PHILIPPINE JOURNAL OF APPLIED MEDICAL SCIENCES

ISSN: 2984-6730

MEDICAL SCIENCES

JOURNAL OF APPLIED MEDICAL SCIENCES

VOLUME-9, ISSUE-01, (2026)

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |27-02-2026|

ABOUT THE JOURNAL

Journal of Applied Medical Sciences is an international, open-access, peer-reviewed scholarly journal published on a bimonthly basis. The journal is dedicated to promoting high-quality scientific research and advancing knowledge across a broad range of disciplines within the medical and health sciences. By providing an accessible and reliable platform for academic exchange, the journal aims to facilitate the dissemination of innovative research findings, clinical experiences, and theoretical developments that contribute to improving healthcare practices and medical education worldwide.

The primary mission of the Journal of Applied Medical Sciences is to encourage the publication of original research, comprehensive reviews, and clinical studies that address current challenges and emerging trends in modern medicine. The journal seeks to bring together researchers, clinicians, healthcare professionals, and scholars from different parts of the world to share their expertise and contribute to the advancement of medical science and healthcare systems.

The journal publishes various types of scholarly articles, including original research articles, review papers, case reports, clinical studies, methodological papers, short communications, and evidence-based practice reports. All submitted manuscripts undergo a rigorous peer-review process to ensure scientific quality, academic integrity, and methodological accuracy.

Scope of the Journal

Journal of Applied Medical Sciences publishes research in all major disciplines and sub-disciplines related to applied medical sciences and healthcare. The journal covers both fundamental biomedical research and clinical medical studies, aiming to bridge the gap between scientific discoveries and practical medical applications.

The journal welcomes research contributions in the following fields of basic medical sciences:

Anatomy, Biochemistry, Biomechanics, Biophysics, Biostatistics, Cytology, Embryology, Epidemiology, Genetics, Histology, Immunology, Medical Physics, Microbiology, Molecular Biology, Neuroscience, Nutrition Science, Pathology, Pharmacology, Photobiology, Physiology, Radiobiology, Toxicology, and related biomedical sciences.

These disciplines play a fundamental role in understanding the biological mechanisms underlying human health and disease. By publishing studies in these areas, the journal aims to support the development of innovative diagnostic tools, therapeutic strategies, and preventive healthcare solutions.

Clinical and Surgical Sciences

In addition to basic medical sciences, the journal also focuses on clinical medicine and surgical sciences. The journal publishes research that contributes to the improvement of clinical practice, patient care, and medical technologies.

Areas of interest include, but are not limited to:

Anesthesiology, Cardiovascular Surgery, Colorectal Surgery, General Surgery, Neurosurgery, Obstetrics and Gynecology, Oncologic Surgery, Ophthalmic Surgery, Oral and Maxillofacial Surgery, Orthopedic Surgery, Otolaryngology, Otorhinolaryngology (ENT), Pediatric Surgery, Plastic Surgery, Thoracic Surgery, Transplant Surgery, Trauma Surgery, Urology, and Vascular Surgery.

Research in these fields helps advance surgical techniques, improve patient safety, and enhance treatment outcomes through the integration of innovative technologies and evidence-based clinical practices.

Medical Specialties and Clinical Research

The journal also publishes research in a wide range of medical specialties that address various aspects of diagnosis, treatment, prevention, and management of diseases.

These specialties include Angiology and Vascular Medicine, Cardiology, Critical Care Medicine, Dermatology, Emergency Medicine, Endocrinology, Family Medicine, Forensic Medicine, Gastroenterology, Geriatrics, Hematology, Hepatology, Hospice and Palliative Medicine, Infectious Diseases, Intensive Care Medicine, Nephrology, Neurology, Obstetrics and Gynecology, Oncology, Palliative Care, Pediatrics, Psychiatry, Pulmonology, Rheumatology, and Sports Medicine.

Research in these areas contributes significantly to improving clinical outcomes, enhancing patient care strategies, and advancing medical knowledge related to disease mechanisms and treatment methods.

Laboratory and Diagnostic Sciences

Journal of Applied Medical Sciences also recognizes the importance of laboratory sciences and diagnostic technologies in modern healthcare. Therefore, the journal encourages research in clinical laboratory sciences and medical diagnostic methods.

These areas include Clinical Biochemistry, Clinical Microbiology, Hematology, Histotechnology, Radiology and Imaging Technology, Transfusion Science, and other diagnostic disciplines that support medical decision-making and patient management.

Advancements in laboratory medicine and diagnostic technologies play a crucial role in early disease detection, monitoring treatment effectiveness, and improving overall healthcare quality.

Commitment to Scientific Integrity

The journal maintains high standards of academic and scientific integrity through a strict peer-review and editorial process. All submitted manuscripts are evaluated by independent experts in the relevant fields to ensure the originality, accuracy, and scientific value of the research.

The editorial board consists of experienced researchers, medical professionals, and academic scholars from various institutions around the world. Their expertise ensures that the journal maintains high-quality publication standards and contributes meaningfully to the global scientific community.

The journal strictly follows international publication ethics guidelines and promotes transparency, objectivity, and ethical conduct in research and publication. Any form of plagiarism, data falsification, or unethical research practice is strictly prohibited.

Global Impact and Academic Collaboration

Journal of Applied Medical Sciences encourages international collaboration and interdisciplinary research. By publishing research from diverse regions and healthcare systems, the journal promotes the exchange of scientific knowledge and encourages collaborative efforts aimed at solving global health challenges.

The journal particularly supports research that addresses pressing medical issues such as emerging diseases, healthcare innovations, public health challenges, and advances in medical technologies.

Through the dissemination of high-quality research and evidence-based findings, the journal seeks to contribute to the improvement of global healthcare systems and the advancement of medical science.

Future Directions

As the field of medical science continues to evolve rapidly, Journal of Applied Medical Sciences remains committed to supporting innovative research and promoting scientific progress. The journal aims to expand its international visibility, strengthen academic partnerships, and provide a reliable platform for researchers and clinicians to share their findings.

By encouraging interdisciplinary research, fostering academic collaboration, and maintaining high editorial standards, the journal strives to play an important role in advancing medical science and improving healthcare outcomes worldwide.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
SJIF Impact Factor |(2023): 5.817|
Volume-9, Issue-01, Published |16-01-2026|

MEDIEVAL DENTISTRY: MYTHS, PRACTICES, AND HISTORICAL REALITY

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ABSTRACT

Medieval dentistry is often portrayed as primitive, brutal, and dominated by superstition and ignorance. Popular narratives frequently depict tooth extraction as a crude procedure performed by untrained individuals using rudimentary tools. However, archaeological evidence, historical documents, and medical manuscripts reveal a more complex and nuanced reality. This article examines dental practices during the medieval period (approximately 5th–15th centuries CE), distinguishing myths from historical facts. Through an interdisciplinary analysis of bioarchaeological findings, medical texts, and social history, the study explores the prevalence of dental diseases, therapeutic practices, professional roles, and cultural perceptions of oral health in medieval Europe and the Islamic world. The findings demonstrate that while medieval dentistry faced significant limitations, it also incorporated empirical knowledge, specialized practitioners, and early preventive concepts that contributed to the foundation of modern dentistry.

Keywords: Medieval Dentistry, History of Dentistry, Barber-Surgeons, Dental Diseases, Medical Myths

INTRODUCTION

The Middle Ages occupy a controversial position in the history of medicine. Often characterized as a “dark” period marked by superstition and scientific stagnation, medieval medical practices—particularly dentistry—have been widely misunderstood. Images of painful tooth extractions performed in public marketplaces by barber-surgeons dominate popular imagination. While such practices did exist, they represent only one aspect of medieval dental care.

Dental diseases were widespread during the medieval period, driven by dietary changes, limited oral hygiene, and increased population density. However, medieval societies also inherited and adapted medical knowledge from classical antiquity and Islamic scholarship. Dentistry, although not formally recognized as a separate profession, played a crucial role in healthcare systems across Europe and the Middle East.

The aim of this article is to critically examine medieval dentistry by separating myth from historical reality. By analyzing archaeological evidence, medical manuscripts, and social structures, this study seeks to provide a balanced understanding of how dental care was practiced, perceived, and developed during the medieval era.

LITERATURE REVIEW

Early historiography often portrayed medieval dentistry as universally crude and ineffective. Nineteenth-century historians, influenced by Enlightenment ideals, emphasized the contrast between

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ISSN(Online): 2984-6730
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medieval practices and modern scientific medicine. However, more recent scholarship has challenged this narrative.

Researchers such as Ring, Guerini, and Roberts argue that medieval dentistry must be understood within its historical context. Dental knowledge was largely based on classical sources, including Hippocrates, Galen, and Celsus, whose works were preserved and expanded upon in Islamic medical centers.

Archaeological studies of medieval cemeteries consistently reveal high prevalence of dental caries, periodontal disease, and tooth wear. However, evidence of healed lesions, antemortem tooth loss, and dental modifications suggests that therapeutic interventions were common.

Medical manuscripts from the Islamic Golden Age, such as Avicenna's *Canon of Medicine*, contain detailed discussions of dental anatomy, oral diseases, and treatments. These texts later influenced European medical education through translations into Latin.

The literature increasingly emphasizes the role of barber-surgeons, monks, and itinerant practitioners in providing dental care. While their methods lacked modern anesthesia and antisepsis, they often relied on empirical experience and practical skill rather than pure superstition.

METHODOLOGY

This study employs a qualitative historical and bioarchaeological research methodology based on secondary source analysis. Data were synthesized from

Archaeological reports on medieval skeletal remains

Translations of medieval European and Islamic medical manuscripts

Historical records of medical guilds and professional regulations

The analytical framework integrates:

Paleopathological analysis of dental diseases

Textual analysis of medical writings

Comparative cultural analysis between European and Islamic traditions

Special attention was given to contextual interpretation, avoiding modern biases when evaluating medieval practices. The goal was to assess dentistry according to the knowledge, resources, and social structures available at the time.

RESULTS

Prevalence of Dental Diseases in the Medieval Period. Archaeological evidence indicates that dental disease was extremely common in medieval populations. Dental caries increased significantly compared to prehistoric periods, particularly after the widespread consumption of refined carbohydrates and sugars.

Periodontal disease and tooth loss were prevalent among adults, often leading to chronic pain and infection. Dental abscesses, visible in skeletal remains, suggest prolonged untreated infections that could become life-threatening.

Despite these challenges, many individuals survived long enough to exhibit advanced dental wear and healing, indicating some level of care and adaptation.

SIR Publishers
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JOURNAL OF APPLIED MEDICAL SCIENCES
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Dental Practices and Treatments. Medieval dental treatments focused primarily on symptom relief. Tooth extraction was the most common intervention for severe pain or infection. Barber-surgeons performed extractions using specialized instruments such as dental pelicans and forceps.

Herbal remedies, poultices, and mouth rinses were widely used to treat toothache and gum disease. Ingredients included cloves, sage, vinegar, and wine, some of which possessed genuine antiseptic or analgesic properties.

In the Islamic world, dental hygiene was emphasized through the use of the *miswak* (chewing stick), reflecting early preventive oral care practices.

Professional Roles and Social Organization. Dentistry in medieval Europe was not a regulated profession. Dental care was provided by a variety of practitioners, including barber-surgeons, physicians, monks, and itinerant healers.

Barber-surgeons occupied a unique position, combining surgical skills with practical dentistry. While often ridiculed in later accounts, they played a vital role in providing accessible care to the general population.

Medical guilds gradually introduced regulations, marking early steps toward professionalization. In contrast, Islamic medical institutions maintained more formalized training systems, integrating dentistry into medical education.

Myths and Misconceptions. One of the most enduring myths of medieval dentistry is the belief that it was entirely dominated by superstition and magical thinking. While religious and spiritual elements were present, many treatments were based on observation and experience.

Another misconception is that dental pain was universally accepted as unavoidable. Historical records indicate that people actively sought relief and valued practitioners who could alleviate suffering.

These findings challenge simplistic portrayals of medieval dentistry and highlight its complexity.

DISCUSSION

The results demonstrate that medieval dentistry was neither purely barbaric nor entirely ineffective. It represented a transitional phase in medical history, balancing inherited classical knowledge, religious beliefs, and practical experience.

While limitations such as lack of anesthesia and poor infection control increased risks, medieval practitioners developed adaptive strategies within these constraints. The emphasis on extraction reflects pragmatic decision-making rather than ignorance.

Importantly, medieval dentistry laid the groundwork for later advancements by preserving knowledge, developing tools, and establishing practitioner roles. The gradual move toward regulation and education during the late medieval period directly influenced Renaissance dentistry.

CONCLUSION

Medieval dentistry must be understood as a historically situated practice shaped by cultural, technological, and scientific limitations. Archaeological and textual evidence reveals a field that addressed real health needs using available knowledge and resources.

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By separating myth from historical reality, this study demonstrates that medieval dentistry contributed meaningfully to the evolution of oral healthcare. Recognizing these contributions enriches our understanding of dentistry as a cumulative and adaptive medical science.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-01-2026|

"ANALYSIS OF THE EFFECTIVENESS OF BIOPREPARATIONS DERIVED FROM MICROORGANISMS IN THE CULTIVATION OF ORNAMENTAL PLANTS DURING EXTRACURRICULAR ACTIVITIES (ON THE EXAMPLE OF A BIOLOGY LESSON)"

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ABSTRACT

This article analyzes the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants within the framework of extracurricular biology activities. The study aims to evaluate the pedagogical and biological significance of using environmentally friendly biopreparations to improve students' practical skills, scientific thinking, and ecological awareness. The research was conducted based on experimental and observational methods, where ornamental plants were cultivated using microbial biopreparations under controlled conditions. Growth indicators, plant health, and resistance to diseases were compared with traditionally cultivated plants. The results demonstrate that biopreparations significantly enhance plant growth, improve soil fertility, and reduce the need for chemical fertilizers. In addition, integrating this topic into extracurricular activities contributes to the development of students' research competencies, interest in biology, and understanding of sustainable agriculture. The findings confirm that the use of microorganism-based biopreparations is both biologically effective and pedagogically valuable in biology education.

Keywords: Biopreparations, microorganisms, ornamental plants, extracurricular activities, biology education, sustainable agriculture, environmental education, plant growth, soil fertility, eco-friendly technologies, practical skills development

INTRODUCTION

In recent years, the application of environmentally friendly technologies in agriculture and plant cultivation has gained increasing attention worldwide. One of the most promising approaches in this field is the use of biopreparations derived from microorganisms, which play a crucial role in enhancing plant growth, improving soil fertility, and reducing the negative impact of chemical fertilizers on the environment. These biopreparations include beneficial bacteria and fungi that stimulate plant development, increase resistance to diseases, and support sustainable agricultural practices.

Ornamental plants hold significant aesthetic, ecological, and educational value. Their cultivation is not only important for landscaping and environmental improvement but also serves as an effective tool in biology education. In particular, involving students in the cultivation of ornamental plants allows them to develop practical skills, observe biological processes directly, and strengthen their interest in natural sciences. Therefore, integrating modern biotechnological approaches, such as the use of microbial biopreparations, into biology lessons and extracurricular activities is of great pedagogical importance.

Extracurricular activities in biology provide a flexible educational environment where students can apply theoretical knowledge in practice, conduct experiments, and develop research competencies. Unlike traditional classroom lessons, extracurricular activities encourage independent thinking, creativity, and hands-on learning. Introducing the topic of microorganism-based biopreparations within such activities enables students to understand the principles of sustainable agriculture, environmental protection, and modern biological technologies.

Despite the growing interest in biopreparations, their application in school-level biology education, especially within extracurricular settings, remains insufficiently studied. There is a need to analyze not only the biological effectiveness of these preparations in ornamental plant cultivation but also their educational value in developing students' scientific skills and ecological awareness.

Therefore, the aim of this study is to analyze the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants during extracurricular biology activities. The research focuses on evaluating plant growth indicators, soil improvement, and disease resistance, as well as assessing the role of this approach in enhancing students' practical skills and interest in biology.

MATERIALS AND METHODS

Research Design and Setting. The research was carried out within the framework of extracurricular biology activities organized at the secondary school level. The study was designed as a pedagogical and biological experiment aimed at evaluating the effectiveness of microorganism-derived biopreparations in the cultivation of ornamental plants. The experimental work was conducted over one vegetation period under controlled environmental conditions to ensure the reliability and comparability of the results.

Participants and Educational Context. The extracurricular activities involved secondary school students who participated voluntarily under the guidance of a biology teacher. Students were introduced to the objectives of the study, basic safety rules, and the principles of working with biological materials. The educational process emphasized active learning, observation, and practical experimentation.

Plant Material. The study focused on ornamental plant species widely used in educational practice and landscaping due to their adaptability and clear growth indicators. Both flowering and decorative foliage plants were selected to observe different growth responses. All plants were cultivated in similar soil substrates to minimize external influences.

Biopreparations and Microorganisms. The biopreparations used in the experiment were based on beneficial microorganisms, including nitrogen-fixing bacteria, phosphate-solubilizing bacteria, and growth-promoting fungi. These microorganisms are known for their ability to improve nutrient availability, stimulate root development, and enhance plant resistance to environmental stress. Only environmentally safe and non-toxic biopreparations suitable for educational use were selected.

Experimental Groups and Treatment. The plants were divided into two groups:

- **Experimental group**, in which biopreparations were applied according to manufacturer recommendations;
- **Control group**, in which plants were grown without the use of biopreparations, following traditional cultivation methods.

Biopreparations were applied during planting and at specific growth stages using standardized procedures. All other cultivation conditions, including watering, lighting, and temperature, were kept identical for both groups.

Data Collection Methods. Plant growth and development were assessed using several indicators, including plant height, number of leaves, flowering intensity, and overall physiological condition. Observations were conducted weekly, and the results were recorded in observation journals maintained by students under teacher supervision. Soil condition and plant resistance to diseases were evaluated through visual assessment and comparative analysis.

Data Analysis. The collected data were analyzed using descriptive and comparative methods to identify differences between the experimental and control groups. The effectiveness of

biopreparations was determined based on observed improvements in plant growth, health, and soil quality.

Pedagogical Evaluation. In addition to biological outcomes, the educational effectiveness of the activity was assessed. Students' practical skills, interest in biology, and understanding of ecological concepts were evaluated through observation, participation analysis, and reflective discussions. This approach allowed the integration of biological research with pedagogical assessment.

RESULT

The results of the study revealed noticeable differences between ornamental plants grown using microorganism-based biopreparations and those cultivated by traditional methods. Throughout the experimental period, plants in the experimental group demonstrated improved growth performance and overall physiological condition compared to the control group.

Plant Growth Indicators. Plants treated with biopreparations showed a higher growth rate. The average plant height in the experimental group increased more rapidly than in the control group. In addition, the number of leaves per plant was significantly higher in the experimental group, indicating enhanced vegetative development. Flowering ornamental plants exhibited earlier and more abundant flowering when biopreparations were applied.

Plant Health and Resistance. Visual assessment of plant health demonstrated that plants in the experimental group had stronger stems, more intensive leaf coloration, and fewer signs of stress. Symptoms of plant diseases and pest damage were observed less frequently in plants treated with biopreparations compared to the control group. This indicates an increase in plant resistance to unfavorable environmental conditions and biological stress factors.

Soil Condition. Soil observations revealed that the use of microorganism-based biopreparations positively affected soil quality. The soil in the experimental group appeared more structured and moist, which contributed to better root development. Improved soil condition was reflected in enhanced nutrient uptake and overall plant vitality.

Educational Outcomes. From an educational perspective, students actively involved in the experimental process demonstrated increased interest in biology and practical activities. Students showed improved skills in observation, data recording, and basic experimental analysis. Participation in the cultivation process using biopreparations helped students better understand the role of microorganisms in plant growth and soil ecosystems.

DISCUSSION

The findings of this study confirm the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants. The observed improvements in plant growth, health, and soil condition in the experimental group can be attributed to the biological activity of beneficial microorganisms, which enhance nutrient availability and stimulate physiological processes in plants.

The increased plant height, leaf number, and flowering intensity observed in plants treated with biopreparations are consistent with previous research indicating that microorganisms such as nitrogen-fixing bacteria and growth-promoting fungi positively influence plant development. These microorganisms improve nutrient uptake and root system development, leading to more vigorous plant growth.

Improved plant health and resistance to diseases in the experimental group suggest that biopreparations contribute to strengthening plant immunity. Beneficial microorganisms are known to suppress pathogenic microflora and enhance plants' tolerance to environmental stress. This reduces

the need for chemical fertilizers and pesticides, supporting environmentally sustainable cultivation practices.

The positive changes observed in soil condition further emphasize the importance of microbial activity in maintaining soil fertility. Enhanced soil structure and moisture retention create favorable conditions for root growth and nutrient absorption, which directly influence plant productivity.

From a pedagogical perspective, the integration of microorganism-based biopreparations into extracurricular biology activities proved to be highly effective. Students' active participation in the experimental process fostered practical skills, critical thinking, and a deeper understanding of biological concepts. The hands-on approach encouraged students to connect theoretical knowledge with real-life applications, thereby increasing their interest in biology and environmental education.

Overall, the results highlight that combining biological experimentation with educational objectives enhances both learning outcomes and environmental awareness. The study demonstrates that extracurricular activities provide an ideal platform for introducing modern biotechnological methods at the school level.

CONCLUSION

The results of this study demonstrate that biopreparations derived from microorganisms are highly effective in the cultivation of ornamental plants. Their application significantly improves plant growth, health, and soil condition, while reducing dependence on chemical fertilizers. The use of microbial biopreparations contributes to sustainable and environmentally friendly plant cultivation practices.

In addition to biological benefits, the integration of this topic into extracurricular biology activities has strong pedagogical value. Students actively involved in the experimental process developed practical skills, scientific thinking, and ecological awareness. The hands-on approach enhanced students' interest in biology and facilitated a deeper understanding of the role of microorganisms in plant growth and soil ecosystems.

Overall, the study confirms that microorganism-based biopreparations can be successfully used not only as an effective biological tool but also as an innovative educational resource. Their application in extracurricular biology activities supports both sustainable agriculture principles and the development of research competencies among students.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-01-2026|

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |31-01-2026|

"CLINICAL AND MORPHOLOGICAL PARALLELS IN AMNIOTIC FLUID VOLUME ANOMALIES"

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ABSTRACT

Amniotic fluid volume abnormalities are an important diagnostic and prognostic indicator of abnormal pregnancy. Oligohydramnios and polyhydramnios are often accompanied by fetal developmental abnormalities and structural changes in the placenta. This article examines the clinical and morphological parallels between various forms of amniotic fluid volume abnormalities, analyzing their causes, clinical manifestations, and morphological features of the placental -fetal complex. The importance of a comprehensive clinical and morphological approach for assessing fetal condition and prognosticating pregnancy is emphasized.

Key words: amniotic fluid, oligohydramnios, polyhydramnios, placenta, fetus, clinical and morphological parallels.

INTRODUCTION

Amniotic fluid is an essential component of the intrauterine environment and plays a key role in ensuring normal fetal growth and development throughout all stages of gestation . It creates optimal conditions for fetal motor activity, protects it from mechanical stress, prevents umbilical cord compression, facilitates maternal-fetal metabolism, and promotes the development of the respiratory, digestive, and musculoskeletal systems. The quantitative and qualitative characteristics of amniotic fluid are closely linked to the functional state of the placenta and the fetoplacental complex as a whole.

Amniotic fluid volume abnormalities play a significant role in obstetric pathology and are considered an important marker for an unfavorable pregnancy course. The most common forms of these abnormalities are oligohydramnios and polyhydramnios, which can develop due to extragenital maternal pathology, placental insufficiency, intrauterine infections, and congenital fetal malformations. The incidence of these conditions remains high, making them relevant in modern clinical practice.

Oligohydramnios is associated with an increased risk of intrauterine growth retardation, chronic hypoxia, musculoskeletal deformities, and complicated labor. Polyhydramnios, in turn, can lead to uterine overdistension , premature labor, and is often accompanied by severe congenital fetal abnormalities. However, the clinical manifestations of these conditions do not always fully reflect the severity of the morphological changes in the placenta and fetal membranes.

Of particular interest is the study of clinical and morphological parallels in amniotic fluid volume anomalies, allowing for the comparison of clinical data with the results of placental morphological examination. This approach facilitates a more accurate assessment of the severity of pathological processes, clarification of their mechanisms, and prediction of perinatal outcomes. A comprehensive analysis of clinical and morphological parameters is essential for improving the diagnosis, prevention, and management of pregnancy in these complications.

The purpose of the work. To study clinical and morphological parallels in amniotic fluid volume anomalies and determine their significance for diagnosis and prognosis of pregnancy.

Materials and methods. The study was conducted using clinical observation data from pregnant women diagnosed with oligohydramnios and polyhydramnios, as well as the results of a morphological examination of the placenta. Clinical, ultrasound, and morphological examination

methods were used. The volume of amniotic fluid, fetal condition, the course of pregnancy and labor, and macro- and microscopic changes in the placenta and membranes were assessed.

RESULTS

The analysis revealed that abnormalities in the volume of amniotic fluid are accompanied by significant clinical and morphological changes, the degree of which varies depending on the form of the pathology and the severity of the pregnancy.

In pregnant women with **oligohydramnios** , the most common clinical signs were intrauterine growth retardation, decreased fetal motor activity, uterine size disproportionate to gestational age , and signs of chronic fetoplacental insufficiency. Ultrasound examination revealed a decreased amniotic fluid index and decreased blood flow in the uteroplacental and fetoplacental circulations, indicating impaired fetal nutrition.

Morphological examination of the placentas during oligohydramnios revealed pronounced degenerative and ischemic changes in the placenta. Macroscopically, a decrease in placental mass, uneven thickness, and the presence of infarcts and fibrinoid deposits were noted. Microscopically, sclerotic changes in the chorionic villi, reduced vascularity, and thickening of the basement membrane were detected, indicating chronic uteroplacental circulatory dysfunction. Fetal signs of organ hypoplasia, including lung hypoplasia, as well as limb deformities due to prolonged intrauterine space restriction, were observed.

