was found that the high content of omega-3 fatty acids in the diet has an anti-stress and adaptogenic effect, stimulates mental activity and human performance [Zaporozhnaya L.And 2012].

Fiber has prebiotic activity, improves the intestinal microflora, is able to absorb and remove toxic substances from the body [Barbashov A.In 2016].

Flax seeds are characterized by a wide range of vitamins and minerals. They are especially high in potassium, phosphorus and magnesium. Gamma-tocopherol is present as a natural antioxidant.

Hydrocolloids of flax seeds, represented by the polysaccharide complex of flax mucus, have a significant effect on the formation of rheological properties of food systems. It was found that the polysaccharides of flaxseed mucus contain two fractions: a neutral one, based on xylose, and an acidic fraction, dominated by galacturonic acid. The functional properties of different groups of flaxseed polysaccharides are determined by the ratio of the neutral and acidic fractions [Minevich I.E. 2018].

It is known that insufficient content of polyunsaturated fatty acids in the body leads to a number of pathological disorders, including growth retardation, changes in capillary permeability, necrotic skin lesions, etc.Polyunsaturated fatty acids are precursors of hormone-like substances - prostaglandins, which exhibit antiatherogenic and immunomodulating properties. Essential fatty acids include linoleic and linolenic acids, of which arachidonic acid is formed during biosynthesis with the participation of vitamin Bb, which has the greatest biological activity [Levitsky, A.P. 2012].

Flax seeds have a high content of phytoestrogens, the use of which should be limited in diseases such as endometriosis, hypothyroidism, hyperthyroidism. [Gavrilova A.V. 2021]

The purpose of the study: To study morphological changes in rats 1-3-6 months of age with EN poisoning and their detoxification with flax oil.

Materials and methods of research: The object of the study was white rats. 66 rats were studied in this group in the vivarium of the Abu Ali ibn Sina Bukhara Medical Institute. The thymus of rats was taken for research. The isolated organ was fixed in a 10% neutral formalin solution, then the blocks were placed in an automated wiring station KD-TS3D1 Automatic Tissue Processor. The tissue was dehydrated, poured into paraffin and thin sections with a thickness of 4 microns were prepared on a rotary microtome Semi Automatic Rotary Microtome KD-3358, histological staining of the tissue was performed with hemotaxillin-eosin paint on a KD-RS2 Automatic Slide Stainer. Documenting the obtained thymus sections microscopically on a Nikon eclipse E200 MV research microscope using a LEICA ICC50 E color camera.

The results of the study and their discussion: Physiologically active components flaxseed is considered a functional unit in the production of innovative food products, the uniqueness of which lies in the high content of alpha-3, alpha-6 fatty acids, and its participation

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in the synthesis of hormones – prostaglandins. They regulate inflammatory processes in the body, including the activity of the cardiovascular and nervous systems.

By the age of 1 month in rats with EN poisoning, the thickness of the membrane of the organ wall is on average 34.9±0.92 microns; Figure 1 shows the structure of the parenchyma and thymus membrane of rats 1 month old. In the second experimental group with the use of linseed oil, the thickness of the wall shells averaged 31.3±1.2 microns. Figure 2 shows the structure of the parenchyma of the thymus with correction with flax oil at 1 month of age.

The thickness of the bundles of collagen fibers of the outer shell of the thymus with the use of EN at 1 month of age is on average 25.8 ± 0.83 microns; with the use of linseed oil in rats of this age, the thickness of the bundles of collagen fibers in the capsule is on average 18.9 ± 0.8 microns.

The dense connective tissue membrane of the thymus separates it from other tissues and organs. From the capsule of the organ, its connective tissue partitions extend, which penetrate into the depths of the organ, which serve as conducting paths and also form the frame.

