ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-5

MORPHOLOGY OF THE SMALL INTESTINAL WALL ADRENERGIC NERVOUS SYSTEM IN A MODEL OF METABOLIC SYNDROME

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Abstract: This article describes the morphological changes in the adrenergic nervous system of the small intestine wall of experimental animals that have created a metabolic syndrome model. At the same time, the involvement of the nervous system in the development of metabolic syndrome is also demonstrated.
Keywords: Metabolic syndrome, adrenergic nerve, metabolic syndrome mechanism.

Introduction: Metabolic syndrome is a group of conditions associated with diabetes, cardiovascular disease, and other metabolic problems. The development of this syndrome is often associated with various physiological and morphological changes.

The small intestine plays an important role in the processes of nutrient absorption and digestion. It is composed of three main layers: mucosa, submucosa, and muscularis. These layers control intestinal motility, secretion, and nutrient absorption.

Adrenergic Nervous System: The adrenergic nervous system functions primarily through norepinephrine and epinephrine (adrenaline). It plays an important role in regulating metabolic processes, blood pressure, and bowel movements. Adrenergic nerve endings and nodules in the wall of the small intestine are important in coordinating intestinal function and nutrient absorption. In metabolic syndrome, the activity of the adrenergic nervous system is altered, which affects the morphology of the small intestinal wall. These changes may affect the intestinal response to nutrients and the process of absorption.

In a model of metabolic syndrome, the morphology of the small intestinal wall adrenergic nervous system is an important factor in determining intestinal function and overall health. This topic provides important information for new approaches to metabolic diseases and their prevention.

Materials and methods: The following materials and methods are used to study the morphology of the adrenergic nervous system of the small intestine wall in the metabolic syndrome model: Materials: Rats are usually selected for the study. They are provided with special diets to simulate metabolic syndrome (for example, high-fat diets). Tissues of the small intestine wall are obtained by taking the animals to the sacrifice. Methods: Tissue samples taken from the small intestine wall are fixed with formalin. The sample is placed in paraffin blocks and sectioned. The sectioned tissues are stained with various dyes (for example, Hematoxylin-Eosin) and examined under a microscope. Special antibodies are used to detect adrenergic nerve nodes and endings. The dimensions and structure of the tissues are analyzed using images taken under a microscope. The data obtained are statistically analyzed. These materials and methods allow for an in-depth study of the morphology of the adrenergic nervous system of the small intestine wall in the metabolic syndrome model. This research is important in developing new approaches to metabolic diseases and their prevention.

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VOLUME-5, ISSUE-5

Research results: In the process of evolution, each organism has its own life stage and type of food. Depending on the type, quality, quantity and lifestyle of this food, the digestive organs also undergo various structural changes and adaptations. The experimental animals we are studying (rats) also have a small intestine wall that is structured according to general laws in accordance with their evolutionary stage, type, quality and lifestyle of food. The small intestine wall of rats, like that of all other mammals, consists of four layers: mucous, submucosal, muscular and serous layers. The small intestine of experimental animals has a unique relief. This relief is formed due to circular folds, suckers and crypts in the mucous layer. These structures increase the absorption area of the small intestine several times. The muscular plate of the mucosa of the circular folds of the small intestine is formed by smooth muscle fibers and sparse fibrous unformed connective tissue of the submucosa. The small intestinal mucosa of rats forms suckers as a result of finger-like growths into the intestinal cavity. On the wall of the small intestine, these suckers formed an average of 4.50±0.25 and a height of 1.2±0.14 per field of view of the microscope. The small intestinal suckers are covered on the outside with a single-layer cylindrical microvilli (marginal) epithelium, the thickness of which is 12.5±0.42. Goblet and endocrine cells are also found among the marginal epithelium. Their number increases towards the bottom of the suckers and crypts. The small intestinal suckers are based on the cylindrical margin epithelium of the small intestine on a basement membrane. Under the basement membrane is a special layer of the small intestinal mucosa, consisting of sparsely formed connective tissue. Its thickness is 22.4±0.86, and collagen fibers, blood vessels, lymphatic vessels, and nerve fibers can be seen in it. The crypts of the small intestine mucosa of experimental animals are formed by penetrating into the lamina propria of the inner surface of the small intestine. These crypts have a tubular structure, and their excretory duct opens into the space between the suckers. The density of the crypts of the small intestine mucosa of rats is on average 12.5±0.36 per 1 cm of the field of view of the microscope. Like suckers, the crypts contain cylindrical, columnar, acidophilic, goblet and endocrine cells with a rim. We see a large number of reticular and collagen fibers in the lamina propriety of the small intestine mucosa. In addition, reticular cells, fibroblasts, lymphocytes, eosinophils and plasma cells can be seen among the reticular and collagen fibers.