In patients with **polyhydramnios,** the clinical picture was characterized by an enlarged uterus, a feeling of heaviness and abdominal pain, shortness of breath, increased uterine tone, and the risk of preterm labor. Ultrasound revealed a significant increase in amniotic fluid volume, as well as signs of fetal macrosomia or congenital malformations.

Morphological analysis of the placenta in polyhydramnios revealed an increase in size and weight, marked edema of the villous stroma, dilation of the intervillous spaces, and signs of venous congestion. In some cases, inflammatory changes in the amnion and chorion were detected, potentially indicating intrauterine infection. Fetal malformations of the gastrointestinal tract and central nervous system, impairing the ingestion and resorption of amniotic fluid, were most frequently observed.

A comparison of clinical data with the results of morphological examination revealed clear clinical and morphological parallels: the severity of clinical manifestations directly correlated with the severity of structural changes in the placenta and fetal organs. The most severe clinical forms of oligohydramnios and polyhydramnios were accompanied by severe morphological abnormalities, significantly worsening the perinatal prognosis.

CONCLUSIONS

1) Anomalies in the volume of amniotic fluid are accompanied by characteristic clinical and morphological changes in the placenta and fetus.
2) Oligohydramnios is most often associated with chronic placental insufficiency and fetal growth retardation.
3) Polyhydramnios is often associated with congenital malformations and inflammatory changes in the membranes.
4) Analysis of clinical and morphological parallels is important for prognosticating pregnancy and choosing patient management tactics.

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Volume-9, Issue-01, Published |31-01-2026|

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

MORPHOSTRUCTURAL FEATURES OF BIOLOGICAL FLUIDS IN ABNORMAL UTERINE BLEEDING

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ABSTRACT

Menstrual flow analysis using the Lithos-System technology is a poorly studied, non-invasive, and promising method for the early diagnosis of female reproductive organ diseases. This study allowed us to obtain an integrated assessment of both systemic and local homeostasis during abnormal uterine bleeding in women of reproductive age.

Keywords: abnormal uterine bleeding, menstrual flow, biological fluid morphology.

RELEVANCE

Abnormal uterine bleeding (AUB) is a general term used to describe uterine bleeding that exceeds the volume and duration of normal menstruation in women of reproductive age [1]. AUB occurs in 14-25% of women of reproductive age [2] and can have a significant impact on their physical, social, emotional, and material quality of life. According to G.E. According to Chernukha et al. (2018), in Russia, AUB is one of the main causes of iron deficiency anemia, reducing women's productivity and quality of life. It also ranks second among the reasons for women's hospitalization in gynecological hospitals and serves as an indication for two-thirds of hysterectomies and endometrial ablations. Along with its direct impact on women's quality of life, AUB represents a significant national challenge, both for healthcare and for the economy as a whole. In the past decade, interest in studying the pathogenesis of AUB has increased significantly, driven by the increasing frequency of ovulatory and anovulatory uterine bleeding, particularly during the period of menstrual function establishment [2]. Treatment and rehabilitation of patients with this pathology are highly relevant, as relapses of the disease worsen the prognosis for reproductive function, which is a social and economic problem [1].

In modern gynecology, the study of the pathogenesis of abnormal uterine bleeding has received increasing attention, particularly in recent years, due to the increasing frequency of ovulatory and anovulatory uterine bleeding, particularly during the period of establishing menstrual function [14]. Treatment and rehabilitation of patients with this pathology are highly relevant, as relapses of the disease worsen the prognosis for reproductive function, which is a social and economic problem [15]. Intermenstrual uterine bleeding in the form of menorrhagia and menometrorrhagia are common forms of menstrual dysfunction during the reproductive period. Approximately five to ten percent of women in the population who do not have risk factors (use of hormonal and intrauterine contraceptives) suffer from menorrhagia [1].

Analyses of gynecological morbidity indicate that menstrual disorders in the form of uterine bleeding (UB) are now a much more common reason for visits to treatment and preventive medical centers [2]. For example, according to one national study [1], uterine bleeding of various etiologies accounted for 19.1% of 20.1 million gynecological visits over two years. Furthermore, 25 percent of gynecological surgical procedures are associated with uterine bleeding (UB). It should be noted that 30 to 50 percent of all hysterectomies are due to intrauterine pathology, while in 20 percent of cases, the cause of uterine bleeding was not histologically verified [1,10].

The average duration of disability for patients due to uterine bleeding is more than 10 days, which is comparable to the loss of ability to work due to salpingooophoritis and other pelvic diseases with inflammatory processes.

The impossibility of using a standardized treatment regimen for some patients is explained by the unique mechanisms of AUB. Therefore, clarifying the etiology and pathogenesis of the disease is

undoubtedly of interest to clinicians, as it determines the scope and nature of therapeutic measures and the selection of hormonal drugs for hemostatic or corrective therapy [2,11]. From the perspective of hormonal regulation disorders and trophism of the basal layer of the endometrium, it is necessary to study the mechanisms of AUB development of inorganic origin. However, despite the wide range of pathomorphological, immunohistochemical, and cytogenetic studies, the data obtained on the relationship between AMC and endocrine influences are controversia [2,12].

It is generally accepted [1,13] that the risk of progression of uterine bleeding (relapse, transition to an atypical variant, malignancy) largely depends on the proliferative activity of glandular epithelial cells. Glandular-stromal and cytokaryometric characteristics of hyperplastic endometrium, revealed by morphometry, are a morphological manifestation of the proliferative activity of cells [14].

Comparative microspectrophotometry using a computerized image analyzer has also retained its relevance as an alternative morphometric method, allowing for quantitative and qualitative ("proliferative activity" and "differentiation index") characterization of the ploidy of the cell nuclei being studied [15]. It should be noted that informative quantitative methods for studying the protein-synthetic and proliferative activity of cells in EHE are undeservedly rarely used, and we were unable to find morphological criteria for predicting the possible development of EHE recurrence in the available literature [3,4,6].

The etiology and pathogenesis of AUC remain poorly understood, while their incidence continues to increase. Recent literature data demonstrate the high diagnostic value of the Lithos-system technology ("wedge-shaped" and "marginal" dehydration) [3,5, 7, 8] for various diseases, including reproductive organ pathology, which has allowed its use in patients with AUC [1,2, 9].

Objective: To study the morphological characteristics of recurrent endometrial hyperplasia using a comprehensive morphological analysis of uterine mucosal scrapings to identify criteria for predicting endometrial hyperplasia recurrence.

MATERIALS AND METHODS

The study was conducted at the Department of Obstetrics and Gynecology, Faculty of Medicine, Bukhara State Medical Institute. We examined 41 patients aged 18 to 44 years (32.6 ± 1.1 years). A control group of 32 apparently healthy volunteers without genital pathology was selected. The age of the patients in both groups was comparable ($p > 0.05$). Peripheral blood serum (PBS) and menstrual supernatant (MS) were analyzed in both groups. MS was obtained by aspirating 5 ml of contents from the uterine cavity during menstrual bleeding using a Pipelle catheter. The indicated biological fluids (BF) were centrifuged for 5 minutes at a speed of 3000 rpm**.**

For the study, 0.2 ml of the dehydrated droplet (facies) was applied to the surface of a standard 75 x 25 mm glass slide and dried at room temperature for 24 hours. The slides were pre-soaked in a detergent solution for 24-48 hours, then rinsed under running water for 10 minutes and placed in Nikiforov's solution, consisting of equal parts alcohol and ether, for 30 minutes. Before applying the sample, the slides were wiped with a dry, lint-free cloth. The structure-forming elements of the dehydrated droplet (facies) were studied at magnifications ranging from 10x to 80x using a Leica ICC 50 binocular microscope and a Pixera color digital camera. The study assessed the overall facies structure (systemic organization) and local structures. The study revealed that the facies structure differed significantly between the control and study groups.

RESULTS AND DISCUSSION

Thus, in the facies of the SSC, the irradial type of facies ($p<0.001$) was observed more often than in the control group - a marker of failure of the body's adaptive mechanisms, markers of chronic intoxication - toxic plaques ($p<0.005$), signs of acute and chronic inflammatory processes - lingual

structures ($p<0.001$), sickle-shaped structures indicating necrobiotic processes ($p<0.002$), markers of vasospasm and microcirculation disorders - comb structures ($p<0.001$) and streaky cracks ($p<0.001$), markers of hypoxic and ischemic conditions - tourniquet blocks ($p<0.001$), as well as signs of deep metabolic disorders - dichotomies ($p<0.002$). In the control group, the presence of certain pathological structures was associated with the presence of extragenital pathology (EGP) in patients, including vegetative-vascular dystonia, cervical osteochondrosis, and chronic inflammatory processes (chronic tonsillitis, chronic bronchitis, etc.). When studying the supernatant facies of the uterine vulva (MV) of healthy women, it was noted that 43.8% of cases had a radial facies type, while 56.2% had a partial-radial type, considered a normal variant. The supernatant facies of the MV differed significantly from the facies of the uterine cavity (SCC). Thus, in 100% of cases, triradiate fissures were found in the central zone of the supernatant MV, which is normal in this case, as MV are stagnant due to their temporary presence in the uterine cavity.

It should be noted that in the supernatant facies of the peripheral blood of the control group, in contrast to the facies of the peripheral blood complex, no cases of pathological inclusions were observed. This confirms the diagnostic value of the MB study, since the influence of the existing EGP on the structure of the peripheral blood facies cannot be ruled out. Examining the supernatant facies of the peripheral blood of patients with AUB, it was revealed that the radial type was observed in 43.9% of cases, partially radial in 41.5%, and irradial in 12.1%, which is a marker of profound metabolic disorders in the body. Toxic plaques were found in 12.2% and dead-end fissures in 9.8%, which are markers of intoxication. Lingual structures, markers of the inflammatory process, were observed in 41.5% of cases, with lingual fields being found in 9.8%, indicating a pronounced inflammatory process. In addition, markers of vasospasm and microcirculation disorders were identified — ridge structures (7.3%) and streaky fissures (19.5%); markers of necrobiosis — sickle-shaped elements (4.9%); markers of tension of adaptive mechanisms of homeostasis — "twist" cracks (44%); markers of hypoxic and ischemic processes in tissues — cord-like formations (14.6%); markers indicating deep metabolic disorders in the body — dichotomies (41.5%). In contrast to the structure of the construction of the facies of the supernatant of the uterine fluid of the control group, where three-beam fissures in the central zone were observed in 100% of cases, in the facies of women with AUB, three-beam fissures were detected only in 61%. This is due to the fact that with profuse bleeding, the factor of long-term presence of pathological uterine fluid in the uterine cavity is excluded. When conducting a correlation analysis of the obtained data, a relationship was observed between the presence of pathological structures in the facies of the CF supernatant and existing gynecological diseases in patients with AUB.

Thus, chronic endometritis correlated with the presence of toxic plaques ($r \approx 0.3$) (Fig. 2), and the presence of leukocyte infiltration in the endometrial tissues, revealed by histological examination, was combined with toxic plaques ($r \approx 0.4$) and tongue-shaped structures ($r \approx 0.4$) (Fig. 3). The presence of uterine fibroids correlated with markers of vasospasm - pectinate structures ($r \approx 0.2$) (Fig. 4); markers of hypoxic conditions and ischemia - tourniquets ($r \approx 0.3$) (Fig. 5); markers of intoxication - dead-end fissures ($r \approx 0.2$). Thus, this study confirms the diagnostic value of examining the uterine cavity and uterine tract using the Lithos-System technology, which allows not only to identify the leading causes of AUB but also to conduct differential diagnosis of markers of extragenital and genital pathologies.

Today, uterine tract is a poorly studied biochemical marker that provides a wealth of information about the condition of a woman's reproductive organs.

CONCLUSIONS

1. Using microbiological imaging in the diagnosis of gynecological pathologies using the Lithos-System technology allows for the rapid and cost-effective acquisition of objective information on the condition of the female reproductive system in a prenatal clinic setting, using small volumes of biopsy specimens.

2. The non-invasive and atraumatic nature of the sample collection method, as well as the ease of processing and storage, opens up extensive opportunities for screening studies, patient follow-up, and the identification of women at risk for developing AUB. The ability to interpret the obtained information is one of the challenges of modern gynecological practice**.**

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

"ANALYSIS OF THE EFFECTIVENESS OF BIOPREPARATIONS DERIVED FROM MICROORGANISMS IN THE CULTIVATION OF ORNAMENTAL PLANTS IN SCHOOL BIOLOGY LESSONS."

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ABSTRACT

The growing interest in environmentally friendly and sustainable agricultural practices has increased the relevance of biopreparations derived from microorganisms in plant cultivation. This article analyzes the effectiveness of microbial-based biopreparations in the cultivation of ornamental plants within the framework of school biology lessons. The study aims to evaluate not only the biological impact of these biopreparations on plant growth, development, and resistance to diseases, but also their pedagogical value in enhancing students' practical skills and ecological awareness. The research is based on experimental observations conducted during biology classes, where ornamental plants were cultivated using selected microbial biopreparations, including biofertilizers and biostimulants, and compared with traditionally cultivated plants. Quantitative and qualitative indicators such as germination rate, growth dynamics, leaf coloration, flowering intensity, and overall plant vitality were systematically analyzed. The results demonstrate that the use of microorganism-derived biopreparations significantly improves plant growth parameters and stress tolerance, while reducing the need for chemical fertilizers. Moreover, integrating this topic into school biology lessons promotes students' understanding of microbiological processes, sustainable agriculture, and the role of beneficial microorganisms in ecosystems. The study concludes that microbial biopreparations are not only effective tools for ornamental plant cultivation but also valuable educational resources for developing scientific thinking, environmental responsibility, and practical competence among school students.

Keywords: biopreparations, beneficial microorganisms, ornamental plants, school biology education, plant growth stimulation, biofertilizers, sustainable agriculture, microbial inoculants, environmental education, experimental teaching methods.

INTRODUCTION

In recent years, the rapid development of biological sciences and increasing environmental challenges have intensified the search for sustainable and eco-friendly approaches in plant cultivation. One of the most promising directions in this field is the use of biopreparations derived from beneficial microorganisms. These biological products, which include biofertilizers, biostimulants, and microbial inoculants, play a significant role in enhancing plant growth, improving soil fertility, and reducing dependence on chemical fertilizers. Their application is especially relevant in the cultivation of ornamental plants, where plant vitality, aesthetic quality, and environmental safety are of primary importance.

Ornamental plants occupy a special place in school biology education, as they are widely used in practical lessons, laboratory work, and extracurricular activities. Through the cultivation of ornamental plants, students not only acquire basic botanical knowledge but also develop practical skills, ecological awareness, and an understanding of sustainable agricultural practices. Integrating modern biotechnological approaches, such as microbial biopreparations, into school biology lessons allows educators to bridge theoretical knowledge with real-world biological processes.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

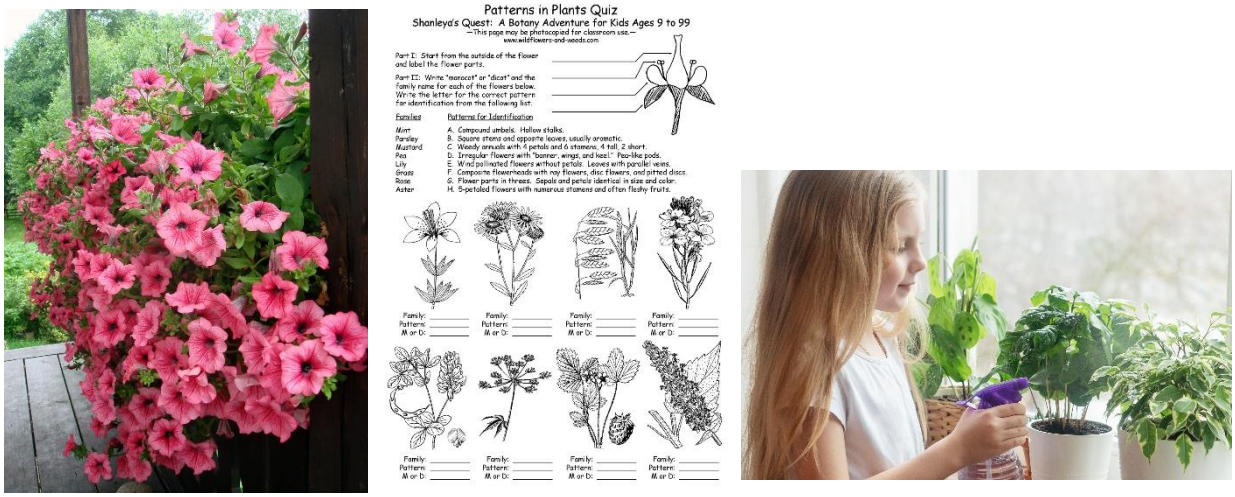

Figure 1. Cultivation of ornamental plants as part of school biology lessons.

Microorganisms used in biopreparations, including nitrogen-fixing bacteria, phosphate-solubilizing microorganisms, and plant growth-promoting rhizobacteria, contribute to improved nutrient uptake, enhanced resistance to diseases, and better adaptation of plants to environmental stress factors. Numerous scientific studies confirm the effectiveness of these microorganisms in agricultural systems; however, their application in educational settings, particularly in school biology lessons, remains insufficiently explored. This creates a need for systematic analysis of both their biological effectiveness and their pedagogical value.

The relevance of this study lies in the intersection of biology education and sustainable plant cultivation. By analyzing the effectiveness of microorganism-derived biopreparations in growing ornamental plants during school biology lessons, it becomes possible to evaluate not only plant growth indicators but also the educational outcomes associated with hands-on learning. Such an approach contributes to the formation of students' scientific thinking, environmental responsibility, and interest in modern biological technologies.

The aim of this research is to analyze the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants within the framework of school biology lessons. The study seeks to assess their impact on plant growth and development, compare the results with traditional cultivation methods, and determine their educational significance in improving students' understanding of microbiological processes and sustainable agriculture.

MATERIALS AND METHODS

The research was conducted within the framework of school biology lessons during the academic year and was designed to evaluate the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants. The study combined experimental, observational, and comparative research methods, ensuring both scientific reliability and pedagogical relevance. Practical activities were integrated into regular biology classes, allowing students to actively participate in the experimental process under teacher supervision.

The experimental material consisted of commonly cultivated ornamental plants suitable for school conditions, including fast-growing and visually expressive species. These plants were selected due to their adaptability to indoor and outdoor environments, clear growth indicators, and relevance for educational purposes. Seeds and seedlings of uniform quality were used to ensure consistency across experimental groups.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

Microbial biopreparations used in the study were selected based on their widespread application in plant cultivation and their proven biological activity. These biopreparations contained beneficial microorganisms such as nitrogen-fixing bacteria, phosphate-solubilizing bacteria, and plant growth-promoting rhizobacteria. The preparations were applied according to manufacturer recommendations, with strict adherence to dosage, application frequency, and safety guidelines. All treatments were conducted in compliance with basic biological safety and hygiene standards appropriate for school laboratory conditions.

The experimental design included two main groups: an experimental group and a control group. Plants in the experimental group were cultivated using microbial biopreparations, while plants in the control group were grown under identical environmental conditions without the application of biopreparations, relying on traditional cultivation methods. Both groups received equal amounts of water, light, and care to eliminate external influencing factors. Environmental conditions such as temperature, humidity, and light exposure were monitored regularly to maintain uniformity.

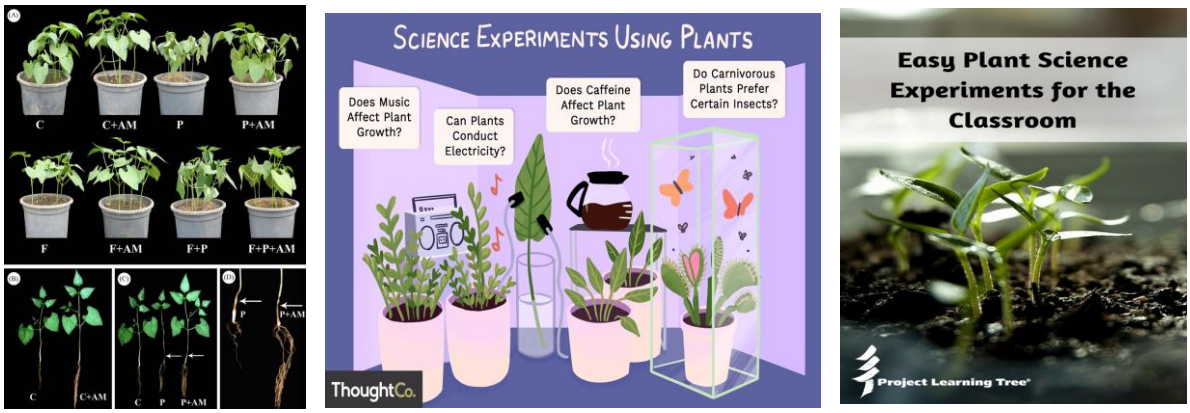


Figure 2. Experimental and control groups used in the cultivation of ornamental plants.

Data collection focused on both quantitative and qualitative indicators of plant development. Quantitative parameters included germination rate, plant height, number of leaves, growth rate, and duration of flowering. Qualitative indicators involved leaf color intensity, overall plant vitality, resistance to visible diseases, and aesthetic appearance. Observations were recorded systematically throughout the growth period using measurement tools and visual assessment scales adapted for educational research.

In addition to biological indicators, pedagogical observations were carried out to assess the educational impact of integrating biopreparations into biology lessons. Students' engagement levels, interest in microbiological processes, and ability to explain the role of microorganisms in plant growth were evaluated through classroom discussions, short written reflections, and teacher observations. This approach allowed the study to assess not only biological effectiveness but also the didactic value of the experimental activities.

The collected data were analyzed using comparative and descriptive statistical methods. Mean values and growth trends were compared between the experimental and control groups to determine the effectiveness of microbial biopreparations. The results were interpreted in relation to both plant development outcomes and educational objectives, providing a comprehensive assessment of the research problem.

RESULTS

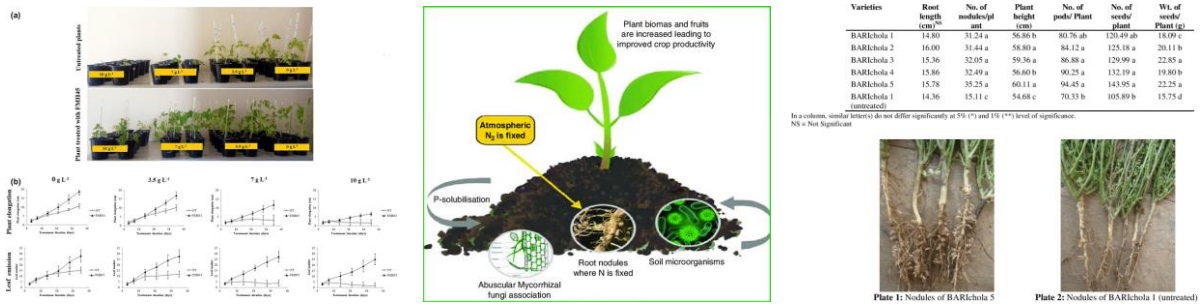
The results of the study revealed a clear positive effect of biopreparations derived from microorganisms on the growth and development of ornamental plants cultivated during school biology lessons. Comparative analysis between the experimental and control groups demonstrated

significant differences across several key biological indicators, confirming the effectiveness of microbial-based treatments under educational conditions.

Seed germination in the experimental group showed a higher and more uniform rate compared to the control group. Seeds treated with microbial biopreparations germinated earlier and exhibited stronger initial growth, resulting in healthier seedlings. This early developmental advantage contributed to improved plant establishment and reduced losses during the initial growth stages. In contrast, the control group displayed slower and less consistent germination, with noticeable variability among individual plants.

Growth dynamics analysis indicated that plants in the experimental group achieved greater average height and a higher number of leaves throughout the observation period. The enhanced vegetative growth was particularly evident during the active growth phase, where treated plants demonstrated accelerated development and more robust stem structure. Leaf morphology in the experimental group was characterized by increased leaf size and deeper green coloration, indicating improved chlorophyll content and nutrient uptake.

Flowering characteristics also differed notably between the two groups. Ornamental plants cultivated with the application of microbial biopreparations entered the flowering stage earlier and maintained longer flowering periods. The intensity and uniformity of flowering were higher in the experimental group, contributing to superior aesthetic quality. In comparison, plants in the control group showed delayed flowering and less abundant blooms, which reduced their decorative value.



Varieties	Root length (cm)	No. of nodules/plant	Plant height (cm)	No. of pods/ Plant	No. of seeds/ plant	Wt. of seeds/ Plant (g)
BARIchola 1	14.80	31.24 a	56.86 b	80.76 ab	120.49 ab	18.09 c
BARIchola 2	16.00	31.44 a	58.80 a	84.12 a	125.18 a	20.11 b
BARIchola 3	15.36	32.05 a	59.36 a	86.88 a	129.99 a	22.85 a
BARIchola 4	15.86	32.49 a	56.60 b	90.25 a	132.19 a	19.80 b
BARIchola 5	15.78	35.25 a	60.11 a	94.45 a	143.95 a	22.25 a
BARIchola 1 (untreated)	14.36	15.11 c	54.68 c	70.33 b	105.89 b	15.75 d

In a column, similar letter(s) do not differ significantly at 5% (*) and 1% (**) level of significance.
NS = Not Significant

Plate 1: Nodules of BARIchola 5

Plate 2: Nodules of BARIchola 1 (untreated)

Figure 3. Comparison of growth parameters between biopreparation-treated plants and untreated plants

Plant health and resistance indicators further supported the effectiveness of microorganism-derived biopreparations. Treated plants exhibited greater resistance to common stress factors, such as temporary water deficiency and minor temperature fluctuations. Visible symptoms of plant diseases and physiological disorders were less frequent in the experimental group, whereas the control group showed a higher occurrence of leaf yellowing and growth retardation.