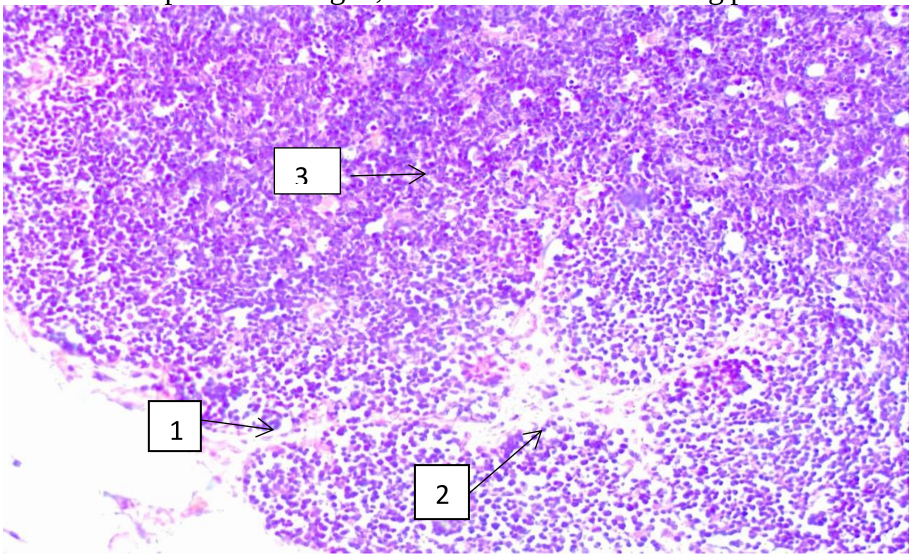

Fig. 1 Structure of the thymus parenchyma of 1-month-old rats in the EN group: 1. Thymus capsule. 2. The trabecula of the thymus. 3. Parenchyma of the thymus. Hematoxylin-eosin staining. Ok.10 x about 20.

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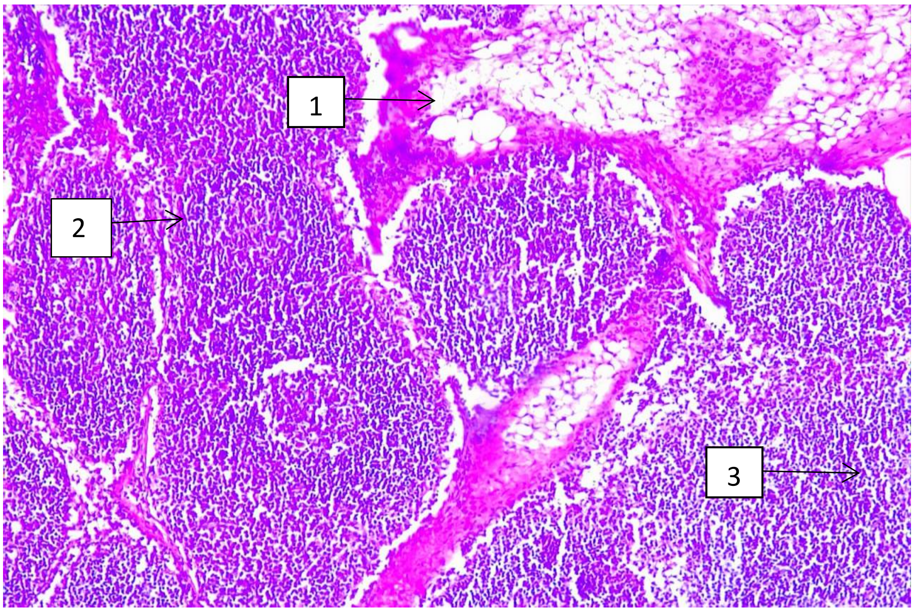
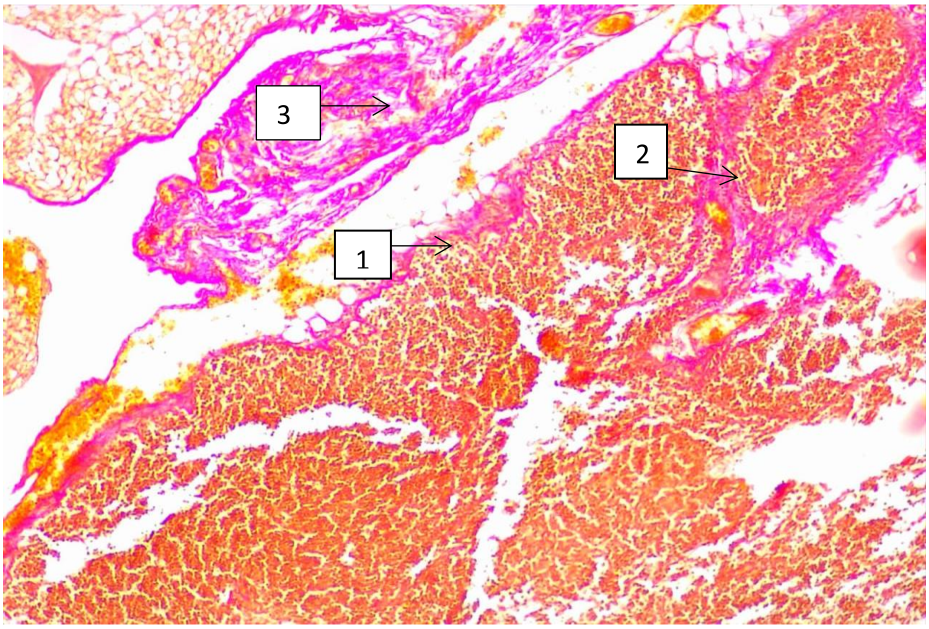