In the composition of the special plate of the mucous membrane of the small intestine of experimental animals, there are also solitary lymphoid nodules consisting of aggregates of lymphoid tissue. The size of these lymphoid nodules is on average 1.4±0.26. Their average density of location is 0.4±0.02. The total thickness of the mucous membrane of the wall of the small intestine of experimental animals is on average 54.5±2.28. The muscular layer of the wall of the small intestine of experimental animals consists of smooth muscle fibers with an inner circular and outer longitudinal direction. Between the circular and longitudinal muscle fibers there is a sparse fibrous connective tissue, in which large blood vessels, nerve fibers and nerve tangle can also be seen. The total thickness of the muscular layer is 41.8±2.12. The wall of the small intestine of experimental animals consists of a serous layer, a single-layered squamous epithelium (mesothelium) and connective tissue parts attached to the muscular layer. Its total thickness is 10.6±0.36.

The total thickness of the small intestine wall of experimental animals is 114.954±6.74, consisting of 47.4% mucous, 15.2% submucosal, 36.36% muscular and 0.94% serous layers. When we observe micropreparations prepared from the small intestine of experimental animals in which the metabolic syndrome model was created under a microscope, we see that there are four layers in it: mucous, submucosal, muscular and serous layers. In the relief of the inner surface of the small intestine of experimental animals, the circular folds are slightly thickened, and the suckers are better (longer)

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VOLUME-5, ISSUE-5

developed compared to those of control animals, and the crypts are thickened. It was found that these suckers have an average of 5.6±0.28 in one field of view of the microscope, and the height of the suckers is up to 1.8±0.17.

Thus, the total thickness of the small intestine wall of the rats in the control group was 124.5±6.56, and the total thickness of the small intestine wall of the experimental animals in which the metabolic syndrome model was created was 129.8±6.78. We see that the small intestine wall of the experimental animals in which the metabolic syndrome model was created was thickened by 5.3 or 4.2%. Such morphological and morphometric changes can be explained by the fact that when the metabolic syndrome model is called, the blood circulation in the small intestine wall is impaired, edema occurs due to stagnation, migration of lymphocytes and macrophages, and hypertrophy of erythrocytes.

Conclusion: In conclusion, a number of functional and morphological changes are observed in the adrenergic nervous systems of the small intestine wall in experimental animals in which a metabolic syndrome model has been created.

The morphology of the adrenergic nervous system of the small intestine wall in the model of metabolic syndrome is an important subject of scientific research. Through these studies, the following conclusions can be drawn:

In the state of metabolic syndrome, changes occur in the morphology of the adrenergic nervous system in the wall of the small intestine. These changes affect the functions of the intestine, in particular, the absorption of nutrients.

Through histological and immunohistochemical analyses, adrenergic nerve ganglia and their location in the intestinal wall are determined. This information helps to understand the morphological structure of the intestine.

Changes in the adrenergic nervous system affect intestinal movement and secretion, which can lead to the development of metabolic diseases.

These studies will contribute to the development of new approaches to the prevention and treatment of metabolic diseases, as well as a deeper understanding of the relationship between the intestinal and nervous systems.

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