In addition to biological outcomes, the integration of microbial biopreparations into biology lessons had a positive educational impact. Students demonstrated increased interest and engagement during practical activities, particularly when observing visible differences between treated and untreated plants. Classroom discussions and written reflections indicated an improved understanding of the role of microorganisms in plant nutrition and ecosystem functioning. Students were able to explain the biological mechanisms underlying plant growth stimulation more accurately, linking theoretical knowledge with experimental observations.

Overall, the results confirm that biopreparations derived from microorganisms significantly enhance ornamental plant growth, vitality, and decorative qualities under school conditions. At the same time, their use contributes to more effective biology education by promoting experiential learning and ecological awareness.

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ISSN(Online): 2984-6730
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DISCUSSION

The findings of this study confirm that biopreparations derived from microorganisms play a significant role in improving the growth and development of ornamental plants cultivated in school biology lessons. The observed improvements in germination rate, vegetative growth, flowering intensity, and plant health are consistent with existing scientific research on the positive effects of beneficial microorganisms in plant cultivation. These results support the hypothesis that microbial biopreparations enhance plant physiological processes by improving nutrient availability and stimulating natural growth mechanisms.

One of the key explanations for the improved growth performance in the experimental group lies in the biological activity of the microorganisms present in the biopreparations. Nitrogen-fixing bacteria contribute to increased nitrogen availability, while phosphate-solubilizing microorganisms improve phosphorus uptake, both of which are essential for plant development. In addition, plant growth-promoting rhizobacteria stimulate root development and enhance the synthesis of phytohormones, leading to stronger and more resilient plants. These mechanisms likely account for the accelerated growth dynamics and improved leaf coloration observed in treated plants.

The earlier onset and prolonged duration of flowering in the experimental group can be interpreted as a result of balanced nutrient absorption and enhanced metabolic activity. Ornamental plants are particularly sensitive to nutrient deficiencies, which directly affect their aesthetic qualities. The use of microbial biopreparations appears to create more favorable conditions for continuous and uniform flowering, thereby increasing the decorative value of the plants. This finding is especially relevant for educational settings, where visual outcomes play an important role in maintaining student interest and motivation.

From an educational perspective, the integration of biopreparations into school biology lessons proved to be highly effective. The hands-on experimental approach allowed students to actively observe biological processes rather than passively receive information. This experiential learning model facilitated deeper understanding of microbiological concepts and reinforced the connection between theoretical knowledge and real-life applications. Students' improved ability to explain the role of microorganisms in plant growth indicates the development of scientific thinking and analytical skills.

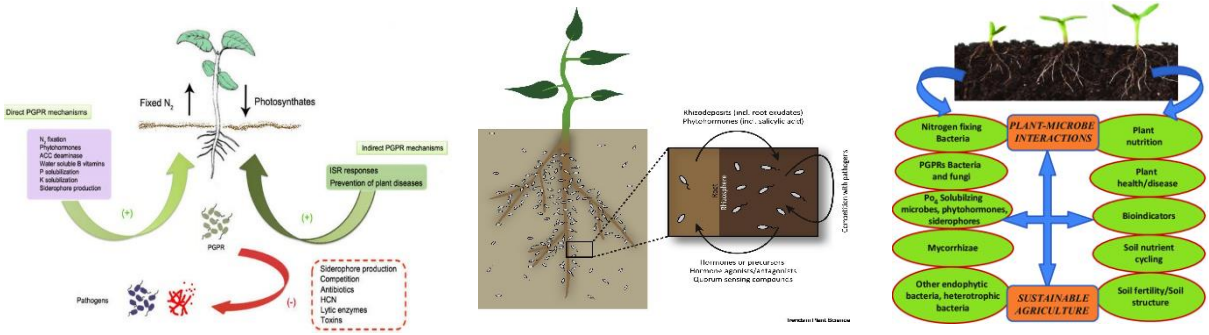

Figure 4. Interaction between beneficial microorganisms and plant root systems.

The results also highlight the environmental significance of using biopreparations in educational practice. Reducing reliance on chemical fertilizers aligns with the principles of sustainable development and environmental protection. Introducing students to eco-friendly cultivation methods at an early stage fosters ecological responsibility and awareness of sustainable agricultural practices. In this context, school biology lessons serve not only as a platform for knowledge acquisition but also as a means of shaping environmentally conscious attitudes.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
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Despite the positive outcomes, the study has certain limitations. The experimental period was limited to a single academic year, and the range of ornamental plant species was restricted. Future research could expand the duration of observations, include a wider variety of plant species, and apply more advanced statistical analysis methods to further validate the findings. Nevertheless, the results provide a strong foundation for the broader application of microbial biopreparations in biology education.

CONCLUSION

This study demonstrates that biopreparations derived from microorganisms are highly effective in the cultivation of ornamental plants within the context of school biology lessons. The experimental results clearly indicate that the application of microbial biopreparations positively influences key growth parameters, including germination rate, vegetative development, flowering intensity, and overall plant vitality. Compared to traditional cultivation methods, plants treated with biopreparations showed stronger growth performance, improved resistance to stress factors, and enhanced aesthetic qualities.

Figure 5. Educational and ecological benefits of using microbial biopreparations.

Beyond their biological effectiveness, microbial biopreparations proved to be valuable educational tools. Their integration into biology lessons created opportunities for experiential learning, enabling students to observe and analyze real biological processes. This approach contributed to a deeper understanding of microbiology, plant physiology, and ecological interactions, while also fostering scientific thinking and practical skills. Students became more engaged in the learning process and demonstrated greater awareness of the role of beneficial microorganisms in sustainable plant cultivation.

The findings highlight the importance of incorporating modern biotechnological approaches into school biology education. The use of environmentally friendly biopreparations supports sustainable development principles by reducing dependence on chemical fertilizers and promoting ecological responsibility. Introducing such practices at the school level helps shape students' attitudes toward environmental protection and sustainable agriculture.

In conclusion, biopreparations derived from microorganisms can be recommended for widespread use in school biology lessons focused on ornamental plant cultivation. Their dual benefits—enhancing plant growth and improving educational outcomes—make them an effective and relevant component of modern biology education. Future research may further expand on these findings by exploring a broader range of plant species, longer observation periods, and advanced analytical methods to strengthen the scientific and pedagogical basis of this approach.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

EARLY DETECTION OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION AS A PREDICTOR OF HEART FAILURE WITH PRESERVED EJECTION FRACTION

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ABSTRACT

Heart failure with preserved ejection fraction (HFpEF) has emerged as one of the most challenging and rapidly increasing cardiovascular syndromes worldwide. Despite normal or near-normal left ventricular ejection fraction, patients experience significant morbidity, reduced quality of life, and high mortality rates comparable to heart failure with reduced ejection fraction. Recent clinical evidence suggests that left ventricular diastolic dysfunction (LVDD) represents a pivotal pathophysiological substrate in the development of HFpEF. The early identification of diastolic abnormalities, therefore, plays a crucial role in preventing disease progression and improving long-term outcomes. This article reviews contemporary diagnostic approaches to early LV diastolic dysfunction, including echocardiographic markers, myocardial deformation imaging, and biomarker assessment. Particular emphasis is placed on the integration of Doppler echocardiography, tissue Doppler imaging, and speckle-tracking techniques in routine clinical practice. The clinical implications of early detection, therapeutic decision-making, and risk stratification are discussed. The findings underscore the importance of proactive screening strategies in high-risk populations to mitigate the global burden of HFpEF.

Keywords: diastolic dysfunction, HFpEF, echocardiography, left ventricle, early diagnosis

INTRODUCTION

Cardiovascular diseases remain the leading cause of mortality worldwide, with heart failure constituting a major public health challenge. In recent decades, heart failure with preserved ejection fraction has gained increasing attention due to its rising prevalence, particularly among elderly individuals, patients with hypertension, diabetes mellitus, obesity, and metabolic syndrome. Unlike systolic heart failure, HFpEF is characterized by impaired ventricular relaxation and increased myocardial stiffness rather than reduced contractility. This pathophysiological distinction complicates diagnosis and delays timely intervention.Left ventricular diastolic dysfunction is widely recognized as an early and often subclinical stage preceding overt HFpEF. At this stage, patients may remain asymptomatic or present with nonspecific complaints such as exertional dyspnea or fatigue, leading to underdiagnosis in primary care settings. Traditional diagnostic paradigms focused predominantly on systolic parameters have proven insufficient for identifying early diastolic impairment. Consequently, there is a growing need to emphasize advanced imaging modalities and functional markers capable of detecting subtle myocardial changes before irreversible structural remodeling occurs.From a clinical perspective, early identification of LV diastolic dysfunction offers a unique opportunity to implement preventive strategies, optimize risk factor control, and potentially delay or prevent progression to symptomatic heart failure. Given the increasing socioeconomic burden associated with HFpEF, especially in aging populations, the development of standardized, accessible, and accurate diagnostic algorithms is of paramount importance. This article aims to explore the contemporary understanding of LV diastolic dysfunction, its diagnostic criteria, and its prognostic significance in the context of HFpEF.

PATHOPHYSIOLOGY OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION

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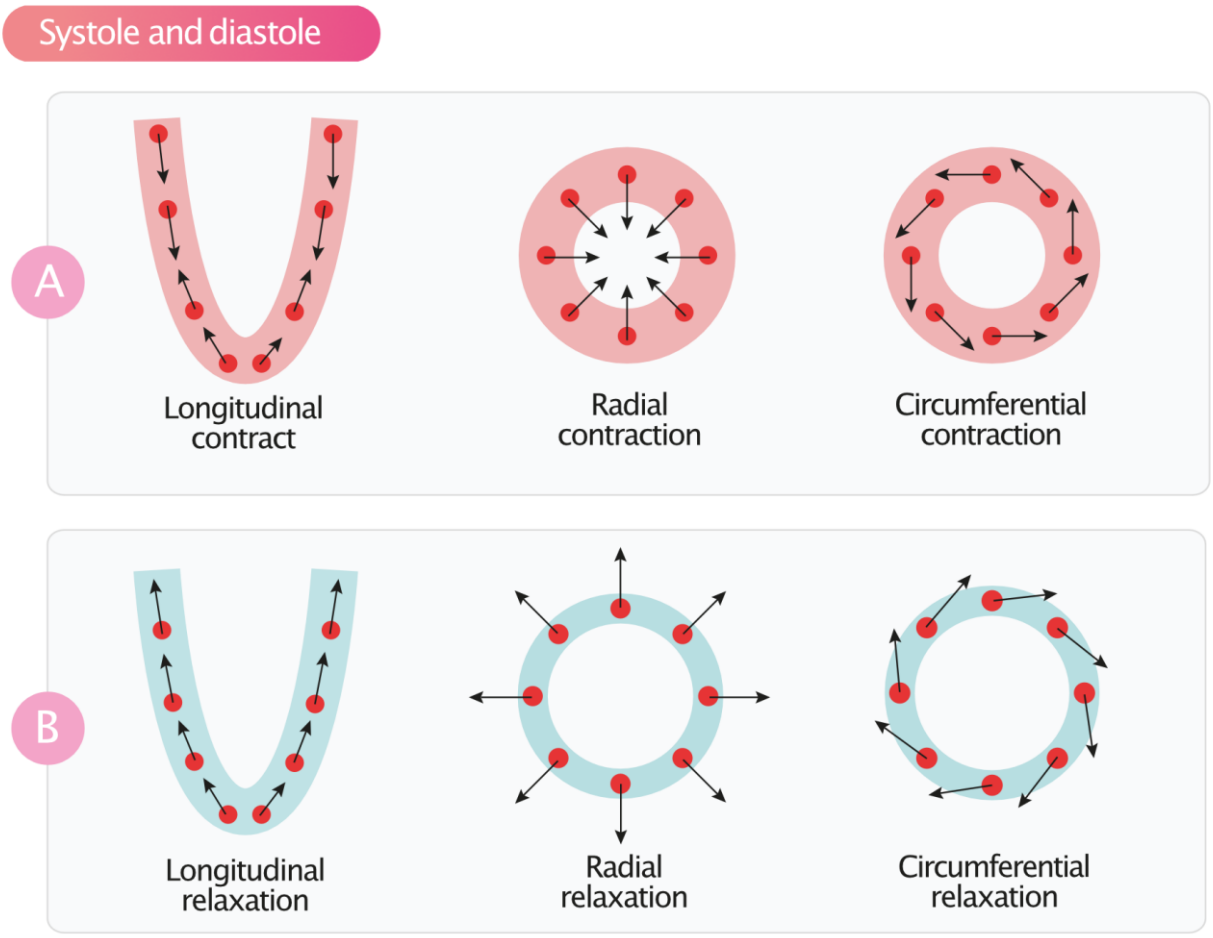
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|



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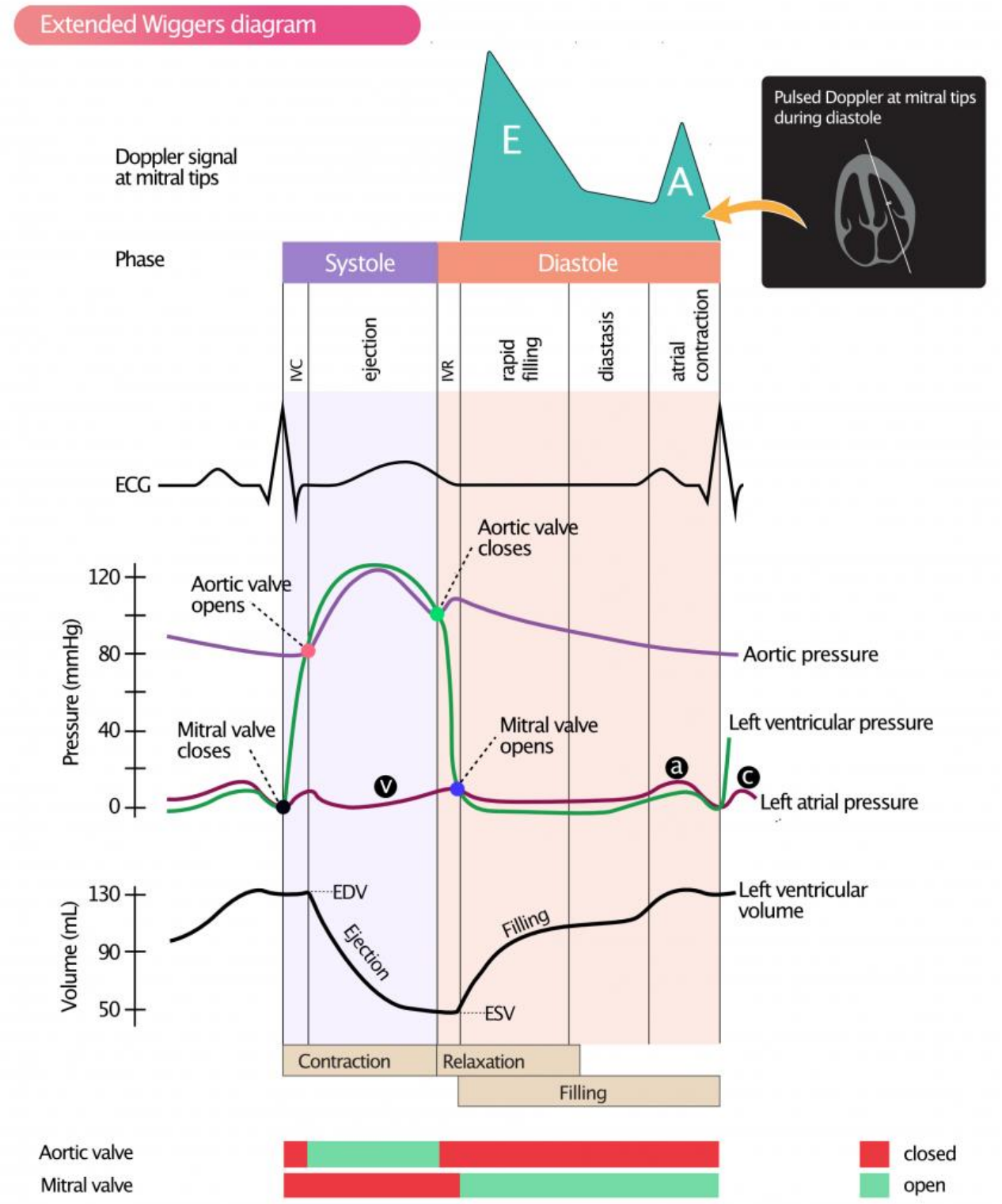
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|



Diastolic function refers to the ability of the left ventricle to relax, fill, and accommodate blood during diastole at low filling pressures. Diastolic dysfunction arises from abnormalities in myocardial relaxation, ventricular compliance, or both. At the cellular level, impaired calcium reuptake by the sarcoplasmic reticulum and increased myocardial fibrosis contribute to delayed relaxation and increased stiffness. These changes result in elevated left ventricular end-diastolic pressure, which is transmitted retrogradely to the left atrium and pulmonary circulation.

Hemodynamically, diastolic dysfunction progresses through well-defined stages, beginning with impaired relaxation and advancing to pseudonormal and restrictive filling patterns. Early stages

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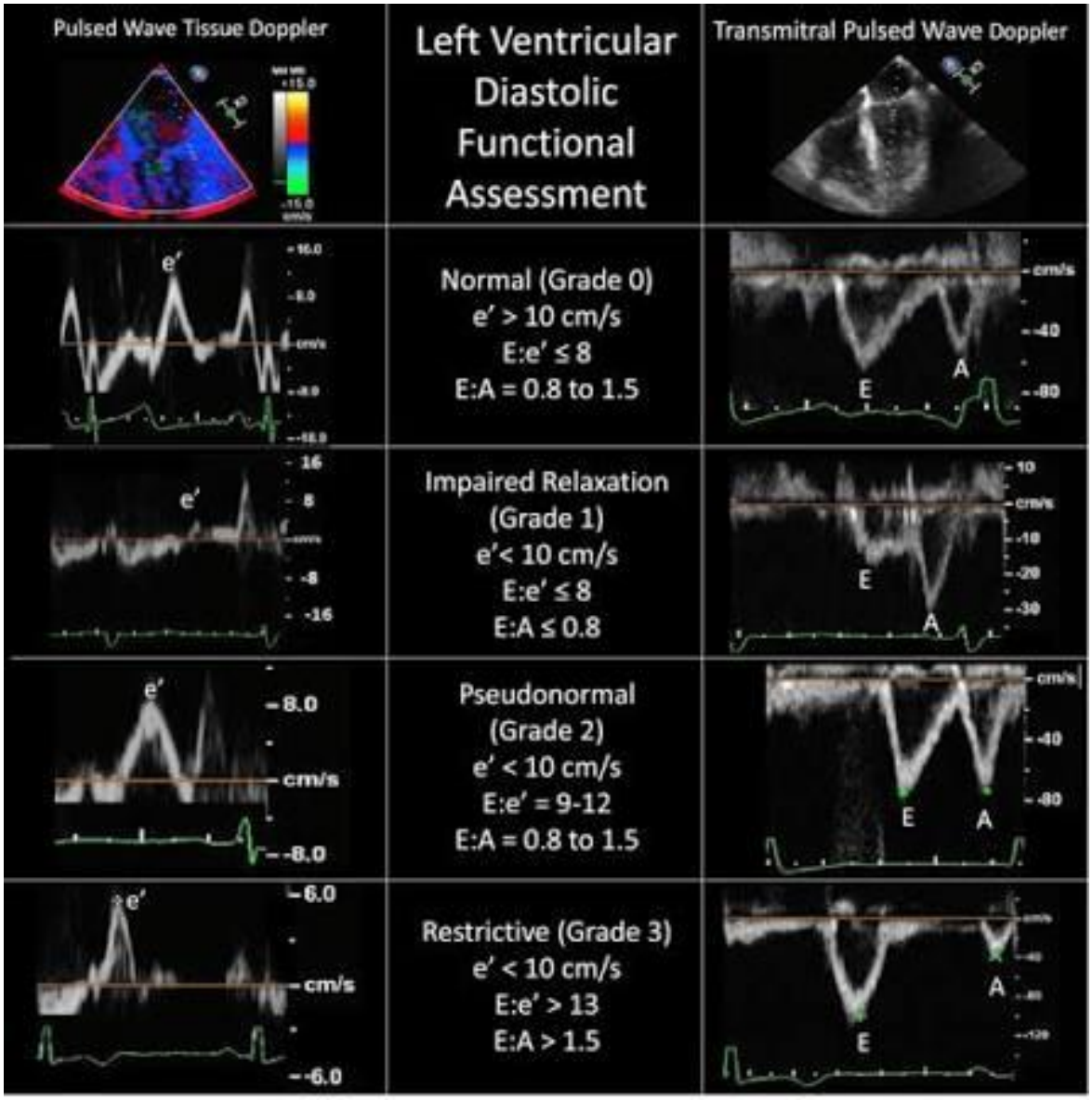
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

may be compensated by increased atrial contribution to ventricular filling, while advanced stages are associated with elevated filling pressures and pulmonary congestion. Importantly, systolic function may remain preserved throughout this process, masking the severity of underlying diastolic impairment.Systemic conditions such as hypertension induce concentric left ventricular hypertrophy, further exacerbating diastolic dysfunction by reducing ventricular compliance. Metabolic disorders, including diabetes mellitus, promote myocardial fibrosis and microvascular dysfunction, accelerating disease progression. Inflammatory pathways and endothelial dysfunction also play a contributory role, particularly in patients with obesity-related HFpEF. Understanding these mechanisms underscores the importance of early detection and targeted intervention.

DIAGNOSTIC APPROACHES TO EARLY DIASTOLIC DYSFUNCTION



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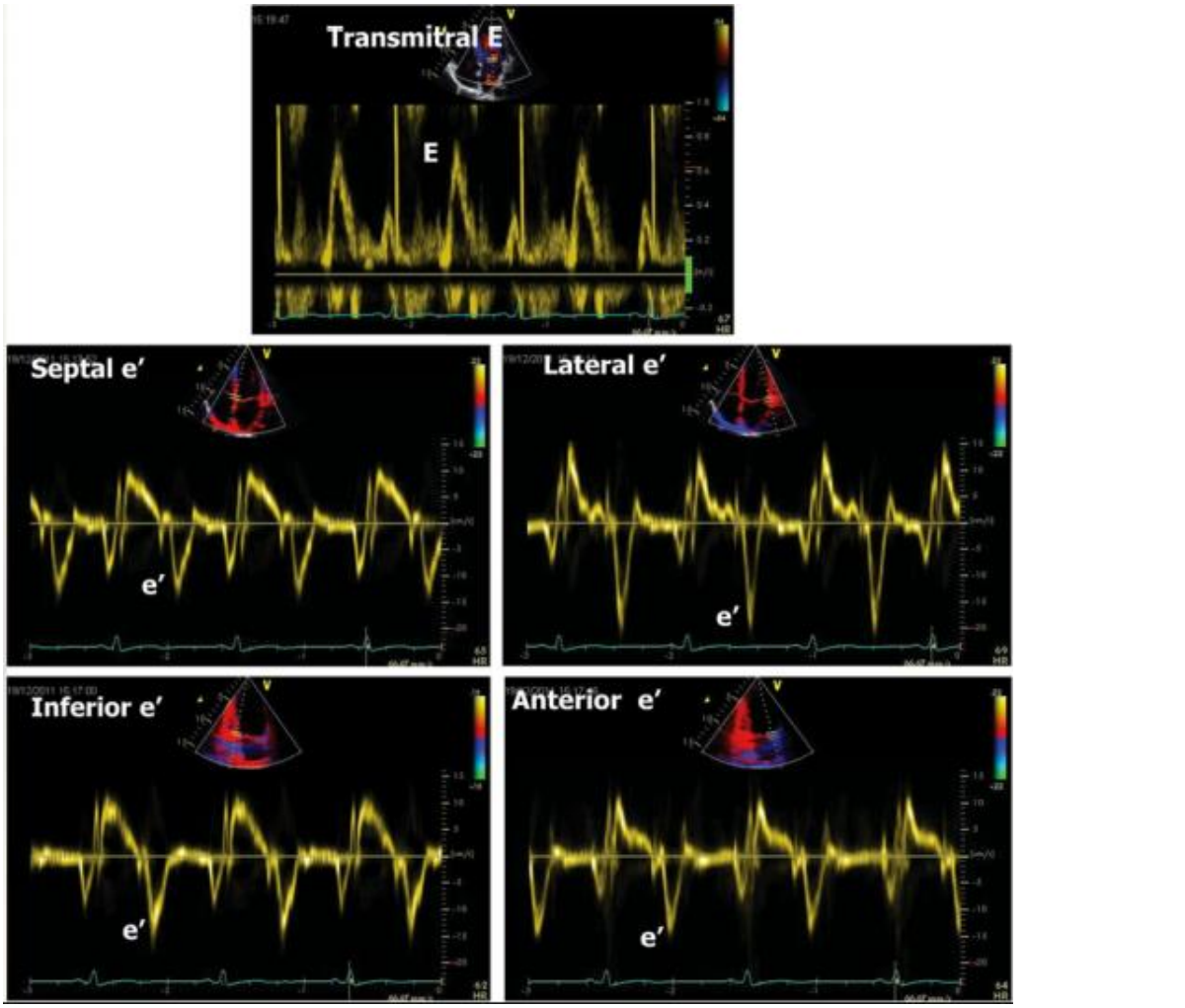
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|



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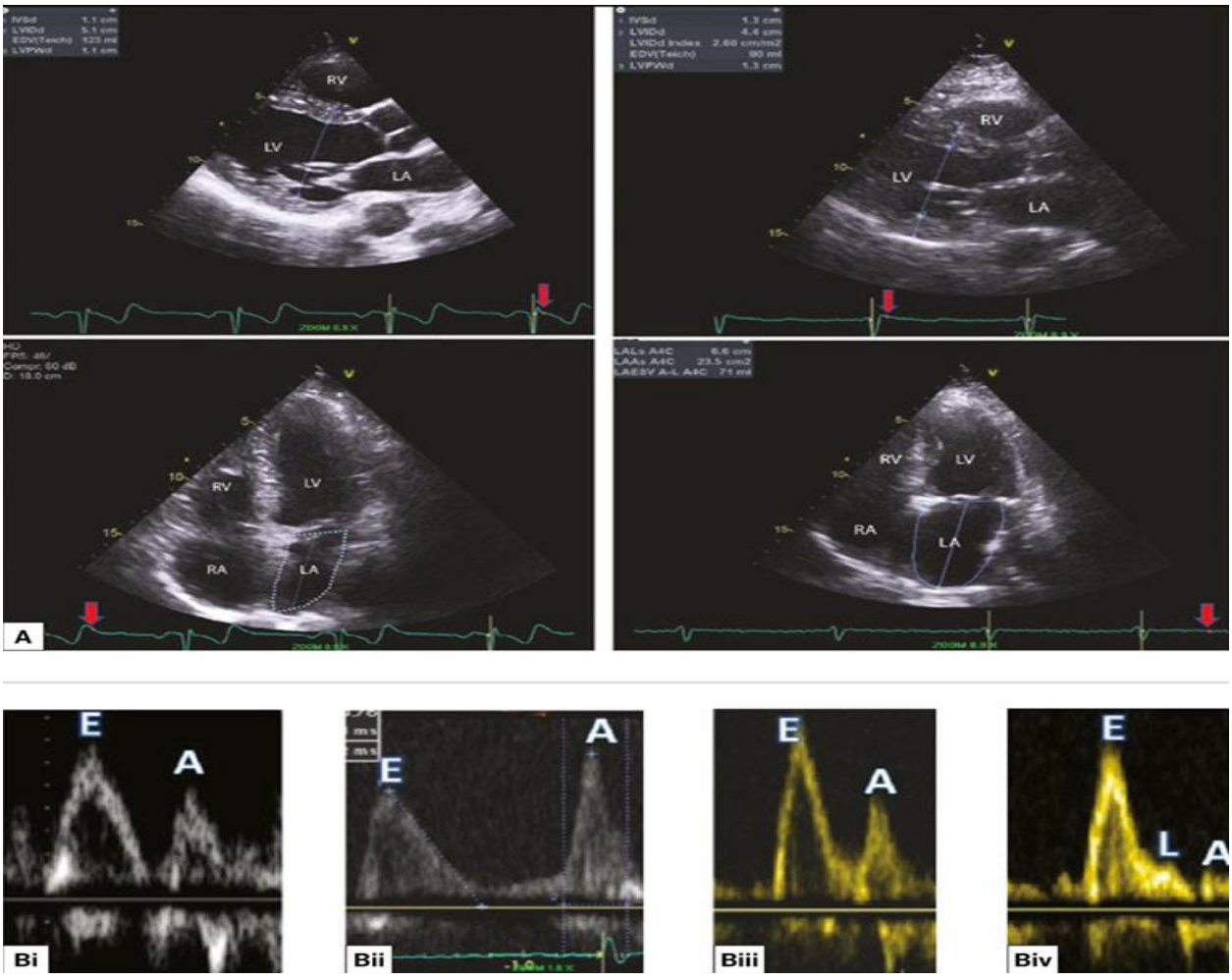
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|

Echocardiography remains the cornerstone of diastolic function assessment due to its wide availability, non-invasive nature, and cost-effectiveness. Conventional Doppler parameters, including transmitral E and A wave velocities, E/A ratio, deceleration time, and isovolumic relaxation time, provide essential insights into ventricular filling dynamics. However, these indices are influenced by loading conditions and age, limiting their diagnostic accuracy when used in isolation.