Fig 2 The structure of the parenchyma of the thymus of 1-month-old rats in the group with the use of linseed oil: 1. Thymus capsule. 2. The trabecula of the thymus. 3. Parenchyma of the thymus. Hematoxylin-eosin staining. Ok.10 x about 20.

At 1 month of age, the wall thickness of the trabecula in case of EN poisoning is on average 12.1 ± 0.37 microns; in this age group with the use of linseed oil, the wall thickness of the trabecula is 10.4 ± 0.5 microns. The thickness of the bundles of collagen fibers in the experimental group with the use of EN is on average 9.2 ± 0.4 microns; in the group with the use of linseed oil, the bundles of collagen fibers are on average 8.1± 0.4 microns.



At 1 month of age, the wall thickness of the trabecula in case of EN poisoning is on average 12.1 ± 0.37 microns; in this age group with the use of linseed oil, the wall thickness of the trabecula is 10.4 ± 0.5 microns. The thickness of the bundles of collagen fibers in the

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experimental group with the use of EN is on average 9.2 ± 0.4 microns; in the group with the use of linseed oil, the bundles of collagen fibers are on average 8.1± 0.4 microns.

At 3 months of age, the thickness of the thymus capsule is on average 39.5 ± 0.92 microns in the group with the use of EN, in this group with the treatment of linseed oil, on average 36.1 ± 1.1 microns. Figure 3 shows bundles of collagen fibers in the trabeculae of the thymus of 1-month-old rats.

Bundles of collagen fibers in a capsule in a 3–month period in the experimental group, the EN is on average 25.8±0.83 microns; in this age group with the use of linseed oil, the average is 22.5±0.7 microns.

By the age of 3 months, the thymus is covered with a connective tissue capsule from which divergent trabeculae depart. The wall thickness of the trabecula at 3 months of age with the use of EN is on average 14.2 ± 0.37 microns, in this age group with the use of linseed oil is on average 12.4 ± 0.5 microns. Bundles of collagen fibers in the trabecula of 3 months of age in the experimental group with the use of EN averaged 10.3±0.46 microns; in this group of rats with the use of linseed oil averaged 9.7± 0.5 microns. Figure 4 shows the histological structures of the capsule and trabeculae of the thymus with the use of linseed oil at 3 months of age.