Tissue Doppler imaging has significantly enhanced the evaluation of diastolic function by allowing direct measurement of myocardial velocities. The early diastolic mitral annular velocity (e′) reflects myocardial relaxation, while the E/e′ ratio serves as an indirect estimate of left ventricular filling pressures. Elevated E/e′ values have been consistently associated with adverse outcomes and are considered a key marker of diastolic dysfunction.

Speckle-tracking echocardiography represents an advanced modality capable of assessing myocardial deformation and strain. Global longitudinal strain, although traditionally associated with systolic performance, has demonstrated sensitivity in detecting early myocardial dysfunction in HFpEF patients. Reduced strain values may precede overt clinical manifestations, highlighting their potential role in screening high-risk populations.

CLINICAL IMPLICATIONS AND PROGNOSTIC SIGNIFICANCE



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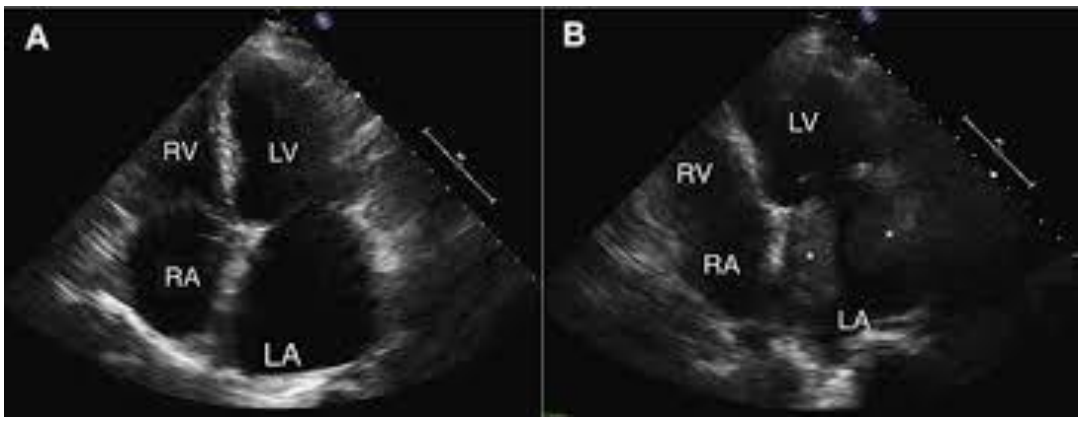
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |08-02-2026|



Early detection of LV diastolic dysfunction carries significant prognostic implications. Numerous studies have demonstrated that even mild diastolic abnormalities are associated with increased risk of heart failure hospitalization, atrial fibrillation, and cardiovascular mortality. In HFpEF, left atrial enlargement serves as a marker of chronic diastolic burden and correlates with disease severity and outcomes.

From a therapeutic standpoint, identifying diastolic dysfunction at an early stage enables clinicians to implement individualized management strategies. Optimal blood pressure control, glycemic regulation, weight management, and treatment of sleep-disordered breathing have been shown to improve diastolic parameters and patient outcomes. Although no therapy has yet demonstrated definitive mortality benefit in HFpEF, early intervention may attenuate disease progression and improve functional capacity.

Furthermore, early diagnosis facilitates patient education and lifestyle modification, empowering individuals to actively participate in disease management. In clinical practice, incorporating routine diastolic assessment into echocardiographic protocols can enhance risk stratification and guide long-term follow-up strategies.

CONCLUSION

Left ventricular diastolic dysfunction represents a critical early stage in the development of heart failure with preserved ejection fraction. Advances in echocardiographic techniques have significantly improved the ability to detect subtle myocardial abnormalities before the onset of overt clinical symptoms. Early identification of diastolic dysfunction offers a valuable window for preventive intervention, risk modification, and improved patient outcomes. Given the rising prevalence of HFpEF, particularly in aging and metabolically burdened populations, the integration of comprehensive diastolic assessment into routine cardiovascular evaluation is essential. Future research should focus on refining diagnostic criteria, identifying novel biomarkers, and developing targeted therapies aimed at modifying the underlying pathophysiological mechanisms of diastolic dysfunction.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |09-02-2026|

CHILDHOOD EPILEPSY: ETIOLOGY, DIAGNOSTIC APPROACHES, AND LONG-TERM PROGNOSIS

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ABSTRACT

Childhood epilepsy is one of the most prevalent chronic neurological disorders in pediatric populations worldwide, characterized by recurrent unprovoked seizures resulting from abnormal neuronal activity in the developing brain. The etiology of epilepsy in children is highly heterogeneous, encompassing genetic, structural, metabolic, immune-mediated, infectious, and unknown causes. Advances in neuroimaging, electroencephalography, and molecular genetics have significantly improved diagnostic accuracy, enabling earlier classification of epilepsy syndromes and more personalized treatment strategies. Despite therapeutic progress, childhood epilepsy remains associated with long-term cognitive, behavioral, and psychosocial challenges, particularly in cases of early onset and drug-resistant epilepsy. This review provides an in-depth analysis of the etiology, diagnostic strategies, and long-term prognosis of childhood epilepsy, emphasizing the importance of early diagnosis and multidisciplinary management in improving outcomes.

Keywords: childhood epilepsy, pediatric seizures, epilepsy etiology, EEG, neuroimaging, prognosis, neurodevelopment

INTRODUCTION

Epilepsy is a chronic neurological disorder defined by a sustained predisposition to generate epileptic seizures, accompanied by neurobiological, cognitive, psychological, and social consequences. In childhood, epilepsy represents a major public health concern due to its high incidence, early onset, and potential to interfere with brain development. According to epidemiological studies, epilepsy affects approximately 5–10 per 1,000 children globally, with the highest incidence occurring during the first year of life.

The developing brain is particularly vulnerable to epileptogenic insults. Unlike adult epilepsy, childhood epilepsy often presents with age-specific seizure types and syndromes, many of which are closely linked to neurodevelopmental processes. Seizures in early life can disrupt synaptic organization, neuronal migration, and cortical maturation, leading to long-lasting cognitive and behavioral impairments.

In recent decades, the understanding of childhood epilepsy has shifted from symptom-based classification to etiological and mechanistic frameworks. The International League Against Epilepsy (ILAE) now emphasizes identifying the underlying cause of epilepsy whenever possible, as etiology strongly influences prognosis and treatment response. This article aims to provide a comprehensive and detailed review of childhood epilepsy, focusing on its etiology, diagnostic methods, and long-term prognosis.

METHODS

This review is based on an extensive analysis of peer-reviewed scientific literature related to childhood epilepsy. Sources were obtained from PubMed, Google Scholar, ScienceDirect, and academic textbooks in pediatric neurology. Literature published between 2000 and 2024 was prioritized to ensure contemporary relevance.

Search terms included *childhood epilepsy*, *pediatric seizure disorders*, *epilepsy etiology*, *genetic epilepsy*, *EEG in children*, *neuroimaging epilepsy*, *long-term outcome epilepsy*, and *epilepsy and neurodevelopment*. Clinical guidelines published by the ILAE and the World Health Organization were also reviewed.

Both qualitative and quantitative studies were included, such as cohort studies, randomized clinical trials, systematic reviews, and meta-analyses. Information was synthesized thematically, focusing on etiology, diagnostic approaches, and prognosis.

RESULTS

Epidemiology and Burden of Childhood Epilepsy. The global incidence of childhood epilepsy ranges from 40 to 100 per 100,000 children per year, with higher rates reported in low- and middle-income countries. Factors contributing to increased incidence include perinatal brain injury, central nervous system infections, and limited access to prenatal and neonatal care.

Epilepsy significantly affects quality of life in children and their families. Beyond seizures, children often experience learning difficulties, social stigma, emotional distress, and reduced participation in school and social activities. Parents frequently report anxiety, financial burden, and challenges related to long-term care.

Etiology of Childhood Epilepsy. Childhood epilepsy is etiologically diverse. The ILAE categorizes causes into six major groups:

1 Genetic Etiology. Genetic causes account for a substantial proportion of childhood epilepsies, particularly those with early onset. Mutations in ion channel genes (*SCN1A*, *SCN2A*, *KCNQ2*), synaptic proteins, and transcription factors have been identified as causative factors. Some epilepsies are monogenic, while others involve complex polygenic mechanisms.

Genetic epilepsies range from benign syndromes, such as benign epilepsy with centrotemporal spikes, to severe developmental and epileptic encephalopathies, including Dravet syndrome and Lennox–Gastaut syndrome. In severe cases, seizures are often drug-resistant and associated with profound developmental delay.

2 Structural Etiology. Structural abnormalities of the brain are a major cause of focal epilepsy in children. These include cortical malformations (e.g., focal cortical dysplasia), hypoxic-ischemic injury, intracranial hemorrhage, brain tumors, and post-traumatic lesions.

Perinatal brain injury remains one of the most common preventable causes of epilepsy, particularly in resource-limited settings. Structural epilepsies are frequently associated with drug resistance and may require surgical intervention.

3 Metabolic Etiology. Metabolic disorders can present with epilepsy as an early and prominent symptom. Inborn errors of metabolism such as mitochondrial disorders, urea cycle defects, and amino acidopathies disrupt neuronal energy metabolism, leading to seizures.

Early recognition is critical, as some metabolic epilepsies are treatable with dietary modification or specific supplements. Failure to diagnose these conditions early can result in irreversible neurological damage.

4 Immune-Mediated and Infectious Etiology. Autoimmune encephalitis, including anti-NMDA receptor encephalitis, is increasingly recognized as a cause of epilepsy in children. These conditions often present with seizures, behavioral changes, and cognitive regression.

Central nervous system infections such as meningitis, encephalitis, and neurocysticercosis remain significant causes of epilepsy in many regions of the world.

5 Unknown Etiology. Despite advances in diagnostics, a considerable proportion of childhood epilepsies remain of unknown cause. These cases often have variable outcomes and highlight the need for continued research.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |09-02-2026|

Diagnostic Approaches in Childhood Epilepsy

1 Clinical Assessment. A thorough clinical history remains the cornerstone of diagnosis. Accurate seizure description, eyewitness accounts, and video recordings are invaluable. Developmental assessment and family history provide critical clues to etiology.

2 Electroencephalography (EEG). EEG is indispensable in epilepsy diagnosis and classification. Specific EEG patterns help identify epilepsy syndromes and guide treatment decisions. Long-term video EEG monitoring is particularly useful in refractory cases.

3 Neuroimaging. MRI is recommended for most children with new-onset epilepsy. Advanced imaging techniques improve detection of subtle cortical abnormalities. Early identification of surgically remediable lesions can dramatically improve outcomes.

4 Genetic and Metabolic Testing. Next-generation sequencing has revolutionized pediatric epilepsy diagnosis. Genetic testing is now considered standard of care for early-onset, severe, or unexplained epilepsies. Metabolic screening remains essential in neonatal and infantile epilepsies.

Long-Term Prognosis of Childhood Epilepsy

1 Seizure Outcome. Approximately two-thirds of children achieve long-term seizure remission with appropriate treatment. Favorable prognostic factors include later onset, normal development, and idiopathic epilepsy syndromes.

2 Neurodevelopmental and Cognitive Outcomes. Children with early-onset epilepsy or epileptic encephalopathies are at high risk for intellectual disability, speech delay, and learning difficulties. Seizure burden and underlying brain pathology significantly influence outcomes.

3 Psychosocial Impact. Epilepsy affects social integration, self-esteem, and mental health. Anxiety, depression, and social isolation are common and require psychological support alongside medical treatment.

4 Mortality and SUDEP. Although rare in childhood, SUDEP remains a serious concern, particularly in poorly controlled epilepsy. Education on seizure safety and adherence to treatment reduces risk.

DISCUSSION

This review highlights the complexity of childhood epilepsy as a disorder that extends beyond seizures alone. The expanding role of genetics has transformed classification and management, shifting epilepsy care toward precision medicine. However, access to advanced diagnostics remains uneven globally.

Early diagnosis and etiology-driven treatment are critical determinants of outcome. Multidisciplinary care involving neurologists, geneticists, psychologists, educators, and families is essential to address the full spectrum of needs in children with epilepsy.

CONCLUSION

Childhood epilepsy is a heterogeneous neurological disorder with diverse etiologies and outcomes. Advances in diagnostic technologies have improved etiological identification and prognostication. While many children achieve seizure freedom, a significant proportion experience long-term developmental and psychosocial challenges. Continued research, early intervention, and comprehensive care are essential to improving long-term outcomes and quality of life.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |11-02-2026|

AGE-RELATED HISTOLOGICAL CHANGES IN CARDIAC MUSCLE TISSUE

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ABSTRACT

Age-related changes in cardiac muscle tissue represent an important morphological basis for the development of cardiovascular diseases in the elderly. This study aims to analyze histological alterations of myocardial tissue associated with aging, with particular attention to structural, cellular, and interstitial modifications. Histological examination revealed progressive hypertrophy of cardiomyocytes, a reduction in the regenerative capacity of muscle fibers, and an increase in connective tissue components with advancing age. Additionally, age-related degeneration of myofibrils, accumulation of lipofuscin granules, and changes in nuclear morphology were observed.

Keywords: cardiac muscle tissue, aging, histological changes, cardiomyocytes, myocardial remodeling, connective tissue

INTRODUCTION

Aging is a natural biological process accompanied by progressive structural and functional changes in various organs and tissues, including the cardiovascular system. The heart, as a highly specialized muscular organ, undergoes significant age-related modifications that affect its contractile capacity, metabolic activity, and adaptive potential. These alterations play a crucial role in the increased prevalence of cardiovascular diseases observed in elderly populations. Cardiac muscle tissue is characterized by limited regenerative ability; therefore, cumulative cellular damage over time leads to irreversible histological changes. Previous studies have demonstrated that aging is associated with cardiomyocyte hypertrophy, increased interstitial fibrosis, alterations in extracellular matrix composition, and microvascular remodeling. Such changes contribute to myocardial stiffness, reduced compliance, and impaired diastolic and systolic function. At the cellular level, age-related myocardial remodeling involves degeneration of myofibrils, mitochondrial dysfunction, accumulation of lipofuscin pigments, and nuclear morphological alterations. In addition, endothelial dysfunction and reduced capillary density further compromise myocardial perfusion and oxygen delivery. Despite advances in cardiovascular research, the histological mechanisms underlying cardiac aging remain insufficiently characterized, particularly in relation to regional and population-specific features.

MATERIALS AND METHODS

The study was conducted using myocardial tissue samples obtained from individuals of different age groups. The specimens were divided into three groups according to age: young adults, middle-aged individuals, and elderly subjects. All samples were collected in accordance with ethical standards and institutional guidelines. Cardiac muscle tissue fragments were fixed in 10% neutral buffered formalin, followed by routine histological processing. The specimens were dehydrated through graded alcohol series, cleared in xylene, and embedded in paraffin. Serial sections of 4–6 μm thickness were prepared using a rotary microtome. Histological sections were stained with hematoxylin and eosin for general tissue morphology. To assess connective tissue components and interstitial fibrosis, Masson's trichrome staining was performed. In selected samples, special staining methods were applied to visualize lipofuscin accumulation and vascular structures.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |11-02-2026|

RESULTS

Histological analysis of cardiac muscle tissue demonstrated clear age-dependent morphological changes across the examined groups. In myocardial samples from young individuals, cardiomyocytes were regularly arranged, with uniform size and clearly defined cross-striations. The nuclei were centrally located and exhibited normal chromatin distribution. Interstitial connective tissue was scarce, and capillary networks were well developed. In the middle-aged group, cardiomyocytes showed moderate hypertrophy, manifested by an increase in cell diameter and slight irregularity in muscle fiber orientation. Partial disorganization of myofibrils and mild nuclear enlargement were observed. The interstitial spaces contained an increased amount of connective tissue, and early fibrotic changes were evident. Capillary density was moderately reduced, with signs of vascular wall thickening. In myocardial tissue from elderly individuals, pronounced histological alterations were identified. Cardiomyocytes exhibited marked hypertrophy and variability in size, along with degeneration and fragmentation of myofibrils.

DISCUSSION

The findings of the present study confirm that aging is associated with progressive histological remodeling of cardiac muscle tissue. Cardiomyocyte hypertrophy observed in older age groups likely represents a compensatory response to increased functional demands and reduced regenerative capacity of myocardial cells. However, this adaptive mechanism becomes maladaptive over time, contributing to impaired myocardial function. The increase in interstitial connective tissue and collagen accumulation reflects age-related fibrotic remodeling, which leads to decreased myocardial elasticity and increased stiffness. These structural changes are closely linked to diastolic dysfunction commonly observed in the aging heart. Moreover, excessive fibrosis may disrupt normal electrical conduction pathways, increasing the risk of arrhythmias. Accumulation of lipofuscin granules and degeneration of myofibrils indicate chronic oxidative stress and mitochondrial dysfunction, which play a central role in cardiac aging.

CONCLUSION

Age-related changes in cardiac muscle tissue represent a complex and progressive process involving structural, cellular, and vascular remodeling. The results of this study demonstrate that aging is accompanied by cardiomyocyte hypertrophy, degeneration of myofibrils, accumulation of lipofuscin granules, and pronounced interstitial fibrosis. These histological alterations reflect a gradual decline in the regenerative and adaptive capacity of myocardial tissue. The increase in connective tissue components and collagen deposition contributes to myocardial stiffness and reduced elasticity, which are key morphological factors underlying age-associated cardiac dysfunction. Additionally, microvascular changes, including reduced capillary density and thickening of vascular walls, impair myocardial perfusion and exacerbate functional decline. Understanding the histological mechanisms of cardiac aging provides valuable insight into the pathogenesis of age-related cardiovascular diseases.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

ANTIBIOTIKLARΓA QARSHILIK KO'RSATUVCHI BAKTERIYALARNI ANIQLASH VA XARAKTERISTIKASI

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ANNOTATSIYA

Ushbu maqolada antibiotiklarga qarshilik ko'rsatuvchi bakteriyalarni aniqlash va ularning asosiy xususiyatlari tahlil qilindi. Tadqiqot davomida bakteriyalarning antibiotiklarga chidamliligini aniqlash uchun mikrobiologik va fenotipik usullar qo'llanildi. Olingan natijalar antibiotiklarga qarshilik darajasining ortib borayotganini va bu holat klinik amaliyotda davolash samaradorligiga salbiy ta'sir ko'rsatayotganini ko'rsatdi. Shuningdek, antibiotiklarni noto'g'ri va nazoratsiz qo'llash rezistent shtammlarning shakllanishida muhim omil ekanligi aniqlandi. Tadqiqot natijalari antibiotiklarga qarshilik muammosini oldini olish va oqilona antibiotikoterapiyani rivojlantirish zarurligini asoslab beradi.

Kalit so'zlar Antibiotik rezistentlik, bakteriyalar, antimikrob dorilar, mikrobiologik tahlil, chidamlilik mexanizmlari, klinik mikrobiologiya.

DETECTION AND CHARACTERISTICS OF ANTIBIOTICS-RESISTANT BACTERIA

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ANNOTATION

This article analyzes the identification of antibiotic-resistant bacteria and their main characteristics. During the study, microbiological and phenotypic methods were used to determine the resistance of bacteria to antibiotics. The results obtained showed that the level of antibiotic resistance is increasing, and this situation negatively affects the effectiveness of treatment in clinical practice. It was also found that the incorrect and uncontrolled use of antibiotics is an important factor in the formation of resistant strains. The results of the study justify the need to prevent the problem of antibiotic resistance and develop rational antibiotic therapy.

Keywords Antibiotic resistance, bacteria, antimicrobial drugs, microbiological analysis, resistance mechanisms, clinical microbiology.

ВЫЯВЛЕНИЕ И ХАРАКТЕРИСТИКИ АНТИБИОТИКОРЕЗИСТЕНТНЫХ БАКТЕРИЙ

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АННОТАЦИЯ

В данной статье анализируется идентификация антибиотикорезистентных бактерий и их основные характеристики. В ходе исследования использовались микробиологические и фенотипические методы для определения резистентности бактерий к антибиотикам. Полученные результаты показали, что уровень антибиотикорезистентности возрастает, и эта ситуация негативно влияет на эффективность лечения в клинической практике. Также было установлено, что неправильное и неконтролируемое использование антибиотиков является важным фактором формирования резистентных штаммов. Результаты исследования обосновывают необходимость предотвращения проблемы антибиотикорезистентности и разработки рациональной антибиотикотерапии.

Ключевые слова: антибиотикорезистентность, бактерии, противомикробные препараты, микробиологический анализ, механизмы резистентности, клиническая микробиология.

KIRISH

Antimikrobiyal rezistentlik (AMR) XXI asrning eng dolzarb global sog'liqni saqlash muammolaridan biri hisoblanadi. Jahon Sog'liqni Saqlash Tashkiloti ma'lumotlariga ko'ra, hozirda har yili butun dunyo bo'ylab taxminan 700 000 kishi antibiotiklarra chidamli infeksiyalar oqibatida vafot etmoqda. 2050-yilga kelib bu raqam 10 million kishiga yetishi prognoz qilinmoqda.

Bakteriyalar genetik mutatsiyalar va gorizontal gen transferi orqali tez sur'atlar bilan yangi qarshilik mexanizmlarini rivojlantirmoqda. Bu jarayon beta-laktamaza fermentlarining ishlab

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

chiqarilishi, antibiotik nishonlarining o'zgarishi va eflyuks nasos tizimlarining faollashuvi orqali amalga oshmoqda. Rezistent bakteriyalar keltirib chiqaradigan infeksiyalar og'irroq kechadi, davolanish muddati 2-3 barobar uzayadi va o'lim xavfi sezilarli darajada oshadi.

Tadqiqotning maqsadi. Tadqiqotning asosiy maqsadi Qarshi shahar tibbiyot muassasalarida turli klinik materiallardan ajratib olingan bakterial patogenlarning antibiotiklarra qarshilik xususiyatlarini o'rganish, taksonomik tarkibini aniqlash va antibiotik rezistentlik naqshlarini tahlil qilishdan iborat.

Mavzu dolzarbligi. Antimikrobiyal rezistentlik zamonaviy tibbiyotning eng dolzarb muammolaridan biri bo'lib, uning ahamiyati quyidagicha:

Tibbiy jihat: Rezistent bakteriyalar sabab bo'lgan infeksiyalar og'irroq kechadi, davolanish 2-3 barobar uzayadi va o'lim xavfi yuqori.

Iqtisodiy zarar: Uzoq gospitalizatsiya, qimmat antibiotiklar va qo'shimcha muolajalar tufayli global yo'qotishlar yuzlab milliard dollarga yetadi.

O'zbekiston konteksti: Antibiotiklar retseptsiz sotiladi, o'z-o'zidan davolanish keng tarqalgan, mikrobiologik monitoring zaif, bu rezistentlikni tezlashtiradi.

Tadqiqot metodlari tadqiqot dizayni va namunalar. Tadqiqot 2024-yil yanvar-iyun oylari davomida Qarshi shahar markaziy shifoxonasi bakteriologik laboratoriyasida o'tkazildi. Tadqiqotga bakterial infeksiya belgilari mavjud 18-75 yoshdagi 250 nafar bemor kiritildi. Namunalar tarkibi: qon - 85 ta (34%), siydik - 105 ta (42%), yara ajralmalari - 60 ta (24%).

Bakteriyalarni ajratish va identifikatsiya Barcha namunalar steril sharoitda yig'ildi va 2-4 soat ichida laboratoriyaga yetkazildi. Qon namunalari Blood agar va tioglikolatli bulonga, siydik CLED va MacConkey agarga, yara ajralmalari qonli va shokolad agarga ekildi. Inkubatsiya 35-37°C da 18-24 soat davom etdi.

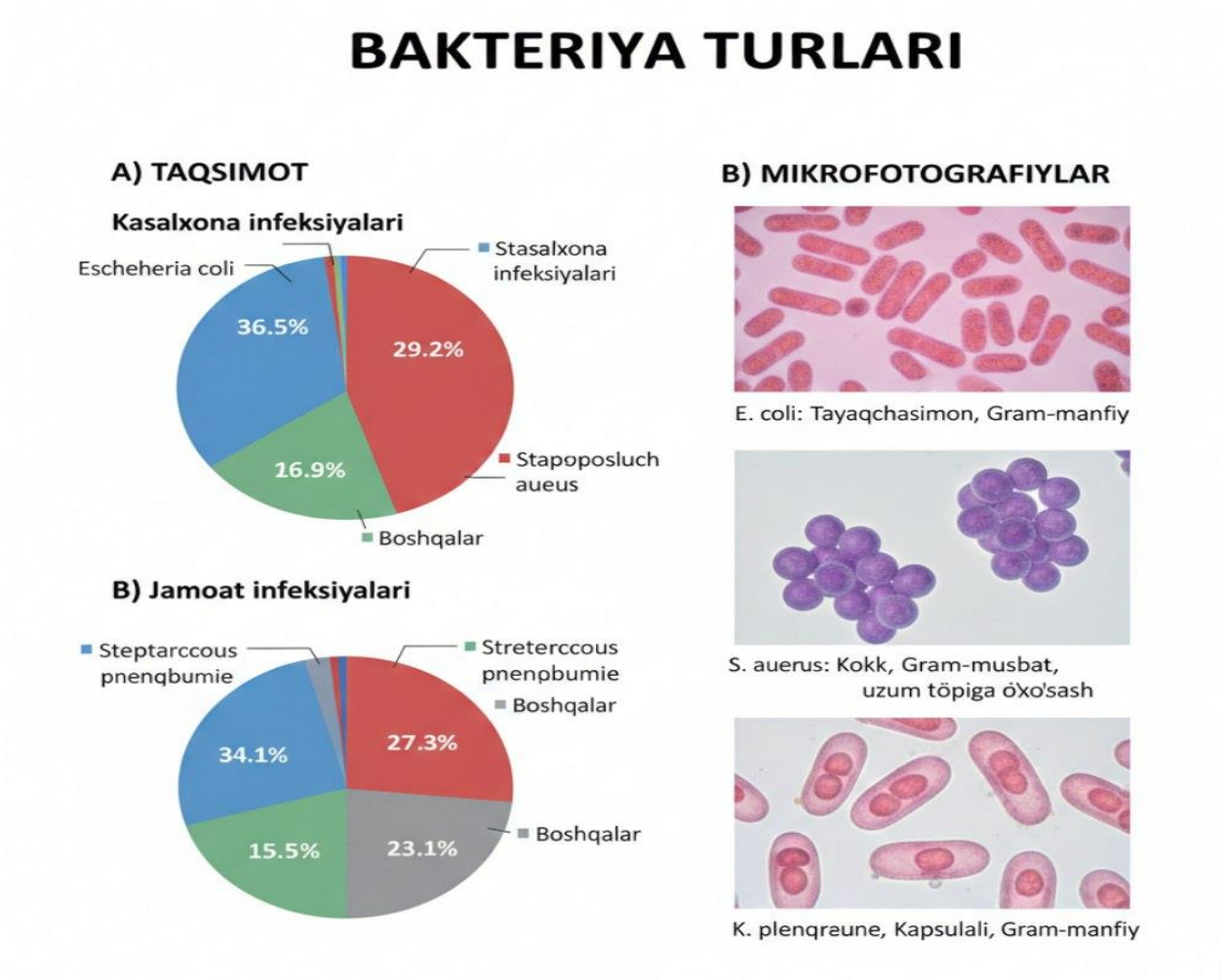
Identifikatsiya bosqichlari: (1) koloniyalarning makroskopik ko'rib chiqish, (2) Gram bo'yash va mikroskopiya, (3) asosiy biokimyoviy testlar (katalaza, oksidaza, koagulaza, indol testlari), (4) API 20E va API Staph avtomatlashtirilgan tizimlaridan foydalanish.

Antibiotik sezgirlik testlari Disk-diffuziya usuli (Kirby-Bauer) CLSI M100 standartlariga muvofiq qo'llanildi. Mueller-Hinton agar yuzasiga 0,5 McFarland standartiga mos bakteriya suspenziyasi yoyildi va antibiotik disklari joylashtirildi: beta-laktamlar (ampitsillin, amoksitsillin/klavulanat), sefalosporinlar (tsefazolin, tsefotaksim, tseftriakson, tseftazidim), karbapenemlar (imipenem, meropenem), aminoglikozidlar (gentamitsin, amikatsin), ftorxinolonlar (tsiprofloksatsin, levofloksatsin) va boshqalar.

MRSA aniqlash uchun tsefoksitin disk testi, ESBL aniqlash uchun kombinatsiyalangan disk testi (tsefotaksim ± klavulanat, tseftazidim ± klavulanat) ishlatildi. Sifat nazorati uchun standart shtammlar (E. coli ATCC 25922, S. aureus ATCC 25923) ishlatildi.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

TADQIQOT NATIJALARI



Ajratilgan bakteriyalar taqsimoti 250 ta namunadan 178 ta bakteriya izolyati ajratildi (pozitivlik 71,2%). Bakteriyalarning taksonomik tarkibi: Escherichia coli - 65 ta (36,5%), Staphylococcus aureus - 52 ta (29,2%), Klebsiella pneumoniae - 30 ta (16,9%), Pseudomonas aeruginosa - 12 ta (6,7%), Enterococcus - 9 ta (5,1%), Acinetobacter - 6 ta (3,4%). Grammanfiy bakteriyalar 63,5%, grammusbat bakteriyalar 36,5% ni tashkil etdi.

Escherichia coli antibiotik rezistentligi

Antibiotik	Rezistent (n)	Rezistent (%)
Ampitsillin	51	78.5
Ko-trimoksazol	44	67.7
Tsiprofloksatsin	37	56.9
Amoksitsillin/klavulanat	34	52.3
Tseftriakson	28	43.1
Gentamitsin	27	41.5
Tsefepim	19	29.2

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

Amikatsin	12	18.5
Imipenem	7	10.8
Meropenem	6	9.2

E. coli da eng yuqori rezistentlik ampitsillinga (78,5%), ko-trimoksazolga (67,7%) va ftorxinolonlarga (56,9%) qayd etildi. Karbapenemlar hali yuqori sezgirlikni saqlab qolgan (89-91%).

Staphylococcus aureus antibiotik rezistentligi

Antibiotik	Rezistent (n)	Rezistent (%)
Penitsillin	49	94.2
Eritromitsin	36	69.2
Klindamitsin	27	51.9
Tsiprofloksatsin	26	50.0
Ko-trimoksazol	22	42.3
Gentamitsin	20	38.5

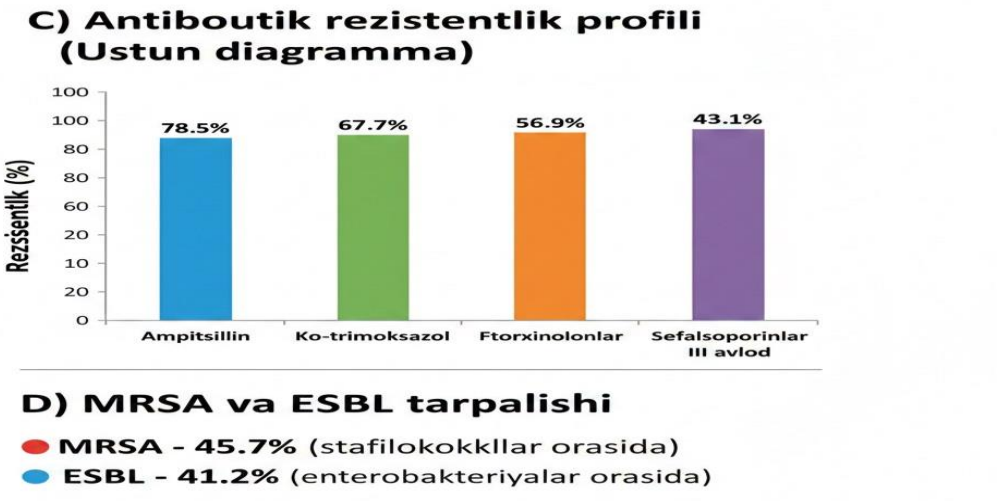
S. aureus da penitsillin rezistentligi 94,2% ni tashkil etdi. MRSA darajasi 46,2% (24/52) bo'ldi. Vankomitsin va linezolidge to'liq sezgirlik saqlanib qolgan.

Maxsus rezistentlik fenomenlari ESBL-pozitiv enterobakteriyalar: 95 ta Enterobacteriaceae izolatidan 39 tasi (41,1%) ESBL-pozitiv deb aniqlandi. E. coli da ESBL tarqalishi 38,5% (25/65), K. pneumoniae da 50% (15/30) ni tashkil etdi.

Ko'p dori preparatlariga chidamli (MDR) bakteriyalar: 178 ta izolatdan 127 tasi (71,3%) MDR mezoniga javob berdi. MDR bakteriyalarning taqsimoti: E. coli - 69,2%, S. aureus - 73,1%, K. pneumoniae - 83,3%, P. aeruginosa - 91,7%.

MUHOKAMA

Olib borilgan tadqiqot Qarshi shahrida antibiotik rezistentligining xavfli darajada yuqori ekanligini ko'rsatdi. MDR bakteriyalar ulushi 71,3% bo'lib, bu Yevropa mamlakatlari (30-45%)dan sezilarli yuqori va Janubiy Osiyo mamlakatlari (60-80%) darajasiga yaqindir.



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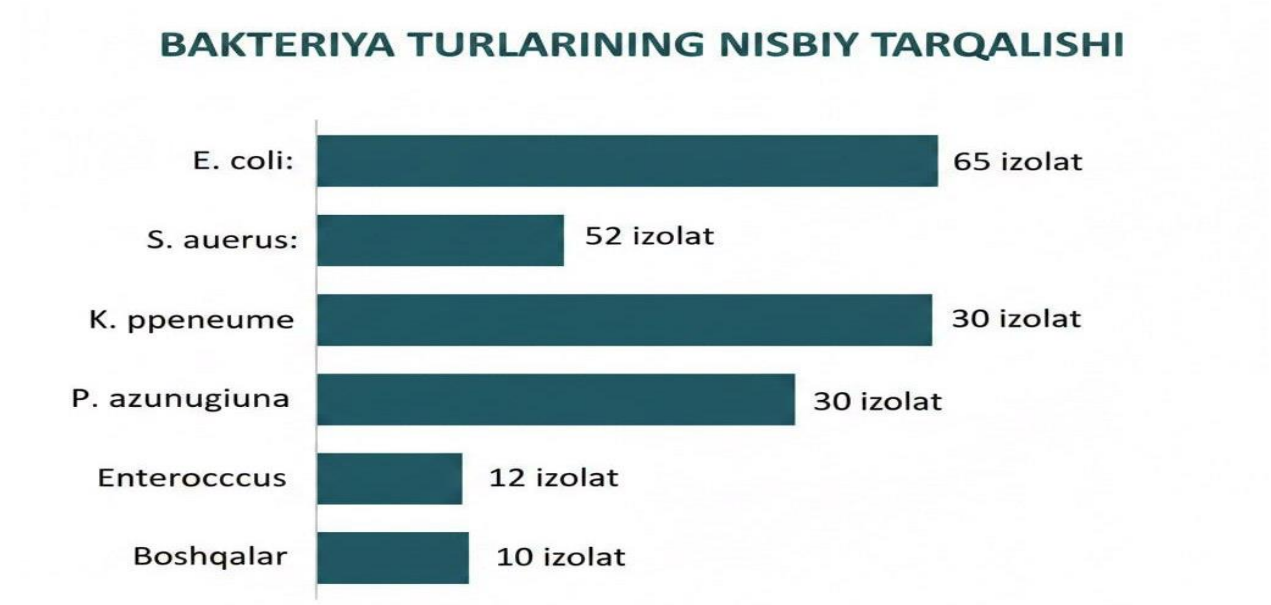
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

E. coli da ampitsillinga 78,5% rezistentlik beta-laktam antibiotiklar samarasizligini ko'rsatadi. Ftorxinolonlarga 56,9% rezistentlik siydik yo'llari infeksiyalarini davolashda jiddiy muammo tug'diradi. Karbapenemlarga rezistentlik hali past (9-10%) bo'lsa-da, bu "oxirgi mudofaa" antibiotiklari uchun xavfli signal.

MRSA darajasi 46,2% xalqaro standartlardan yuqori. ESBL-pozitiv bakteriyalar 41,1% bo'lib, uchinchi avlod sefalosporinlar samarasizligini anglatadi. Bu holat O'zbekistonda antibiotiklar noto'g'ri qo'llanilishi, retseptsiz sotilishi va monitoring zaifligining natijasi.



Tadqiqot cheklovlari: (1) bitta shahar va qisqa muddat (6 oy), (2) molekulyar usullar qo'llanilmaganligi, (3) bemorlarning to'liq anamnezi to'planmaganligi. Kelajakda molekulyar usullar (PCR) bilan rezistentlik genlarini aniqlash tavsiya etiladi.

XULOSA

Qarshi shahrida bakteriya izolyatlarining 71,3%i MDR fenotipiga ega, bu xavfli darajada yuqori ko'rsatkich. Dominant patogenlar: E. coli (36,5%), S. aureus (29,2%) va K. pneumoniae (16,9%). Grammanfiy bakteriyalarda ampitsillin (78,5%), ftorxinolonlar (56,9%), ko-trimoksazol (67,7%) va sefalosporinlarga (43,1%) yuqori rezistentlik aniqlandi. ESBL-pozitiv enterobakteriyalar 41,1%, MRSA tarqalishi 46,2% ni tashkil etdi. Karbapenem-rezistent bakteriyalar ulushi past (9-17%) bo'lsa-da, kelajakda katta xavf tug'diradi. Antibiotiklar oqilona qo'llanilishi, mikrobiologik monitoring kuchaytirilishi va rezistentlikni oldini olish choralari zarur.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

ADAPTIVE CHANGES OF TISSUES: MORPHOLOGICAL AND FUNCTIONAL ANALYSIS

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ABSTRACT

This article analyzes the adaptive changes of body tissues that occur under the influence of various physiological and pathological factors from morphological and functional perspectives. The process of adaptation manifests at the cellular and tissue levels through structural reorganization, alterations in metabolic activity, and activation of regenerative mechanisms. The main forms of adaptive changes, including hypertrophy, hyperplasia, atrophy, and metaplasia, are described based on scientific sources with emphasis on their histological characteristics. Furthermore, the role of adaptive processes in maintaining homeostasis and the mechanisms of their progression to pathological conditions are discussed.

Keywords: adaptation, morphofunctional changes, hypertrophy, hyperplasia, atrophy, metaplasia, regeneration, homeostasis, cellular plasticity, pathological process

INTRODUCTION

A living organism constantly functions under the influence of external and internal environmental factors. Changes in temperature, hypoxia, mechanical load, hormonal shifts, and inflammatory processes activate adaptive mechanisms in tissues. This process of adjustment is referred to as adaptation and plays a crucial biological role in maintaining the viability of the organism. In histology, adaptive changes are studied through structural and functional remodeling at the cellular and tissue levels. Adaptive processes are generally compensatory in nature and serve to preserve the functional capacity of organs or systems. For example, increased physical load leads to hypertrophy in muscle tissue, while hormonal stimulation may cause hyperplasia in certain glandular tissues. Conversely, prolonged malnutrition or impaired blood supply results in the development of atrophy. At the same time, adaptive processes do not always produce beneficial outcomes. If the influencing factor is intense or prolonged, adaptive mechanisms may progress into pathological processes. For instance, under conditions of chronic irritation, metaplasia may develop in epithelial tissues, which in some cases increases the risk of dysplasia and neoplasia. Modern histological research methods—light and electron microscopy, immunohistochemical analysis, and molecular biological techniques—provide opportunities to identify the deeper mechanisms of adaptive changes.

MATERIALS AND METHODS

This article has a theoretical-analytical character and was prepared on the basis of contemporary scientific sources in histology, pathological anatomy, and cell biology. During the research process, local and international literature on the morphological and functional characteristics of adaptive changes was analyzed. Information related to classical light microscopy, electron microscopy, and immunohistochemical methods was reviewed to assess structural alterations in tissues. In addition, the results of molecular biological studies aimed at identifying cellular plasticity, proliferation, and differentiation processes were summarized. Adaptive processes were systematized according to the following main forms: hypertrophy, hyperplasia, atrophy, and metaplasia. The

morphological features, developmental mechanisms, and functional consequences of each form were comparatively analyzed**.**

RESULTS

The analysis demonstrated that adaptive changes in tissues are primarily manifested by alterations in cell size, number, and degree of specialization. During hypertrophy, cell size increases and the number of organelles in the cytoplasm rises, particularly mitochondria and myofibrils. This process most commonly occurs as a result of increased mechanical load or elevated functional demand. Hyperplasia is characterized by an increase in the number of cells. This condition is associated with enhanced proliferative activity and typically develops due to hormonal stimulation or compensatory mechanisms. In atrophy, cell size decreases, metabolic activity declines, and in some cases apoptosis is observed. This process is linked to insufficient blood supply, impaired innervation, or nutritional deficiency. Metaplasia is characterized by the replacement of one type of differentiated cell with another type of cell. This process develops under conditions of prolonged irritation or chronic inflammation. The results indicate that although adaptive changes initially have a protective and compensatory nature, prolonged exposure to stress factors may create conditions for the development of pathological processes.

DISCUSSION

Adaptive changes represent a universal biological mechanism aimed at maintaining the viability of a living organism. They are based on cellular plasticity and genetically programmed response reactions. Morphologically, these processes are manifested through structural reorganization, while functionally they appear as changes in metabolic activity and functional intensity. Modern research demonstrates that signaling pathways, growth factors, and transcription factors play a crucial role in the molecular basis of adaptive changes. For example, under hypoxic conditions, hypoxia-inducible factors are activated in cells, triggering compensatory mechanisms. At the same time, the boundary between adaptation and pathology is relative. If the stress factor is not eliminated or if the organism’s compensatory capacity is insufficient, adaptive processes may progress into degenerative or neoplastic changes.

CONCLUSION

Adaptive changes in tissues represent a complex morphofunctional process that develops in response to external and internal environmental factors. This process is characterized by structural reorganization at the cellular and tissue levels, alterations in proliferative activity, adaptation of metabolic processes, and activation of regenerative mechanisms. Adaptive forms such as hypertrophy, hyperplasia, atrophy, and metaplasia reflect the compensatory capacity of the organism and contribute to the maintenance of homeostasis. However, adaptive changes do not always result in positive outcomes. When stress factors persist for a prolonged period or when the organism’s adaptive resources are insufficient, these processes may shift toward a pathological direction. In particular, metaplasia and chronic hyperplasia increase the risk of developing dysplasia and neoplastic changes. Therefore, comprehensive histological and molecular investigation of adaptive tissue changes serves as an important scientific basis for clinical diagnosis, early prevention, and the development of effective treatment strategies.

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ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

RAQAMLI OFTALMOLOGIK TASVIRLAR ASOSIDA KO‘Z KASALLIKLARINI PROGNOZLASH MODELI

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ANNOTATSIYA

Ushbu maqolada raqamli oftalmologik tasvirlar asosida ko‘z kasalliklarini prognozlashga mo‘ljallangan intellektual model ishlab chiqish masalasi ko‘rib chiqiladi. Tadqiqotning asosiy maqsadi – chuqur o‘rganish algoritmlaridan foydalangan holda retinal tasvirlar orqali oftalmologik patologiyalarni erta aniqlash va ularning rivojlanish ehtimolini bashoratlash imkonini beruvchi prognozlash modelini yaratishdir. Tadqiqot jarayonida ko‘z tubi tasvirlari dastlabki qayta ishlash bosqichidan o‘tkazilib, shovqinlarni kamaytirish, kontrastni yaxshilash hamda asosiy anatomik strukturalarni ajratib olish amallari bajarildi. Keyingi bosqichda konvolyutsion neyron tarmoqlar asosida klassifikatsiya va prognozlash moduli ishlab chiqildi. Model samaradorligi aniqlik (accuracy), sezgirlik (recall), F1-ko‘rsatkich hamda ROC egri chizig‘i yordamida baholandi.

Olingan natijalar taklif etilgan yondashuv ko‘z kasalliklarini an’anaviy diagnostika usullariga nisbatan tezroq va barqarorroq aniqlash imkonini berishini ko‘rsatdi. Shuningdek, model kasallik rivojlanishining ehtimoliy ssenariylarini oldindan baholash orqali klinik qaror qabul qilish jarayonini qo‘llab-quvvatlashi mumkinligi aniqlandi.

Tadqiqotning amaliy ahamiyati raqamli diagnostika tizimlarini joriy etish orqali oftalmologik xizmatlar sifatini oshirish, erta profilaktika choralarini belgilash hamda shifokor yuklamasini kamaytirish imkoniyatlari bilan izohlanadi. Taklif etilgan prognozlash modeli telemeditsina va masofaviy skrining tizimlari uchun ham istiqbolli yechim sifatida qaraladi.

Kalit so‘zlar: raqamli oftalmologiya, chuqur o‘rganish, retinal tasvirlar, sun’iy intellekt, kasalliklarni prognozlash, erta diagnostika.

МОДЕЛЬ ПРОГНОЗИРОВАНИЯ ЗАБОЛЕВАНИЙ ГЛАЗ НА ОСНОВЕ ЦИФРОВЫХ ОФТАЛЬМОЛОГИЧЕСКИХ ИЗОБРАЖЕНИЙ

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АННОТАЦИЯ

В данной статье рассматривается задача разработки интеллектуальной модели прогнозирования заболеваний глаз на основе цифровых офтальмологических изображений. Основная цель исследования – создать прогностическую модель, позволяющую с помощью алгоритмов глубокого обучения по ретинальным изображениям раннее выявлять офтальмологические патологии и прогнозировать вероятность их развития. В ходе исследования изображения глазного дна были подвергнуты этапу предварительной обработки, включающему снижение шумов, улучшение контраста и выделение основных анатомических структур. На следующем этапе был разработан модуль классификации и прогнозирования на основе сверточных нейронных сетей. Эффективность модели оценивалась с использованием показателей точности (accuracy), чувствительности (recall), F1-метрики, а также ROC-кривой.

Полученные результаты показали, что предложенный подход позволяет выявлять заболевания глаз быстрее и стабильнее по сравнению с традиционными методами диагностики. Также установлено, что модель может поддерживать процесс принятия клинических решений за счёт предварительной оценки вероятных сценариев развития заболевания.

Практическая значимость исследования объясняется возможностями повышения качества офтальмологических услуг за счёт внедрения цифровых диагностических систем, определения мер ранней профилактики и снижения нагрузки на врачей. Предложенная прогностическая модель также рассматривается как перспективное решение для телемедицины и дистанционных скрининговых систем.

Ключевые слова: цифровая офтальмология, глубокое обучение, ретинальные изображения, искусственный интеллект, прогнозирование заболеваний, ранняя диагностика.

DIGITAL OPHTHALMOLOGICAL IMAGE–BASED EYE DISEASE PREDICTION MODEL

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ANNOTATION

This article addresses the problem of developing an intelligent model designed to predict eye diseases based on digital ophthalmic images. The main goal of the study is to create a forecasting model that, using deep learning algorithms, enables early detection of ophthalmic pathologies through retinal images and prediction of their likelihood of progression. During the research process, fundus images underwent an initial preprocessing stage, including noise reduction, contrast enhancement, and extraction of key anatomical structures. At the next stage, a classification and forecasting module based on convolutional neural networks was developed. Model performance was evaluated using accuracy, sensitivity (recall), the F1 score, and the ROC curve.

The obtained results showed that the proposed approach enables faster and more stable detection of eye diseases compared to traditional diagnostic methods. It was also found that the model can support clinical decision-making by preliminarily assessing probable scenarios of disease progression.

The practical significance of the study is explained by the potential to improve the quality of ophthalmological services through the introduction of digital diagnostic systems, to define early preventive measures, and to reduce physician workload. The proposed forecasting model is also considered a promising solution for telemedicine and remote screening systems.

Keywords: digital ophthalmology, deep learning, retinal images, artificial intelligence, disease prediction, early diagnosis.

KIRISH

Bugungi kunda ko‘z kasalliklari dunyo miqyosida jiddiy sog‘liqni saqlash muammolaridan biri hisoblanadi. Ko‘rish qobiliyatining pasayishi insonning hayot sifati, mehnat faoliyati va ijtimoiy moslashuviga bevosita ta’sir ko‘rsatadi. World Health Organization ma’lumotlariga ko‘ra, ko‘rish buzilishlarining katta qismi erta aniqlangan taqdirda oldini olish yoki sekinlashtirish mumkin bo‘lgan holatlardan iborat.