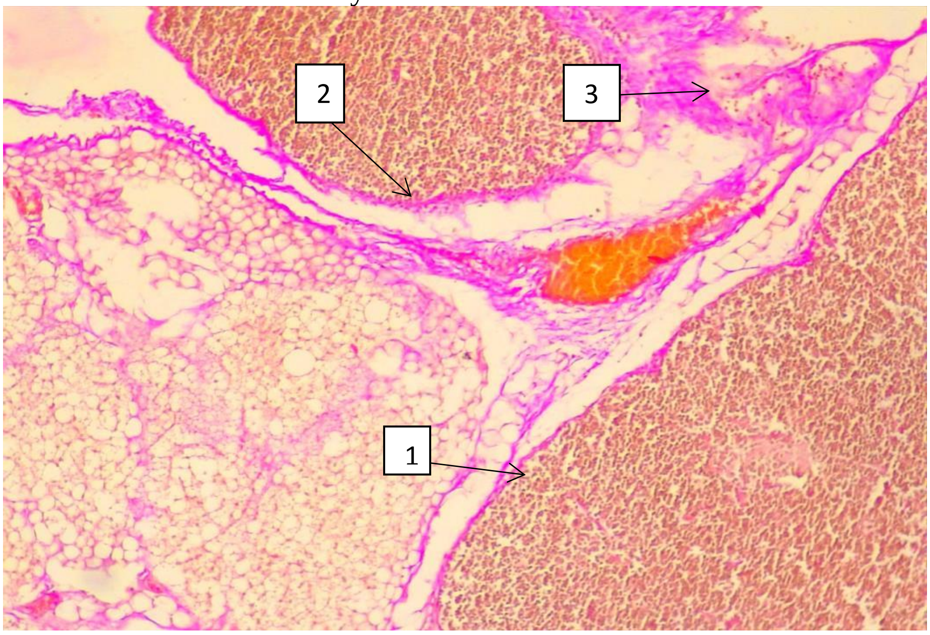

Fig 4 The structure of the bundles of collagen fibers of the thymus of 3-month-old rats in the group with the use of linseed oil: 1. Thymus capsule. 2. The trabecula of the thymus. 3. Bundles of collagen fibers. Van Gieson coloring. Ok.10 x about 20.

By the age of 6 months, the wall thickness of the thymus capsule with the use of EN in white mongrel rats is on average 28.7 ± 1.3 microns; at this age, with the use of linseed oil, the thickness of the shell is on average 26.8 ± 1.3 microns. Bundles of collagen fibers at 6 months of age in the experimental group with EN in the thymus capsule averaged 24.1±0.83 microns; in the group of rats with the use of linseed oil for detoxification, the size of bundles of collagen fibers is 21.2±0.8 microns.

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Table 4.1.1

The structure of the rat thymus under the influence of EN and the restorative parameters of linseed oil in the experiment.

age	group	shell thickness		trabeculae	
		wall thickness	bundles of collagen fibers	wall thickness	bundles of collagen fibers
1 month	experiment	30,0-40,0 34,9±0,92	17,0-25,0 21,1±0,74	10,0-14,0 12,1±0,37	7,0-11,0 9,2±0,4
	correction	25,0-37,0 31,3±1,2	15,0-23,0 18,9±0,8	8,0-13,0 10,4±0,5	6,0-10,0 8,1±0,4
3 month	experiment	35,0-45,0 39,5±0,92	21,0-30,0 25,8±0,83	12,0-16,0 14,2±0,37	8,0-13,0 10,3±0,46
	correction	31,0-42,0 36,1±1,1	19,0-26,0 22,5±0,7	10,0-15,0 12,4±0,5	7,0-12,0 9,7±0,5
6 month	experiment	21,0-35,0 28,7±1,3	19,0-28,0 24,1±0,83	7,0-13,0 10,3±0,55	5,0-9,0 7,2±0,37
	correction	20,0-33,0 26,8±1,3	17,0-25,0 21,2±0,8	7,0-12,0 9,2±0,5	5,0-8,0 6,6±0,3

At the age of 6 months in the experimental group with the use of EN, the thymus capsule became thickened and the bundles of collagen fibers became more pronounced, and the trabecular structures in the group with EN repeated their parallelism and had a different ratio. In the experimental group for the purpose of treatment with flax oil, the capsule of the organ and its trabeculae acquired a more uniform structure in relation to the group with the use of EN.