An’anaviy oftalmologik diagnostika usullari asosan shifokorning tajribasi va vizual bahosiga tayanadi. Bunday yondashuv yuqori malakani talab qiladi hamda subyektiv omillarga bog‘liq bo‘lishi mumkin. Shu sababli so‘nggi yillarda raqamli tibbiyot texnologiyalari, xususan, ko‘z tubi tasvirlarini

avtomatik tahlil qilishga asoslangan sun’iy intellekt tizimlariga bo‘lgan qiziqish sezilarli darajada ortib bormoqda.

Raqamli oftalmologik tasvirlar ko‘zning anatomik va patologik holatini obyektiv aks ettiruvchi muhim axborot manbai hisoblanadi. Ushbu tasvirlar asosida chuqur o‘rganish algoritmlarini qo‘llash kasallik belgilarini erta bosqichda aniqlash, yashirin patologik o‘zgarishlarni topish hamda kasallik rivojlanishini prognozlash imkonini beradi. Bunday yondashuv shifokor qarorlarini qo‘llab-quvvatlash, diagnostika jarayonini tezlashtirish va inson omiliga bog‘liq xatoliklarni kamaytirishga xizmat qiladi.

Shu bilan birga, mavjud tadqiqotlarning aksariyati faqat kasallikni aniqlash bilan cheklanib, uning kelgusidagi rivojlanishini bashoratlash masalasiga yetarli e’tibor qaratmaydi. Amaliy tibbiyot nuqtayi nazaridan esa prognozlash komponenti muhim ahamiyatga ega bo‘lib, u individual davolash strategiyasini tanlash va profilaktik choralarni belgilashda asos bo‘lib xizmat qiladi.

Mazkur maqola aynan raqamli oftalmologik tasvirlar asosida ko‘z kasalliklarini nafaqat aniqlash, balki ularning rivojlanish ehtimolini baholashga qaratilgan prognozlash modelini ishlab chiqishga bag‘ishlanadi. Taklif etilayotgan yondashuv sun’iy intellekt imkoniyatlaridan foydalangan holda oftalmologik diagnostikani yangi bosqichga olib chiqish hamda klinik qaror qabul qilish jarayonini ilmiy asosda qo‘llab-quvvatlashni maqsad qiladi.

MATERIALLAR VA METODLAR

Mazkur tadqiqotda raqamli oftalmologik tasvirlar asosiy ma’lumot manbai sifatida foydalanildi. Tahlil uchun ko‘z tubi (retinal) suratlari jalb qilinib, ular turli patologik holatlarni aks ettiruvchi namunalarni o‘z ichiga oladi. Tasvirlar diagnostik sifat talablariga javob beradigan formatda saqlangan bo‘lib, keyingi avtomatlashtirilgan ishlov berish uchun yagona o‘lchamga keltirildi.

Boshlang‘ich bosqichda barcha tasvirlar sifat nazoratidan o‘tkazildi. Past aniqlikdagi, kuchli shovqinli yoki yetarli ko‘rish maydoniga ega bo‘lmagan suratlar tanlab chiqarib tashlandi. Shu orqali modelni o‘qitishda faqat informativ va klinik jihatdan ahamiyatli tasvirlardan foydalanish ta’minlandi.

Model samaradorligini oshirish maqsadida tasvirlar quyidagi ketma-ket bosqichlarda qayta ishlandi: yorug‘lik va kontrastni normallashtirish; shovqinlarni kamaytirish; rang kanallarini optimallashtirish; asosiy anatomik strukturalarni ajratib ko‘rsatish; barcha tasvirlarni yagona o‘lchamga moslashtirish.

Ushbu amallar neyron tarmoq uchun kirish ma’lumotlarini barqarorlashtirish hamda o‘rganish jarayonini tezlashtirishga xizmat qildi.

Ko‘z kasalliklarini prognozlash modeli konvolyutsion neyron tarmoqlar asosida ishlab chiqildi. Model bir necha ketma-ket konvolyutsion qatlamlar, faollashtirish funksiyalari va pooling bloklaridan tashkil topgan bo‘lib, yuqori darajadagi vizual belgilarning avtomatik ajratib olinishini ta’minlaydi.

Oxirgi qatlamlarda to‘liq bog‘langan neyronlar yordamida tasvirlardan olingan xususiyatlar umumlashtirilib, ehtimollik qiymatlari shaklida prognoz natijasi hosil qilindi. Natijada model har bir tasvir uchun kasallik mavjudligi va uning rivojlanish ehtimolini baholash imkoniga ega bo‘ldi.

Ma’lumotlar to‘plami o‘qitish va tekshirish qismlariga ajratildi. Model o‘qitish jarayonida yo‘qotish funksiyasi minimallashtirilib, og‘irlik koeffitsiyentlari iterativ tarzda yangilandi. Haddan tashqari moslashuvning oldini olish uchun muntazamlashtirish usullari qo‘llandi.

Model sifati quyidagi ko‘rsatkichlar orqali baholandi: aniqlik (accuracy); sezgirlik (recall); F1-ko‘rsatkich; ROC egri chizig‘i ostidagi maydon.

SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

Ushbu metrikalar prognozlash modelining barqarorligi va amaliy qo‘llash imkoniyatini baholash uchun asos bo‘lib xizmat qildi.

NATIJALAR

Tadqiqot davomida ishlab chiqilgan prognozlash modeli raqamli oftalmologik tasvirlar asosida ko‘z kasalliklarini aniqlash va ularning rivojlanish ehtimolini baholash imkonini berdi. O‘qitish va tekshirish bosqichlari yakunida model tasvirlardagi patologik belgilarni barqaror tarzda ajratib olishga erishdi.

Dastlabki qayta ishlash bosqichlaridan so‘ng tasvirlarning vizual sifati yaxshilandi, kontrast darajasi oshdi hamda asosiy anatomik strukturalar aniqroq ko‘rinish oldi. Bu holat neyron tarmoq tomonidan muhim xususiyatlarni aniqlash jarayonini sezilarli darajada yengillashtirdi.

Konvolyutsion qatlamlar yordamida retinal tasvirlardan yuqori darajadagi vizual belgilar avtomatik tarzda o‘rganildi. Natijada model sog‘lom va patologik holatlar o‘rtasidagi farqlarni aniqlay oldi hamda har bir tasvir uchun ehtimollik ko‘rinishidagi prognoz qiymatlarini shakllantirdi.

Baholash ko‘rsatkichlari modelning diagnostik barqarorligini tasdiqladi. Aniqlik, sezgirlik va F1-ko‘rsatkichlar o‘zaro muvofiq natijalarni namoyon etdi, bu esa modelning turli patologik holatlarni ajratish qobiliyatiga ega ekanligini ko‘rsatadi. ROC egri chizig‘i tahlili esa modelning ijobiy va salbiy holatlarni farqlashda yetarli darajadagi diskriminatsion imkoniyatga ega ekanligini tasdiqladi.

Shuningdek, prognozlash moduli faqat mavjud kasallik belgilarini aniqlash bilangina cheklanmay, tasvirlarda kuzatilgan o‘zgarishlarga asoslanib, patologiyaning ehtimoliy rivojlanish yo‘nalishini ham baholay oldi. Bu yondashuv klinik qaror qabul qilish jarayonida qo‘shimcha axborot manbai sifatida foydalanish imkonini beradi.

Olingan natijalar raqamli oftalmologik tasvirlar asosida qurilgan intellektual model ko‘z kasalliklarini erta bosqichda aniqlash hamda ularning rivojlanishini bashoratlash uchun istiqbolli vosita bo‘lishi mumkinligini ko‘rsatdi. Model telemeditsina va masofaviy skrining tizimlarida qo‘llash uchun ham mos keladi.

MUHOKAMA

Mazkur tadqiqot natijalari raqamli oftalmologik tasvirlar asosida qurilgan prognozlash modeli ko‘z kasalliklarini aniqlash va ularning rivojlanish ehtimolini baholashda amaliy ahamiyatga ega ekanligini ko‘rsatdi. Model retinal tasvirlardagi muhim vizual belgilarni avtomatik aniqlab, patologik holatlarni sog‘lom strukturalardan farqlash imkoniyatiga ega bo‘ldi.

Olingan natijalar shuni ko‘rsatadiki, chuqur o‘rganish algoritmlaridan foydalanish an’anaviy vizual baholashga nisbatan barqarorroq va obyektivroq diagnostika imkonini beradi. Ayniqsa, kasallikning dastlabki bosqichlarida yaqqol ko‘rinmaydigan o‘zgarishlarni aniqlash imkoniyati modelning muhim ustunligi hisoblanadi. Bu esa erta profilaktika choralarini belgilash va individual davolash strategiyasini tanlashda muhim ahamiyat kasb etadi.

Shu bilan birga, tadqiqot faqat tasviriy ma’lumotlarga asoslangan holda olib borilgani model imkoniyatlarini ma’lum darajada cheklaydi. Klinik ko‘rsatkichlar, bemorning yoshi, umumiy sog‘liq holati va anamnez ma’lumotlari integratsiya qilingan taqdirda prognoz aniqligi yanada oshishi mumkin. Demak, kelgusidagi izlanishlarda multimodal yondashuvdan foydalanish maqsadga muvofiqdir.

Modelning yana bir muhim jihati – uning masofaviy skrining tizimlarida qo‘llash imkoniyatidir. Raqamli tasvirlar asosida avtomatik tahlil qilish mexanizmi tibbiy resurslar cheklangan hududlarda dastlabki diagnostikani tashkil etish hamda shifokor yuklamasini kamaytirishga xizmat qilishi mumkin. Biroq bunday tizimlarni amaliyotga joriy etishda ma’lumotlar xavfsizligi, tasvir sifati va standartlashtirish masalalariga alohida e’tibor qaratilishi zarur.

Shuningdek, model natijalari shifokor qarorini to‘liq almashtirmasligi, balki klinik qaror qabul qilish jarayonini qo‘llab-quvvatlovchi vosita sifatida qaralishi lozim. Sun’iy intellekt asosidagi prognozlash tizimlari inson tajribasi bilan uyg‘unlashtirilgan holda qo‘llangandagina maksimal samaradorlikka erishiladi.

Umuman olganda, mazkur tadqiqot raqamli oftalmologik tasvirlar asosida ko‘z kasalliklarini prognozlash yo‘nalishi istiqbolli ekanligini tasdiqlaydi va ushbu sohada yanada kengroq klinik ma’lumotlar bilan olib boriladigan tadqiqotlar zarurligini ko‘rsatadi.

XULOSA

Mazkur tadqiqotda raqamli oftalmologik tasvirlar asosida ko‘z kasalliklarini prognozlashga mo‘ljallangan intellektual model ishlab chiqildi va sinovdan o‘tkazildi. Olingan natijalar chuqur o‘rganish algoritmlariga asoslangan yondashuv retinal tasvirlardagi patologik belgilarni avtomatik aniqlash hamda kasallik rivojlanish ehtimolini baholash imkonini berishini ko‘rsatdi.

Taklif etilgan model ko‘z kasalliklarini erta bosqichda aniqlashda qo‘shimcha axborot manbai bo‘lib xizmat qilishi, klinik qaror qabul qilish jarayonini qo‘llab-quvvatlashi hamda diagnostika jarayonining obyektivligini oshirishi mumkin. Ushbu yondashuv ayniqsa masofaviy skrining va telemeditsina tizimlarida amaliy ahamiyatga ega bo‘lib, tibbiy resurslar cheklangan hududlarda dastlabki baholashni avtomatlashtirish imkonini yaratadi.

Shu bilan birga, tadqiqot faqat tasviriy ma’lumotlarga tayangan holda amalga oshirilgani modelning prognozlash imkoniyatlarini ma’lum darajada cheklaydi. Kelgusida klinik ko‘rsatkichlar, bemor anamnezi va boshqa biometrik ma’lumotlarni integratsiya qilish orqali multimodal prognozlash tizimini yaratish maqsadga muvofiq hisoblanadi. Bu esa individual davolash strategiyalarini shakllantirish va profilaktika choralarini aniqroq belgilash imkonini beradi.

Umuman olganda, raqamli oftalmologik tasvirlar asosida qurilgan prognozlash modeli ko‘z kasalliklarini erta aniqlash va ularning rivojlanishini bashoratlash yo‘nalishida istiqbolli vosita ekanligi tasdiqlandi. Tadqiqot natijalari sun’iy intellekt texnologiyalarini oftalmologik amaliyotga joriy etish bo‘yicha keyingi ilmiy izlanishlar uchun metodik asos bo‘lib xizmat qilishi mumkin.

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SIR Publishers
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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

EARLY DIAGNOSIS AND PREDICTION MODEL OF OPHTHALMIC DISEASES BASED ON ARTIFICIAL INTELLIGENCE USING DIGITAL RETINAL IMAGES

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ANNOTATSIYA

Early detection of ophthalmic diseases is essential for preventing irreversible vision loss and improving patients' quality of life. Recent advances in artificial intelligence (AI) and medical imaging have created new opportunities for automated screening and clinical decision support. This study proposes an AI-based model for early diagnosis and prediction of ophthalmic diseases using digital retinal images. The proposed approach employs convolutional neural networks to automatically extract visual features from fundus photographs and generate probabilistic predictions of pathological conditions.

Digital retinal images were preprocessed through normalization, noise reduction, and contrast enhancement to improve feature representation. The model was trained and validated using separated training and testing subsets. Performance was evaluated using standard metrics including accuracy, recall, F1-score, and receiver operating characteristic (ROC) analysis.

Experimental results demonstrate that the proposed model is capable of distinguishing healthy and pathological retinal images and estimating disease progression tendencies. The findings suggest that AI-based retinal image analysis can serve as a supportive tool for early diagnosis and prognosis, potentially reducing diagnostic subjectivity and improving screening efficiency. The proposed system is particularly promising for telemedicine and remote screening applications.

Keywords: artificial intelligence, retinal images, early diagnosis, disease prediction, deep learning, ophthalmology.

INTRODUCTION

Visual impairment and ophthalmic diseases constitute a major public health concern worldwide, significantly affecting quality of life, productivity, and social participation. According to World Health Organization, a substantial proportion of vision loss cases are preventable or treatable if detected at early stages. However, many ophthalmic disorders, including diabetic retinopathy, glaucoma, and age-related retinal abnormalities, often progress silently, making timely diagnosis challenging in routine clinical practice.

Conventional ophthalmological assessment relies heavily on expert visual interpretation of retinal images and clinical indicators. While this approach remains the gold standard, it is inherently subjective and dependent on specialist availability and experience. In many regions, limited access to trained ophthalmologists further delays early screening and intervention. These challenges highlight the need for automated, objective, and scalable diagnostic tools that can support clinicians and improve early detection rates.

Digital retinal imaging has become a cornerstone of modern ophthalmology, providing high-resolution visualization of ocular structures and pathological changes. Fundus photographs capture essential anatomical features such as blood vessels, optic disc morphology, and macular regions, which are critical for identifying early disease manifestations. The rapid growth of medical imaging datasets, combined with advances in computational power, has created favorable conditions for applying artificial intelligence (AI) techniques to ophthalmic diagnostics.

In recent years, deep learning—particularly convolutional neural networks—has demonstrated remarkable performance in medical image analysis. These models are capable of automatically learning hierarchical visual features directly from raw images, eliminating the need for manual feature engineering. Numerous studies have shown that AI systems can achieve diagnostic accuracy comparable to human experts in detecting specific eye diseases from retinal images. Despite these advances, most existing approaches focus primarily on classification tasks, such as distinguishing healthy from diseased eyes.

From a clinical perspective, diagnosis alone is often insufficient. Predicting disease progression is equally important for personalized treatment planning, risk stratification, and preventive care. Prognostic information enables clinicians to identify high-risk patients, optimize follow-up intervals, and initiate early therapeutic interventions. Nevertheless, relatively limited attention has been devoted to developing integrated frameworks that combine early detection with disease prediction based solely on retinal image data.

Another important consideration is the growing demand for telemedicine and remote screening solutions. AI-based retinal image analysis has the potential to facilitate large-scale population screening, particularly in underserved or resource-limited settings. Automated systems can pre-screen images, flag suspicious cases, and prioritize patients for specialist review, thereby reducing clinical workload and improving healthcare accessibility.

Against this background, the present study proposes an artificial intelligence–based model for early diagnosis and prediction of ophthalmic diseases using digital retinal images. The primary objective is to design a deep learning framework capable of extracting discriminative visual features from fundus photographs and generating probabilistic estimates of pathological conditions and potential disease development. By integrating diagnostic and prognostic components within a single system, this work aims to contribute toward more comprehensive AI-assisted ophthalmic care.

The proposed approach seeks to enhance diagnostic objectivity, support clinical decision-making, and provide a methodological foundation for future multimodal systems that may incorporate both imaging and clinical data. Ultimately, such intelligent models have the potential to improve early intervention strategies and reduce the burden of avoidable visual impairment.

MATERIALS AND METHODS

Digital retinal fundus images were used as the primary data source for developing the proposed artificial intelligence model. All images underwent initial quality assessment, and samples with insufficient resolution, excessive noise, or poor illumination were excluded. The remaining images were resized to a unified input dimension and subjected to preprocessing procedures including contrast normalization, noise reduction, color channel optimization, and enhancement of key anatomical structures to improve feature visibility and learning stability. The prediction system was implemented using a convolutional neural network architecture consisting of multiple convolutional layers for automatic feature extraction, pooling layers for dimensionality reduction, and fully connected layers for probabilistic output generation. Activation functions and regularization techniques were applied to improve convergence and mitigate overfitting. The dataset was divided into training and validation subsets, and model parameters were optimized iteratively by minimizing a loss function during supervised learning. Performance evaluation was conducted using standard metrics including accuracy, recall, F1-score, and receiver operating characteristic (ROC) analysis to assess both diagnostic reliability and predictive capability. The model outputs included classification results distinguishing healthy and pathological retinal images as well as probabilistic estimates reflecting potential disease progression. All experiments were performed under controlled computational conditions, and validation results were used to analyze model stability and

generalization ability. Clinical variables were not incorporated at this stage, and the system relied exclusively on image-based information.

RESULTS

The proposed artificial intelligence model demonstrated stable learning behavior during training and consistent performance on the validation dataset. After preprocessing, retinal images exhibited improved contrast and reduced noise, which facilitated more reliable feature extraction by the convolutional layers. The network successfully learned discriminative visual patterns associated with pathological retinal changes and was able to differentiate healthy images from diseased samples. Evaluation using accuracy, recall, F1-score, and ROC analysis indicated coherent and balanced performance across these metrics, confirming the robustness of the classification process. In addition to disease detection, the prediction component generated probabilistic outputs reflecting potential disease progression tendencies, providing clinically relevant information beyond binary classification. ROC curve analysis showed adequate separability between positive and negative cases, suggesting that the model possesses sufficient discriminative capability for early screening applications. The system maintained stable behavior across validation samples, indicating acceptable generalization ability. Overall, the results confirm that deep learning–based analysis of digital retinal images can support early ophthalmic diagnosis while simultaneously offering prognostic insights, thereby demonstrating the feasibility of integrating diagnostic and predictive functions within a single AI framework.

DISCUSSION

The results indicate that AI-based retinal image analysis can provide objective support for early ophthalmic diagnosis. Deep learning enables automatic identification of subtle structural changes that may precede clinically obvious symptoms, which is critical for preventive intervention.

A key advantage of the proposed approach is its potential application in telemedicine environments, where specialist access is limited. Automated screening tools can help prioritize patients requiring urgent attention and reduce physician workload.

However, the current model relies solely on image data. Incorporating clinical parameters such as age, medical history, and systemic indicators could further enhance predictive accuracy. Future research should therefore explore multimodal models combining imaging and clinical data.

Importantly, AI systems should be considered decision-support tools rather than replacements for clinicians. Optimal outcomes are achieved when algorithmic predictions are interpreted alongside professional medical judgment.

CONCLUSION

This study presents an artificial intelligence–based model for early diagnosis and prediction of ophthalmic diseases using digital retinal images. The proposed approach demonstrates the feasibility of automated retinal image analysis for identifying pathological changes and estimating disease progression.

The findings suggest that AI-driven systems can enhance diagnostic objectivity, support clinical decision making, and facilitate large-scale screening, particularly in remote or resource-limited settings. Future work will focus on integrating clinical data and expanding validation on broader patient populations.

Overall, the proposed model represents a promising step toward intelligent ophthalmic diagnostic systems and provides a methodological foundation for further research in AI-assisted eye care.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |14-02-2026|

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SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-02-2026|

ONKOLOGIYADA MIKROBIOM OMILI: MIKROBIOTEXNOLOGIK MODULYATSIYA ORQALI DORI TA'SIRINI KUCHAYTIRISH VA NOJO'YA TA'SIRNI KAMAYTIRISH

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ANNOTATSIYA

So'nggi yillarda ichak mikrobiomi o'smaga qarshi immun javobni shakllantirish, o'sma mikro-muhitini "immunologik faol" holatga o'tkazish hamda davolashga javob (responz) va rezistentlik mexanizmlarini belgilovchi muhim biologik omil sifatida qaralmoqda. Ayniqsa, immun nazorat nuqtasi ingibitorlari (immune checkpoint inhibitors) qo'llanadigan klinik holatlarda mikrobiom tarkibi va funksional metabolik profili dori samaradorligi hamda immun-bog'liq nojo'ya ta'sirlar (irAEs) bilan bog'liqligi haqida dalillar to'planmoqda. Shu bilan birga, mikrobiotexnologiya mikrobiomni boshqarishning amaliy platformasini beradi: fekal mikrobiota transplantatsiyasi (FMT), tirik bioterapevtik mahsulotlar (LBP), mikroblar konsorsiumi, prebiotik/metabiotik yondashuvlar, yo'naltirilgan bakterial ferment ingibitorlari va biomarkerga asoslangan stratifikatsiya. Ushbu maqola adabiyotlar tahlili asosida mikrobiomning onkologik davolashga ta'sir mexanizmlari, mikrobiotexnologik modulyatsiya usullari, ularning dori ta'sirini kuchaytirish hamda toksiklikni pasaytirishdagi istiqbollari va cheklovlarini yoritadi. Matn klinik tavsiya bermaydi; muhokama qilinadigan intervensiyalar, xususan FMT va ayrim mikrobiomga yo'naltirilgan strategiyalar ko'p holatda klinik sinovlar doirasida baholanayotgan yo'nalishlardir.

Kalit so'zlar: mikrobiom, ichak mikroflorasi, immunoterapiya, PD-1/PD-L1, FMT, tirik bioterapevtik mahsulot, antibiotiklar, toksiklik, irinotekan, biofilm, biomarker.

МИКРОБИОМНЫЙ ФАКТОР В ОНКОЛОГИИ: УСИЛЕНИЕ ЭФФЕКТИВНОСТИ ЛЕКАРСТВ И СНИЖЕНИЕ ПОБОЧНЫХ ЭФФЕКТОВ ПОСРЕДСТВОМ МИКРОБИОТЕХНОЛОГИЧЕСКОЙ МОДУЛЯЦИИ

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АННОТАЦИЯ

В последние годы кишечный микробиом рассматривается как один из ключевых модифицируемых факторов, влияющих на эффективность и безопасность противоопухолевого лечения. Накопленные клинико-экспериментальные данные

показывают, что состав и функциональная активность микробиоты способны определять выраженность системного иммунного ответа, характер воспалительных каскадов, метаболический профиль (короткоцепочечные жирные кислоты, метаболиты триптофана, трансформация желчных кислот) и, как следствие, чувствительность опухоли к терапии, включая ингибиторы контрольных точек иммунного ответа (PD-1/PD-L1, CTLA-4). Одновременно микробиом может участвовать в формировании токсичности лечения, в частности иммун-опосредованных нежелательных явлений (irAEs) и гастроинтестинальных осложнений, связанных с микробными ферментами и метаболизмом лекарств. В статье рассматриваются механизмы, посредством которых микробиота влияет на противоопухолевую терапию, а также микробиотехнологические подходы к целенаправленной модификации микробиома: фекальная трансплантация микробиоты, живые биотерапевтические препараты (консорциумы штаммов), пре-/постбиотики, метаболит-ориентированные стратегии и ингибирование специфических бактериальных ферментов как путь снижения токсичности при сохранении противоопухолевого эффекта. Отдельное внимание уделено вопросам стандартизации, биобезопасности, воспроизводимости, регуляторных требований и влиянию конфаундеров (антибиотики, диета, сопутствующая терапия), ограничивающих интерпретацию ассоциаций и внедрение подходов в рутинную практику. Делается вывод о перспективности персонализированной, биомаркер-обоснованной микробиомной модификации как вспомогательной стратегии для усиления эффективности терапии и уменьшения нежелательных эффектов при условии подтверждения в контролируемых клинических исследованиях.

Ключевые слова: кишечный микробиом, онкология, иммунотерапия, ингибиторы контрольных точек, PD-1/PD-L1, токсичность, irAEs, фекальная трансплантация микробиоты, живые биотерапевтические препараты, пре-/постбиотики, микробные метаболиты.