By the age of 6 months, the trabeculae that depart from the wall of the capsule size is on average 10.3 ± 0.55 microns. At this age, in the experimental group with the use of linseed oil, it is 9.2 ± 0.5 microns. Bundles of collagen fibers in the group with the use of EN at 6 months of age averaged 7.2± 0.37 microns. The bundles of collagen fibers in the experimental group with the use of linseed oil averaged 6.6± 0.3 microns. Figure 4.1.5 shows the structure of the bundles of collagen fibers of the thymus of 6-month-old rats in the experimental group with the use of linseed oil. Table 4.1.1 shows the structure of the rat thymus when exposed to EN and the reduction parameters of linseed oil in the experiment.

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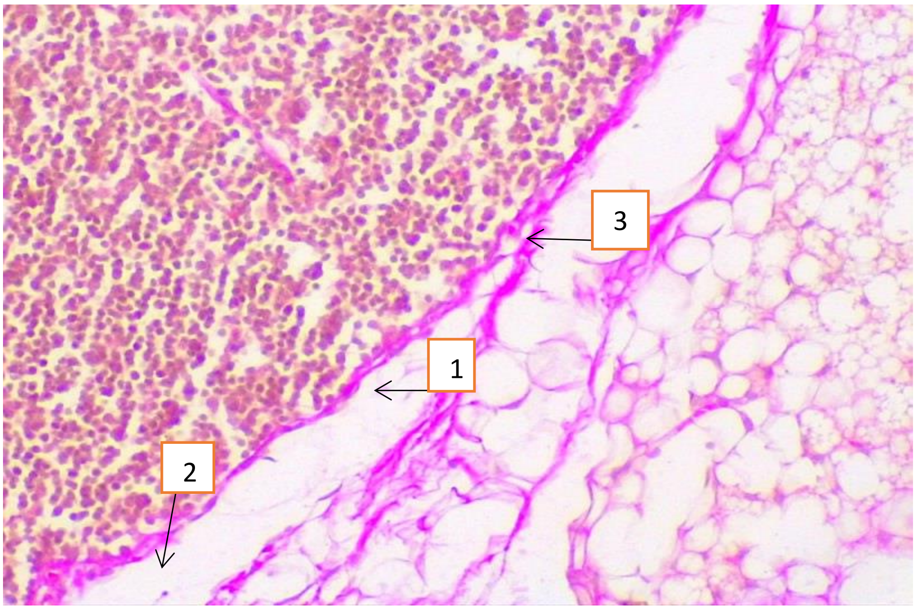

Figure 4.1.6 The structure of the bundles of collagen fibers of the thymus of 6-month-old rats in the experimental group with the use of linseed oil: 1. Thymus capsule. 2. The trabecula of the thymus. 3. Bundles of collagen fibers. Van Gieson coloring. Approx.10 x 40 vol.

Conclusion: In the study of thymus rats, when compared with the experimental group and the group that consumed linseed oil, all indicators were calibrated, but when taking linseed oil, the greatest change occurred at one month of age. The thickness of the trabecular wall decreased by 16.3%. At 3 and 6 months of age, bundles of collagen fibers in the capsule wall thinned by 14.6% and 13.7%, respectively, and were close to the norm of the control group of the thymus in the period of late postnatal ontogenesis.

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ISSN (E): 2942-1918 Open Access| Peer Reviewed

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