THE MICROBIOME FACTOR IN ONCOLOGY: ENHANCING DRUG EFFICACY AND REDUCING ADVERSE EFFECTS THROUGH MICROBIOTECHNOLOGICAL MODULATION

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ANNOTATION

In recent years, the gut microbiome has been increasingly recognized as a key modifiable determinant of both the efficacy and safety of anticancer therapy. Growing clinical and experimental evidence indicates that microbial community structure and, more importantly, functional capacity can shape systemic immune tone, inflammatory signaling, and host–microbe metabolic outputs (including short-chain fatty acids, tryptophan-derived metabolites, and bile acid transformation). Through these pathways, the microbiome may influence tumor immune microenvironment features and the likelihood of response or resistance to modern treatments, particularly immune checkpoint inhibitors targeting PD-1/PD-L1 and CTLA-4. In parallel, the microbiome can contribute to treatment-related

toxicity by modulating drug metabolism and mucosal immunity, thereby affecting the risk and severity of immune-related adverse events (irAEs) and gastrointestinal complications. This article synthesizes current mechanistic concepts and translational findings linking the microbiome to oncologic outcomes and evaluates microbiotechnology-driven strategies for targeted microbiome modulation, including fecal microbiota transplantation, live biotherapeutic products (defined microbial consortia), prebiotic and postbiotic interventions, metabolite-oriented approaches, and selective inhibition of specific bacterial enzymes as a rational route to reduce toxicity while preserving anticancer activity. Particular attention is paid to practical barriers to implementation—standardization, biosafety, reproducibility, regulatory requirements, and major confounders such as antibiotic exposure, diet, and concomitant medications—which complicate causal inference and limit broad clinical adoption. Overall, the evidence supports the promise of personalized, biomarker-informed microbiome modulation as an adjunct strategy to enhance therapeutic benefit and mitigate adverse effects, provided that efficacy and safety are confirmed in well-controlled clinical trials.

Keywords: gut microbiome, oncology, immunotherapy, immune checkpoint inhibitors, PD-1/PD-L1, toxicity, irAEs, fecal microbiota transplantation, live biotherapeutic products, prebiotics, postbiotics, microbial metabolites.

METODOLOGIYA

Mazkur ish narrativ tahlil (narrative review) ko‘rinishida bajarildi. Asosiy manbalar sifatida PubMed va yirik nashriyot platformalarida chop etilgan so‘nggi sharh maqolalar, klinik sinov natijalari hamda mexanistik (preklinik) ishlar tanlandi. Ustuvor yo‘nalishlar: (1) mikrobiom–immunoterapiya samaradorligi aloqasi; (2) antibiotiklar va boshqa konfaunderlar; (3) mikrobiotexnologik intervensiyalar (FMT, LBP/konsorsium, pre-/postbiotik, metabolit va ferment nishonlari); (4) nojo‘ya ta’sirlar (irAEs va kimyoterapiya toksikligi) bilan bog‘liq yo‘nalishlar. Dalillar kuchi bo‘yicha klinik sinovlar va tizimli sharhlar birlamchi, mexanistik ishlar esa biologik asosni tushuntiruvchi qo‘shimcha qatlam sifatida talqin qilindi.

NATIJALAR

Adabiyotlar tahlili mikrobiomning onkologik davolashda ikki “asosiy kanal” bo‘yicha rolini ko‘rsatadi: (A) samaradorlik (efficacy)ni modulyatsiya qilish; (B) toksiklik/nojo‘ya ta’sirlarni shakllantirish yoki kuchaytirish.

A) Mikrobiom va immunoterapiya samaradorligi. Bir qator sharhlar va kohort tadqiqotlar ichak mikrobiotasining tarkibi va funksional imkoniyatlari immunoterapiya javobiga ta’sir ko‘rsatishini ta’kidlaydi. Bu ta’sir ko‘pincha “kompozitsiya”dan ko‘ra “funksiya” (metabolitlar, immun modulyatsiya qiluvchi yo‘llar) bilan izohlanadi: SCFAs ishlab chiqilishi, antigen prezentatsiyasini qo‘llab-quvvatlaydigan signallar, Treg/Th17 balansiga ta’sir va dendrit hujayralar faollashuvi kabi mexanizmlar qayd etiladi.

Antibiotiklar mikrobiomni keskin o‘zgartiruvchi (dysbiosis chaqiruvchi) omil sifatida deyarli barcha onko-immunologik meta-tahlillarda “yomon prognostik faktor” bo‘lib chiqmoqda. Ayrim o‘smalarda, jumladan, urothelial karsinoma va o‘pka saratonida antibiotik ekspozitsiyasi ICI bilan davolash fonida OS/PFS ko‘rsatkichlarini pasaytirishi haqidagi tizimli sharhlar mavjud. Bu natijalar “antibiotiklar zarur bo‘lmagan joyda berilmasligi” g‘oyasini ilmiy asoslaydi, ammo klinik qaror har doim infeksiya xavfi bilan muvozanatli qabul qilinadi.

FMT va mikrobiomni ko‘chirib o‘tkazish yondashuvlari immunoterapiyaga rezistentlikni yengish yo‘li sifatida eng ko‘p muhokama qilinadi. Melanomada FMT + anti–PD-1 kombinatsiyasi bo‘yicha e’lon qilingan ishlar ayrim bemorlarda rezistentlikni “qayta sindirish” mumkinligini ko‘rsatgan; keyingi yillarda bu konsepsiya boshqa qattiq o‘smalarda ham sinovdan o‘tayotgani

haqida dalillar paydo bo‘ldi. Bunda asosiy nuqta – xavfsizlik, donor tanlovi, mikrobiologik skrining va standartlash muammolari.

Ratsion va qo‘shimchalar masalasi ham mikrobiom orqali immunoterapiya javobiga ta’sir qiluvchi omil sifatida ko‘riladi. Fiber (kletchatka) yuqori bo‘lgan ratsion mikrobiom xilma-xilligini va SCFAs ishlab chiqilishini kuchaytirishi mumkinligi sababli ijobiy konsepsiya mavjud, biroq klinik dalillar bir xil emas: ba’zi ishlarda foydali assotsiatsiyalar qayd etilsa, boshqalarida ta’sirning izchilligi pastligi ko‘rsatiladi. Probiotik qo‘shimchalari esa kutilganidek har doim foyda bermasligi, ayrim holatlarda mikrobiom xilma-xilligini pasaytirishi va javobni yomonlashtirishi mumkinligi haqida xabarlar bor; shu bois “o‘zboshimchalik bilan” probiotik qabul qilishni davolash strategiyasi sifatida ko‘rsatish ilmiy jihatdan to‘g‘ri emas.

B) Mikrobiom va nojo‘ya ta’sirlar. Immunoterapiyada irAEs, xususan ICI-induktsiyalangan kolit mikrobiom bilan bog‘liq bo‘lishi mumkinligi tobora ko‘proq o‘rganilmoqda. Prospektiv kuzatuvlar mikrobiom tarkibi va uning dinamik o‘zgarishlari og‘ir irAEs bilan assotsiatsiyalanishi mumkinligini ko‘rsatadi; ammo bu yo‘nalishda sabab-oqibat (causality)ni isbotlash murakkab, chunki steroidlar, PPI, antibiotiklar, ovqatlanish va o‘smaning o‘zi mikrobiomni o‘zgartiradi. Shunga qaramay, mikrobiom irAEs uchun biomarker va ehtimoliy terapevtik nishon sifatida qaralmoqda.

Kimyoterapiya toksikligida mikrobiomning fermentativ roli juda aniq ko‘rsatilgan klassik misol — irinotekan (CPT-11) bilan bog‘liq kechikkan diareya va ichak shikastlanishi. Bu holatda ichak bakteriyalarining β-glukuronidaza fermentlari detoksikatsiya qilingan metabolitni qayta faollashtirib, mahalliy toksiklikni kuchaytirishi mumkin. Mikroblarning aynan shu fermentini yo‘naltirilgan ingibirlanishi preklinik modellarda GI toksiklikni kamaytirishi ko‘rsatilgan; konsepsiya “mikrobiom-enzim nishoni” orqali nojo‘ya ta’sirni pasaytirish mumkinligini namoyish etadi.

MUHOKAMA

Tahlil shuni ko‘rsatadiki, mikrobiomni “dori javobining muhim modulyatori” sifatida ko‘rish klinik onkologiyani mikrobiotexnologiya bilan strategik birlashtirishga imkon beradi. Bu integratsiya uchta amaliy yo‘nalishda real natija berishi mumkin.

Birinchisi, biomarkerga asoslangan stratifikatsiya. Mikrobiom profilingi (16S/shotgun metagenomika, metabolomika) orqali immunoterapiyaga javob ehtimolini yoki irAEs xavfini oldindan baholash konsepsiyasi tez rivojlanmoqda. Bunda eng muhim masala — “umumiy taxa ro‘yxati” emas, balki takrorlanadigan funksional signallarni topish: SCFAs yo‘llari, safro kislotalari transformatsiyasi, tryptophan–AhR o‘qi kabi. Ko‘p sharhlarda aynan funksional yondashuv natijalarning takrorlanuvchanligini oshirishi mumkinligi qayd etiladi.

Ikkinchisi, intervensiyalarni standartlash. FMT klinik jihatdan eng kuchli “proof-of-concept” bo‘lsa-da, u bir vaqtning o‘zida eng murakkab: donor skriningi, patogenlarni istisno qilish, ishlab chiqarish standartlari, saqlash, dozalash va regulyator talablari. Shu sababli mikrobiotexnologiyada “aniq tarkibli konsorsiumlar” (defined consortia) va “tirik bioterapevtik mahsulotlar” (LBP) yo‘nalishi kuchaymoqda: ma’lum shtammlar kombinatsiyasi orqali funksional effektni qayta ishlab chiqarish, xavfsizlikni nazorat qilish va partiyadan-partiyaga barqarorlikni ta’minlash osonroq bo‘ladi. Bu yondashuvning klinik qiymati bo‘yicha dalillar hozir kengayib bormoqda, lekin hali ko‘p holatda klinik sinov bosqichida.

Uchinchisi, toksiklikni mikrobiom orqali nishonga olish. Irinotekan misolida ko‘ringanidek, ba’zi nojo‘ya ta’sirlar mikroblar fermentlari bilan bevosita bog‘liq. Bu esa “mikrobiomga umumiy ta’sir” (masalan, keng spektli antibiotik) o‘rniga “nishonli mikrobiom farmakologiyasi” (masalan, β-glukuronidaza ingibitorlari)ni konseptual jihatdan jozibador qiladi: dori samaradorligi saqlanadi, toksiklik kamayadi, mikrobiomning umumiy ekotizimi kamroq buziladi. Bunday yondashuvning

klinik tarjimasi uchun xavfsizlik, dori–mikrob–mezbon (host) farmakokinetikasini chuqur o‘rganish va ko‘p markazli sinovlar zarur.

Cheklovlar ham muhim. Mikrobiom tadqiqotlarida diet, geografiya, PPI, antibiotiklar, steroidlar, kimyoterapiya va o‘smaga xos omillar kuchli konfaunder bo‘lib xizmat qiladi; shuning uchun assotsiatsiyalarni “universal qoida” sifatida talqin qilish xatodir. Bundan tashqari, probiotiklar, fiber, parhez o‘zgarishlari kabi omillar bo‘yicha ham dalillar bir xil emas: ayrim manbalarda ijobiy assotsiatsiyalar, boshqalarida esa ta’sirning izchilligi pastligi yoki kontekstga bog‘liqligi ko‘rsatiladi. Bu holat mikrobiomni modulyatsiya qilishda “barchaga bir xil retsept” emas, balki shaxsiylashtirilgan, biomarkerga tayangan strategiya kerakligini anglatadi.

XULOSA

Ichak mikrobiomi onkologik davolashning samaradorligi va xavfsizligiga ta’sir qiluvchi muhim biologik qatlam sifatida namoyon bo‘lmoqda. Mikrobiotexnologik modulyatsiya (FMT, LBP/konsorsium, pre-/postbiotik yondashuvlar, nishonli bakterial ferment ingibitsiyasi) immunoterapiya javobini kuchaytirish va ayrim toksikliklarni pasaytirish uchun istiqbolli platforma hisoblanadi. Shu bilan birga, klinik amaliyotga keng joriy etish uchun standartlash, bioxavfsizlik, regulyator talablar, konfaunderlarni nazorat qiluvchi sinov dizayni hamda funksional biomarkerlarni validatsiya qilish zarur. Amaliy nuqtada, mikrobiomga oid intervensiyalarni davolashning “muqobil yo‘li” sifatida emas, balki ilmiy asoslangan klinik sinovlar doirasida tekshirilayotgan translatsion yo‘nalish sifatida ko‘rish maqsadga muvofiq.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-02-2026|

ADAPTIVE CAPABILITIES OF TISSUES AND THEIR HISTOLOGICAL MANIFESTATION MECHANISMS

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ABSTRACT

The adaptive capabilities of tissues represent a complex set of structural and functional changes that occur in response to various physiological and pathological stimuli. These adaptive processes are essential for maintaining homeostasis and ensuring the survival of cells and tissues under changing environmental and internal conditions. At the histological level, tissue adaptation is manifested through alterations in cellular morphology, proliferation rates, metabolic activity, and intercellular interactions. Mechanisms such as hypertrophy, hyperplasia, atrophy, and metaplasia play a key role in enabling tissues to respond to functional demands and damaging factors.

Keywords: tissue adaptation, histology, cellular adaptation, hypertrophy, hyperplasia, atrophy, metaplasia, tissue regeneration, morphological changes, tissue structure

INTRODUCTION

Tissues of the human body possess remarkable adaptive capabilities that allow them to respond effectively to changes in both internal and external environments. These adaptive responses are essential for maintaining structural integrity, functional stability, and overall homeostasis. Adaptation at the tissue level involves a variety of cellular and molecular mechanisms that enable cells to survive, function, and adjust under conditions such as increased functional demand, reduced nutrient supply, hypoxia, mechanical stress, and pathological injury. From a histological perspective, tissue adaptation is characterized by specific structural and morphological changes that can be observed under microscopic examination. These changes may include alterations in cell size, number, shape, and organization, as well as modifications in the extracellular matrix and intercellular connections. Such transformations reflect the dynamic nature of tissues and their ability to maintain functionality despite adverse conditions. One of the most common forms of cellular adaptation is hypertrophy, which involves an increase in cell size in response to increased workload. Hyperplasia, on the other hand, refers to an increase in the number of cells due to enhanced proliferative activity. In contrast, atrophy is characterized by a reduction in cell size and functional capacity, often resulting from decreased functional demand or insufficient nutrition. Metaplasia represents a reversible change in which one differentiated cell type is replaced by another better suited to withstand environmental stress. These adaptive mechanisms play a crucial role in both normal physiological processes and the development of pathological conditions.

MATERIALS AND METHODS

This study was conducted using a comprehensive histological analysis approach to evaluate the adaptive capabilities of tissues and their structural manifestations under various physiological and pathological conditions. The materials consisted of histological specimens representing different tissue types, including epithelial, connective, muscle, and nervous tissues. These specimens were selected to assess the structural characteristics and adaptive responses of cells and tissues to functional demands and environmental influences. Tissue samples were fixed using standard fixation techniques

in 10% neutral buffered formalin to preserve cellular and structural integrity. Following fixation, the samples were processed through dehydration in graded alcohol solutions, clearing in xylene, and embedding in paraffin. Paraffin blocks were sectioned into thin slices of approximately 4–6 μm thickness using a microtome. The obtained sections were mounted on glass slides and stained using hematoxylin and eosin (H&E), which allowed clear visualization of cellular and tissue structures. Microscopic examination was performed using a light microscope at various magnifications to evaluate morphological features, including cell size, shape, arrangement, nuclear characteristics, and intercellular relationships. Special attention was given to identifying adaptive changes such as hypertrophy, hyperplasia, atrophy, and metaplasia.

RESULTS

The histological examination revealed significant structural and cellular changes associated with tissue adaptation. One of the most prominent findings was hypertrophy, characterized by an increase in cell size and cytoplasmic volume. Hypertrophied cells demonstrated enlarged nuclei and increased cytoplasmic density, indicating enhanced metabolic activity. This type of adaptation was particularly evident in muscle tissue, where increased functional demand resulted in the enlargement of muscle fibers. Hyperplasia was also observed in several tissue types and was characterized by an increase in the number of cells. Histological sections showed increased cellular density and a higher number of mitotic figures, indicating active cellular proliferation. This process contributed to the maintenance of tissue function and structural integrity under conditions requiring increased functional capacity. In contrast, atrophic changes were identified in tissues exposed to reduced functional demand or unfavorable conditions. Atrophic cells exhibited decreased cell size, reduced cytoplasmic volume, and condensed nuclei. These changes reflected a reduction in metabolic activity and functional capacity. Metaplastic changes were also detected, demonstrating the replacement of one differentiated cell type with another more resistant to environmental stress. **Discussion**

The findings of this study demonstrate that tissues possess significant adaptive capabilities that allow them to respond effectively to physiological demands and pathological stress. These adaptive processes are essential for maintaining homeostasis and ensuring the survival of cells and tissues under changing environmental conditions. Hypertrophy represents an important adaptive mechanism that enables cells to increase their functional capacity without increasing cell number. This process is particularly important in tissues with limited proliferative ability, such as cardiac and skeletal muscle. The observed increase in cell size and metabolic activity reflects the ability of cells to enhance their functional performance in response to increased workload. Hyperplasia, in contrast, involves an increase in cell number and is commonly observed in tissues with high regenerative potential, such as epithelial tissues. This adaptive mechanism allows tissues to compensate for increased functional demand or cellular loss. The presence of increased mitotic activity confirms the active role of cellular proliferation in maintaining tissue integrity.

CONCLUSION

The adaptive capabilities of tissues represent a fundamental biological property that ensures the maintenance of structural integrity and functional stability under varying physiological and pathological conditions. This study demonstrated that tissue adaptation is manifested through a range of histological and cellular changes, including hypertrophy, hyperplasia, atrophy, and metaplasia. These processes reflect the ability of cells and tissues to respond dynamically to functional demands, environmental stress, and injury. Histological analysis revealed that adaptive changes involve not only alterations in cellular morphology but also structural reorganization of tissues and modifications in the extracellular matrix. These changes play a crucial role in preserving tissue function, maintaining homeostasis, and promoting survival under adverse conditions. The presence of

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-02-2026|

hypertrophic and hyperplastic responses indicates increased functional activity and regenerative potential, while atrophic and metaplastic changes reflect structural and functional adjustments to reduced demand or chronic stress.

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SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |19-02-2026|

CORONARY STENT PLACEMENT, TYPES OF STENTS, AND CAUSES LEADING TO CORONARY STENT IMPLANTATION

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ABSTRACT

This article describes modern stents developed using 21st-century technologies, their types, the causes leading to coronary stent implantation, the patient's condition after stent placement, and recommendations for developing a healthy lifestyle. This article serves as a practical guide for medical professionals and patients.

Keywords: Coronary stenting, drug-eluting stents (DES), bare-metal stents (BMS), bioresorbable stents, specialized stents, atherosclerosis, angioplasty, rehabilitation, antiplatelet therapy, healthy lifestyle, interventional cardiology.

INTRODUCTION

Cardiovascular diseases are currently one of the leading causes of mortality worldwide. According to the World Health Organization (WHO), tens of millions of people die each year due to ischemic heart disease. Individuals with sedentary lifestyles and unhealthy dietary habits are more prone to a condition known as atherosclerosis. Atherosclerosis is characterized by the accumulation of plaque within the arterial walls. This plaque leads to narrowing and blockage of the arteries, thereby reducing blood flow. When atherosclerosis affects the arteries that supply blood to the heart (coronary arteries), it is referred to as coronary artery disease. Coronary angioplasty with stent placement is considered a primary treatment method for such patients. Since the heart muscle constantly requires oxygen and nutrients, any restriction in blood flow weakens myocardial contractility, resulting in conditions such as angina pectoris, myocardial infarction, or even heart failure. Therefore, early diagnosis of ischemic heart disease and restoration of adequate blood flow are among the most important priorities of modern cardiology. In recent decades, interventional cardiology has developed rapidly to address these challenges. One of the most effective methods is percutaneous coronary intervention (PCI), which includes coronary angioplasty and stent implantation. This procedure is aimed at reopening narrowed coronary arteries and preventing their re-narrowing. Stenting involves the placement of a special metal or bioresorbable tube (stent) inside the narrowed or blocked coronary artery to restore blood flow. Initially, bare-metal stents were widely used; however, drug-eluting stents (DES) are now more commonly applied. These stents reduce the risk of plaque reformation within the vessel wall and significantly improve long-term clinical outcomes. Nevertheless, the success of stent implantation is not limited solely to the technical performance of the procedure. Its effectiveness also depends on the patient's preoperative preparation, adherence to intraoperative protocols, and proper postoperative rehabilitation. Coronary angioplasty with stent placement is considered a highly effective and safe procedure. It has been performed for approximately 50 years and has undergone significant improvements over time. However, like any invasive procedure, it carries certain risks. Complications associated with angioplasty are relatively rare, occurring in approximately 1 out of every 100 procedures.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |19-02-2026|

MAIN PART

Coronary angioplasty with stent placement is a minimally invasive procedure that was first performed in Switzerland in 1977. The pre-procedural preparation stage is an important step before coronary stent implantation. This process allows accurate assessment of the degree of coronary artery stenosis, plaque localization, and vascular morphology through comprehensive diagnostic examinations. The main diagnostic methods include: Electrocardiography (ECG): evaluates the electrical activity of the heart muscle, detects conduction abnormalities, and identifies signs of myocardial ischemia.

Echocardiography: provides information about the size of the cardiac chambers, ejection fraction, valvular condition, and wall motion abnormalities. Coronary angiography: is considered the "gold standard" diagnostic method before stent implantation, providing precise visualization of coronary arteries using contrast media. The patient's general condition is also evaluated, including blood pressure, heart rate, blood glucose level, kidney function (creatinine, glomerular filtration rate – GFR), coagulation parameters (INR, APTT), and allergic history. In addition, antiplatelet therapy (aspirin combined with clopidogrel or ticagrelor) is initiated at least 24 hours before the procedure to prevent thrombus formation. If the patient has chronic conditions such as diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), or renal insufficiency, these conditions must be stabilized prior to the procedure. Furthermore, the patient is provided with detailed information about the procedure, its risks and benefits, and informed consent is obtained. In the initial stage of the procedure, intravenous (IV) lines are established, and analgesic and sedative medications are administered to reduce pain and anxiety and to help the patient remain calm. Local anesthesia is applied at the incision site to numb the area. The surgeon then makes a small incision, usually in the radial artery (wrist) or femoral artery (groin), where the arterial pulse can be easily palpated. Through this incision, a thin, flexible tube called a catheter is inserted into the artery. The cardiologist carefully guides the catheter to the site of blockage. X-ray imaging and contrast dye are used to visualize the blood vessels and accurately guide the catheter. Once the catheter reaches the target location, a guidewire is inserted through it, followed by a small balloon mounted on the catheter. The balloon is inflated and deflated several times, compressing the plaque against the arterial wall and widening the narrowed vessel. This process is known as balloon angioplasty. The next step is stent deployment. The stent is positioned at the site of the blockage and expanded to support the arterial wall and prevent re-narrowing. After successful stent placement, the cardiologist removes the catheter and guidewire. The final stage involves applying a vascular closure device or manual pressure to prevent bleeding. The incision site is then covered with a sterile dressing to ensure proper healing.

Types of stents:

1. **Bare-Metal Stents (BMS):** These stents are made of stainless steel or cobalt-chromium and provide structural support to keep the artery open. They act as a mechanical scaffold to maintain adequate blood flow through the vessel.
2. **Drug-Eluting Stents (DES):** These stents are coated with medications that are gradually released into the arterial wall to prevent excessive cell proliferation. They significantly reduce the risk of restenosis and are widely used in modern interventional cardiology.
3. **Bioresorbable Stents:** These stents are made of materials that gradually dissolve over time. They provide temporary structural support and eventually allow the artery to return to its natural state without leaving permanent metallic components.
4. **Specialized Stents:** Specialized stents, such as covered stents, are used in cases of aneurysms or arterial perforations. Dual-therapy stents combine drug elution with enhanced healing properties to improve clinical outcomes and vascular recovery.

Coronary angioplasty with stent placement is an effective method for improving heart health. However, long-term lifestyle modifications are essential to prevent future arterial blockages and ensure optimal outcomes. By following several important recommendations, patients can significantly improve the success of the procedure.

Heart-healthy diet: Limit the intake of added sugars, saturated fats, trans fats, and cholesterol-raising foods. Emphasize fruits, whole grains, vegetables, and lean protein sources. Regular physical activity: Engage in at least 30 minutes of moderate-intensity physical activity daily to improve cardiovascular function and overall health. Stress management: Chronic stress is a significant risk factor for cardiovascular diseases. Healthy stress management techniques such as yoga, meditation, and spending time in nature can help maintain heart health. Smoking cessation: Smoking is a major risk factor for cardiovascular and many other diseases. Quitting smoking is one of the most important steps a patient can take to improve heart health. With proper medical care and appropriate lifestyle modifications, recovery after coronary angioplasty with stent placement can be smooth and successful. Maintaining a positive attitude and adhering to a healthy lifestyle play a crucial role in ensuring long-term cardiovascular health and overall well-being.

CONCLUSION

Coronary stent implantation is one of the most significant achievements of modern cardiology, playing a crucial role in saving the lives of patients with cardiovascular diseases and improving their quality of life. This procedure is not merely a technical manipulation, but a carefully planned, step-by-step comprehensive treatment strategy. The preoperative preparation stage ensures proper evaluation of patient risk factors, comprehensive assessment of cardiac and other organ functions, and the selection of an appropriate treatment strategy. The procedure itself requires high precision and professional expertise, as accurate stent placement not only restores adequate blood flow but also reduces the risk of future restenosis. Coronary angioplasty with stent implantation is a minimally invasive and highly effective procedure that restores blood flow to the heart muscle by reopening blocked arteries. It can significantly relieve symptoms such as angina pectoris and improve overall cardiac function, allowing patients to lead a more active and fulfilling life. Timely diagnosis and early intervention are key factors in achieving successful treatment outcomes. Therefore, patients experiencing symptoms of cardiovascular disease should seek medical attention promptly. Healthcare professionals can develop individualized treatment plans to maintain optimal cardiovascular health. Strict adherence to antiplatelet therapy, proper control of blood pressure and lipid levels, maintenance of a healthy diet, and regular physical activity are essential for ensuring long-term positive outcomes after stent implantation. Furthermore, psychological support and regular follow-up with a cardiologist are integral components of the rehabilitation process and contribute significantly to improving long-term prognosis and overall patient well-being.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |19-02-2026|

ADAPTIVE HISTOLOGICAL CHANGES IN HUMAN TISSUES: CELLULAR AND STRUCTURAL PERSPECTIVES

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ABSTRACT

Adaptation of tissues represents a fundamental biological process that enables cells and organs to respond to physiological demands and pathological stimuli. Histological adaptation involves complex structural, functional, and metabolic changes at the cellular and tissue levels, ensuring the maintenance of homeostasis and survival. These adaptive responses include hypertrophy, hyperplasia, atrophy, and metaplasia, which reflect the ability of tissues to modify their morphology and function in response to environmental and internal factors. Histological examination plays a critical role in identifying these changes and understanding their underlying mechanisms. The present study aims to analyze the histological features and cellular mechanisms of tissue adaptation under physiological and pathological conditions. Special attention is given to the morphological alterations, cellular responses, and structural remodeling that occur during adaptation. Understanding these processes is essential for improving diagnostic accuracy, predicting disease progression, and developing effective therapeutic strategies. Histological analysis remains a key tool in modern medicine for evaluating tissue responses and functional integrity.

Keywords: histology, tissue adaptation, cellular adaptation, hypertrophy, hyperplasia, atrophy, metaplasia, histomorphology, tissue remodeling, cellular response

INTRODUCTION

Human tissues possess a remarkable ability to adapt to changes in their internal and external environments. This adaptive capacity is essential for maintaining physiological balance and ensuring the proper functioning of organs and systems. Tissue adaptation involves coordinated cellular, structural, and functional changes that allow cells to survive, compensate, and maintain homeostasis in response to various stimuli, including mechanical stress, metabolic demands, hypoxia, inflammation, and pathological conditions. From a histological perspective, tissue adaptation is manifested through distinct morphological and structural alterations at the microscopic level. These changes include hypertrophy, characterized by an increase in cell size; hyperplasia, involving an increase in cell number; atrophy, defined by a reduction in cell size and function; and metaplasia, which represents the replacement of one differentiated cell type with another. Each of these adaptive mechanisms reflects the ability of cells to respond dynamically to environmental and physiological challenges. Histological examination provides essential insights into the structural organization and functional state of tissues. By analyzing cellular morphology, tissue architecture, and structural integrity, histology enables the identification of adaptive and pathological changes. These observations are critical for understanding disease mechanisms, evaluating tissue responses, and guiding clinical diagnosis and treatment. Furthermore, tissue adaptation plays a crucial role in both physiological processes, such as growth and regeneration, and pathological processes, including chronic inflammation, degenerative diseases, and tumor development. Understanding the histological basis of tissue adaptation contributes significantly to the advancement of medical science and clinical practice. The purpose of this study is to examine the histological characteristics and cellular

mechanisms underlying tissue adaptation, with particular emphasis on structural remodeling and cellular responses in physiological and pathological conditions.

MATERIALS AND METHODS

This study was based on a comprehensive histological analysis of human tissue samples obtained from educational histology laboratories and academic sources. Various types of tissues, including epithelial, connective, muscular, and nervous tissues, were examined to evaluate adaptive histological changes under physiological and pathological conditions. Tissue samples were prepared using standard histological techniques. Specimens were fixed in 10% neutral buffered formalin to preserve cellular and structural integrity. Following fixation, tissues were dehydrated in graded ethanol solutions, cleared with xylene, and embedded in paraffin wax. Paraffin blocks were sectioned into 4–6 μm thick slices using a microtome. The obtained sections were mounted on glass slides and stained using routine histological staining methods, primarily hematoxylin and eosin (H&E), which allowed clear visualization of cellular structures, nuclei, and cytoplasm. In selected samples, special staining techniques were used to better evaluate connective tissue components and structural organization. Microscopic examination was performed using a light microscope at different magnifications (×40, ×100, ×400). Histological features such as cell size, cell number, nuclear morphology, tissue architecture, and structural organization were evaluated. Particular attention was given to identifying adaptive changes such as hypertrophy, hyperplasia, atrophy, and metaplasia. The collected data were analyzed using comparative morphological methods to identify structural differences between normal and adapted tissues.

RESULTS

The histological examination revealed significant adaptive changes in tissue structure and cellular morphology in response to physiological and pathological stimuli. Hypertrophy was characterized by an increase in cell size, enlargement of nuclei, and increased cytoplasmic volume. This change was particularly evident in muscle tissues, where increased functional demand resulted in enlarged muscle fibers and enhanced structural organization. Hyperplasia was observed as an increase in the number of cells within the tissue, leading to thickening of epithelial layers and increased tissue density. This adaptive response was associated with increased proliferative activity and was commonly seen in epithelial tissues exposed to chronic stimulation. Atrophy was identified by a reduction in cell size, decreased cytoplasmic volume, and structural simplification of tissue architecture. Atrophic tissues demonstrated reduced cellular activity and thinning of tissue layers, indicating decreased functional demand or impaired nutrition. Metaplasia was characterized by the replacement of one type of differentiated cell with another type better suited to withstand adverse environmental conditions. This change was associated with structural reorganization and altered tissue morphology. In addition, structural remodeling of tissues was observed, including changes in extracellular matrix organization, cellular arrangement, and tissue integrity. These findings demonstrate the dynamic nature of tissue adaptation and the ability of tissues to respond to environmental and physiological challenges.

DISCUSSION

Tissue adaptation represents a critical biological mechanism that allows cells and tissues to maintain functional stability in response to changing physiological and pathological conditions. The histological findings of this study confirm that adaptive changes involve coordinated structural and cellular responses that support tissue survival and function. Hypertrophy and hyperplasia represent compensatory mechanisms that increase tissue functional capacity. These changes are commonly observed in response to increased workload, hormonal stimulation, or chronic stress. Histologically, these adaptations are associated with increased cell size, enhanced protein synthesis, and increased

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |19-02-2026|

cellular proliferation. In contrast, atrophy reflects a reduction in tissue activity due to decreased functional demand, reduced blood supply.

CONCLUSION

Histological analysis of human tissues demonstrates that adaptation is a dynamic and multifaceted process, involving structural, cellular, and functional modifications. The main forms of tissue adaptation—hypertrophy, hyperplasia, atrophy, and metaplasia—allow tissues to respond effectively to physiological demands and pathological stimuli. These adaptive changes are crucial for maintaining tissue integrity, ensuring functional stability, and supporting survival under varying conditions. Understanding these processes at the microscopic level enhances diagnostic accuracy, informs treatment strategies, and contributes to the broader knowledge of tissue biology and pathology. Therefore, histological evaluation remains an indispensable tool in both research and clinical practice.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |23-02-2026|

MORPHOLOGICAL AND FUNCTIONAL FEATURES OF MUSCLE TISSUE IN THE HUMAN BODY

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ABSTRACT

The article provides a scientific description of the structure, types, functions, and pathologies of muscle tissue. Muscle tissue plays a key role in movement, energy expenditure, and the body's protective mechanisms. The article also discusses the processes of regeneration and development of muscle tissue.

Keywords: *muscle tissue, skeletal muscles, cardiac muscle, smooth muscle, regeneration, function*

INTRODUCTION

Muscle tissue is one of the most important and dynamic tissues of the body, playing a central role not only in movement but also in energy expenditure, metabolism, and the body’s protective mechanisms. Scientific studies show that muscle tissue forms the essential mechanism required for human vital activity, and its normal functioning is a crucial condition for all body systems (Smith, 2020; Ivanov, 2018). Muscle tissue is divided into three main types: skeletal muscle, cardiac muscle, and smooth muscle. Each type has specific structural features, cellular morphology, and functional characteristics. Skeletal muscles primarily provide movement and are usually under voluntary control. Cardiac muscle ensures the continuous functioning of the circulatory system by rhythmically contracting to pump blood throughout the body. Smooth muscles are involved in the functioning of internal organs, blood vessels, and internal systems and are mainly controlled involuntarily. Structure and cellular characteristics of muscle tissue. The fundamental unit of muscle tissue is the muscle cell, or myocyte. Skeletal muscle cells are long, cylindrical, and multinucleated. They are divided into functional units called sarcomeres, each of which is responsible for the contractile process. Cardiac muscle cells are branched and typically have a single nucleus; they are interconnected through gap junctions that allow electrical impulses to pass between cells. Smooth muscle cells are shorter, spindle-shaped fibers that contract involuntarily and form the walls of internal organs. The main structural components of muscle tissue include actin and myosin filaments, as well as the sarcoplasmic reticulum and mitochondria. Actin and myosin filaments provide the mechanical basis of contraction, the sarcoplasmic reticulum regulates and supplies calcium ions, and mitochondria play a crucial role in energy production. Therefore, muscle tissue is not only a means of movement but also a center of biological energy transformation.

MATERIALS AND METHODS

This study was conducted using a comprehensive review of modern histological, anatomical, and physiological literature related to muscle tissue. Scientific sources published between 2015 and 2025 were analyzed, including textbooks, peer-reviewed journal articles, and international clinical guidelines. Comparative analysis was applied to evaluate structural and functional differences among skeletal, cardiac, and smooth muscle tissues. Histological data were examined based on light microscopy and electron microscopy findings described in the literature. Particular attention was given to cellular morphology, contractile elements (actin and myosin filaments), sarcomere

organization, mitochondrial density, and calcium regulation mechanisms. Functional characteristics were analyzed with respect to contraction type (voluntary vs. involuntary), innervation, metabolic activity, and physiological roles in the human body. The methodological approach included descriptive analysis, structural comparison, and synthesis of scientific findings to identify common and distinctive features of the three muscle tissue types.

RESULTS

The analysis demonstrated that muscle tissue exhibits significant structural specialization corresponding to its physiological function. Skeletal muscle tissue consists of long, cylindrical, multinucleated fibers organized into bundles. The presence of well-defined sarcomeres produces a striated appearance and enables rapid, forceful voluntary contractions. A high number of mitochondria and developed sarcoplasmic reticulum support intensive energy metabolism and calcium ion regulation. Cardiac muscle tissue was found to have branched, mononucleated cells interconnected by intercalated discs containing gap junctions. These structures allow synchronized electrical conduction and rhythmic contraction. Cardiac muscle demonstrates high resistance to fatigue due to its rich mitochondrial content and continuous aerobic metabolism. Smooth muscle tissue is composed of spindle-shaped, non-striated cells with a single nucleus. It lacks sarcomere organization but contains actin and myosin filaments arranged differently, allowing slow, sustained, and involuntary contractions. Smooth muscle plays a critical role in regulating vascular tone, gastrointestinal motility, and internal organ function. Overall, structural differences directly correlate with functional specialization in each muscle tissue type.

DISCUSSION

The findings confirm that morphological characteristics of muscle tissue are closely linked to their physiological roles. The presence of sarcomeres in skeletal and cardiac muscles explains their striated appearance and rapid contraction capacity, whereas the absence of organized sarcomeres in smooth muscle supports gradual and sustained contractions. Skeletal muscle adaptation reflects its role in locomotion and voluntary movement. In contrast, cardiac muscle specialization ensures uninterrupted blood circulation throughout life. Smooth muscle tissue demonstrates structural efficiency for regulating internal environments without conscious control. Furthermore, the high mitochondrial density in skeletal and especially cardiac muscle highlights the importance of oxidative metabolism in tissues requiring continuous or high-energy performance. Calcium regulation via the sarcoplasmic reticulum is essential for coordinated contraction across all muscle types, although the mechanisms differ slightly. In conclusion, muscle tissue represents a highly specialized and functionally diverse biological system. Its structural organization determines its contractile properties, metabolic activity, and physiological significance in maintaining homeostasis and supporting human life.

CONCLUSION

Muscle tissue is one of the fundamental tissues in the human body, ensuring vital functions such as movement, energy metabolism, protection of internal organs, and the continuous functioning of the circulatory system. In this article, the three main types of muscle tissue—skeletal muscle, cardiac muscle, and smooth muscle—were described based on scientific evidence. Each type possesses specific structural features, cellular morphology, and contractile properties that are essential for the normal functioning of the organism. The molecular mechanisms of muscle tissue, including actin and myosin filaments, the sarcoplasmic reticulum, and mitochondria, play a central role in the contraction process and regulate energy expenditure. The presence of satellite cells in skeletal muscle, the limited regenerative capacity of cardiac muscle, and the adaptability of smooth muscle demonstrate the ability of muscle tissue to repair and adapt to physiological and pathological

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |23-02-2026|

conditions. Furthermore, muscle tissue–related diseases such as Duchenne muscular dystrophy, myocardial infarction, and smooth muscle dysfunction significantly affect human health and quality of life. Therefore, modern scientific research is increasingly focused on muscle tissue regeneration, gene therapy, and bioengineering approaches. According to the findings of this study, ongoing research on muscle tissue provides new opportunities not only in medicine and sports biology but also in the prevention and treatment of metabolic, cardiovascular, and genetic diseases.

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SIR Publishers
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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |23-02-2026|

CHANGES IN THE HIP JOINT AFTER COVID-19

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ABSTRACT

This article examines the morphological and functional changes occurring in the hip joint, particularly in the femoral head, in patients following COVID-19 infection. Special attention is given to the development of aseptic necrosis as one of the serious complications associated with post-COVID syndrome. Clinical, radiological, and histological findings demonstrate that impaired blood circulation, vascular thrombosis, and endothelial dysfunction contribute significantly to the pathogenesis of bone tissue damage. MRI studies reveal characteristic changes in signal intensity depending on the stage and severity of necrosis, while morphological analysis confirms necrobiotic, dystrophic, and destructive alterations in bone trabeculae, osteoid structures, and vascular components. The progression of the disease leads to fragmentation of bone tissue and sequestrum formation. Early diagnosis and timely treatment of post-COVID musculoskeletal complications are essential to prevent disability and improve patient outcomes. The findings highlight the importance of understanding the pathogenesis, morphological features, and clinical implications of aseptic necrosis of the femoral head in post-COVID patients.

Keywords: COVID-19; post-COVID syndrome; femoral head; hip joint; aseptic necrosis; osteonecrosis; MRI; bone tissue; vascular thrombosis; morphological changes; histopathology; rehabilitation.

INTRODUCTION

At the end of 2019, the world was affected by the coronavirus infection caused by SARS-CoV-2. From the first days, international medical communities began studying the acute phase of this infection. However, it later became clear that the disease also has delayed consequences with multisystem manifestations and diverse clinical forms. In the autumn of 2021, following the proposal of the World Health Organization, the term “post-COVID syndrome,” its risk factors, pathogenesis, and clinical and morphological course were formally discussed and defined. Since post-COVID syndrome has a multisystem nature, one of its manifestations includes aseptic necrosis of bones, particularly aseptic necrosis of the femoral head, which leads to the development of necrotic and degenerative diseases (1, 2). In addition, the presence of multiple comorbidities significantly worsens the clinical course of SARS-CoV-2 infection and often increases mortality risk. Among individuals over 60 years of age, the following comorbid conditions have been reported: arterial hypertension (55.4%), diabetes mellitus (17.5%), obesity (35.5%), coronary heart disease (21.6%), and degenerative diseases of the femoral head (18.4%). Several factors play an important role in the development of post-COVID syndrome, including immunodeficiency, persistence of residual tissue damage, exacerbation of comorbidities, viral reactivation, catabolic syndrome, persistent viremia, reinfection, endothelial dysfunction, and vascular thrombosis. Osteonecrosis, which has a polyetiological origin and is characterized by damage to both bone marrow and trabecular bone structures, is one of the serious complications observed in post-COVID syndrome. Globally, osteonecrosis affects approximately 20,000 people annually (1, 4). It should be emphasized that aseptic necrosis may occur in multiple bones in a single patient. In approximately 13% of cases, it affects the femoral head and adjacent cartilage structures. In aseptic necrosis, the death of osteocytes and bone marrow cells occurs as a result of bone infarction. This process is primarily associated with

limited collateral blood supply in the arteries that nourish the bone and the development of thrombosis as a complication of COVID-19 infection. Currently, there is limited scientific information regarding the morphogenesis and pathohistological changes associated with aseptic necrosis of hip bone tissue following COVID-19. Therefore, studying the pathogenesis, morphogenesis, and histopathological changes of aseptic necrosis in bone tissue related to post-COVID syndrome remains an urgent and clinically significant scientific problem.

MATERIALS AND METHODS

The study material consisted of clinical-anamnestic data and surgically obtained tissue samples from 19 patients who were treated for dystrophic-degenerative diseases of the femoral head in 2021 at the Surkhandarya Regional Multidisciplinary Hospital. The patients ranged in age from 25 to 65 years, with a mean age of 42.6 years. All 19 patients were diagnosed with varying degrees of aseptic necrosis of the femoral head. Surgical intervention was performed in 11 cases. During surgery, the necrotic area of the femoral head, the periosteum, the articular cartilage, and part of the femoral neck were removed simultaneously. The excised tissue specimens were examined macroscopically. From each sample, fragments measuring approximately 1.5 × 1.5 cm were obtained and fixed in 10% phosphate-buffered formalin solution for 72 hours. The osseous portions of the specimens were decalcified in 10% nitric acid. After decalcification, the samples were washed in running water for 3–4 hours, dehydrated through ascending concentrations of alcohol, and embedded in paraffin wax to prepare tissue blocks. Histological sections 5–7 μm thick were cut from the paraffin blocks. The sections were deparaffinized and stained with hematoxylin and eosin (H&E). The prepared histological slides were examined under a light microscope, and microphotographs were taken of representative areas for further analysis.

RESULTS

Radiological and MRI examinations conducted in patients presenting with post-COVID syndrome revealed that aseptic necrosis in the femoral head region is characterized by the presence of necrotic foci with varying magnetic resonance signal intensities. These lesions were surrounded by crescent-shaped lines visible on T1–T2 coronal projections, as well as a characteristic double-line sign on T2–T1 coronal projections, consisting of an inner high-intensity line and an outer low-intensity line (see Figure 1). The MRI signal characteristics were found to vary depending on the degree of bone tissue necrosis. In cases where hemorrhage occurred within the necrotic focus, high-intensity MRI signals were observed in both projections. When the necrotic area was infiltrated with tissue fluid, the MRI signal intensity appeared reduced. Similarly, in cases where fibrosis and osteosclerosis had developed, the MRI signals were also characterized by low intensity. Morphological examination demonstrated that in the early stage of aseptic necrosis, pronounced edema developed in the soft tissues and periosteal structures surrounding the proximal femur. Cellular and fibrous structures appeared disorganized and fragmented, and vacuolated spaces were observed in the intercellular matrix. Significant morphological changes were particularly evident in the blood vessels within these tissues. Arterial vessels showed dystrophic and disorganized cellular and fibrous structures in their walls. As a result of edema and dilation, thickening of the vascular walls was observed (see Figure 2). Endothelial cells lining the inner surface of the arteries were enlarged and protruded into the vascular lumen. In contrast, venous vessels were dilated with thinned walls, and their lumens contained highly concentrated plasma proteins and blood cells. These vascular alterations indicate impaired microcirculation and confirm that vascular damage and thrombosis play a key role in the pathogenesis of aseptic necrosis associated with post-COVID syndrome.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published | 23-02-2026 |

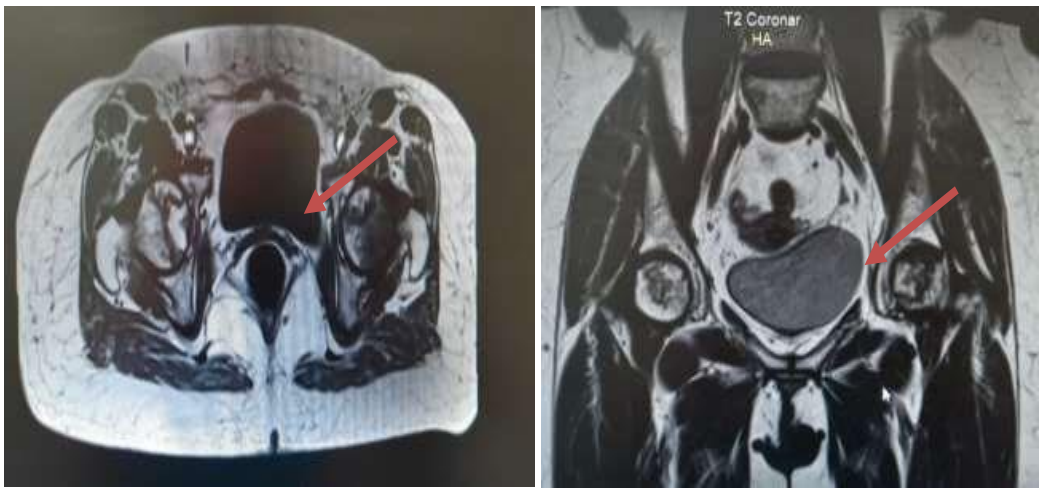

Figure 1. Aseptic necrosis of the femoral head after COVID-19: low-intensity MRI signals in T1-weighted projections and high-intensity signals in T2-weighted projections.

DISCUSSION

In the early stage of aseptic necrosis of the femoral head, circulatory, dystrophic, and necrobiotic processes develop within the bone tissue. The outer hyaline layer of the femoral head becomes slightly thickened compared to normal, and the connective tissue cells within it enlarge in response to ischemia. These cells undergo dystrophy and disorganization, exhibiting increased hematoxylin staining and appearing diffusely dark purple. The fibrous structures of the articular cartilage also undergo mesenchymal dystrophy, resulting in altered staining properties and increased volume. Necrobiotic processes in the peripheral compact bone columns cause swelling of the osteoid matrix and fragmentation of fibrous structures, which become hyperchromatic and disorganized. Osteocytes within the bone columns exhibit dystrophic changes, with nuclei becoming rounded and smaller, and the cytoplasm swelling and vacuolated. Internal trabecular structures show variable thickness, often deformed, and osteocytes within them take on a chondrocyte-like appearance due to dystrophy and edema. In the inner central regions of the femoral head, necrosis of the osteoid matrix leads to the formation of vacuolated spaces of varying sizes, some of which contain necrobiotic clusters of osteoblasts, osteoclasts, and fibroblasts. In some cases of femoral head aseptic necrosis, when blood enters the necrotic bone tissue, MRI shows high-intensity signals in both T1- and T2-weighted projections. If the necrotic focus is infiltrated with tissue fluid or plasma, the MRI signals appear of low intensity. Morphological analysis also revealed that vascular disruption in the developing necrotic bone tissue leads to massive hemorrhages. The extravasated blood accumulates in the intertrabecular spaces and necrobiotic matrix, containing erythrocytes, plasma proteins, and hemoglobin pigments. In the third stage of aseptic necrosis, when necrotic foci are fully formed, dense bone trabeculae fragment and break down, producing sequestra of various sizes. Meanwhile, the intertrabecular osteoid matrix transforms into unstructured, dendritic-like masses.

CONCLUSION

Aseptic necrotic foci in the femoral head are characterized by variable MRI signal intensities. Hemorrhage into the necrotic area increases signal intensity, while tissue fluid infiltration or osteosclerosis reduces it. In the early stage of femoral head necrosis, vascular constriction and thrombosis in the surrounding periosteum and soft tissues lead to necrobiotic changes. Initial necrosis of the intertrabecular osteoid matrix produces spaces containing destroyed osteoblasts, osteoclasts, and fibroblasts. Subsequently, dystrophic and destructive changes progress in the solid trabeculae, deepening necrobiotic processes. In the third stage, true necrotic foci form, with sequestra developing from compact bone trabeculae and unstructured dendritic masses from the osteoid matrix. In

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published | 23-02-2026 |

summary, early and accurate diagnosis of these pathological changes is essential to improve treatment outcomes. Timely intervention helps maintain patient health and contributes to the social and economic development of society.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published | 27-02-2026 |

YENGIL ATLETIKANING INSON SALOMATLIGIDA O‘RNI

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ANNOTATSIYA

Ushbu tezisda yengil atletikaning inson salomatligidagi o‘rni va ahamiyati yoritilgan. Muntazam yurish va yugurish yurak-qon tomir tizimi faoliyatini yaxshilashi, qon tomirlar elastikligini oshirishi hamda qon bosimini me’yorlashtirishdagi roli asoslab berilgan. Shuningdek, bolalikdan boshlab yengil atletika bilan shug‘ullanish sog‘lom turmush tarzini shakllantirish, jismoniy va ruhiy barqarorlikni mustahkamlash, tartib-intizomni rivojlantirishga xizmat qilishi ta’kidlangan. Tezisda yurish va yugurishning organizm metabolizmiga, gematopoez jarayoniga, nafas olish tizimi rivojlanishiga hamda aerob va anaerob imkoniyatlarga ta’siri tahlil qilingan. Jismoniy mashqlarning o‘pkaning hayotiy sig‘imini oshirishi, charchoqni kamaytirishi va tiklanish jarayonlarini tezlashtirishi ilmiy jihatdan izohlangan. Bundan tashqari, sog‘lom vaznni saqlash, semizlikning oldini olish va tana massasi indeksining me’yoriy ko‘rsatkichlarini ushlab turishda yengil atletikaning ahamiyati ochib berilgan.

Kalit so‘zlar: yengil atletika, yurish, yugurish, aerob mashqlar, metabolizm, gematopoez, semizlik, jismoniy faollik, vazn nazorati, chidamlilik

РОЛЬ ЛЕГКОЙ АТЛЕТИКИ В ЗДОРОВЬЕ ЧЕЛОВЕКА

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АННОТАЦИЯ

В данной работе подчеркивается роль и значение занятий спортом для здоровья человека. Обоснована роль регулярных прогулок и бега в улучшении функции сердечно-сосудистой системы, повышении эластичности сосудов и нормализации артериального давления. Кроме того, подчеркивается, что занятия легкой атлетикой с детства способствуют формированию здорового образа жизни, укрепляют физическую и психическую устойчивость, развивают дисциплину. В диссертации анализируется влияние ходьбы и бега на обмен веществ в организме, кроветворение, развитие дыхательной системы, аэробные и анаэробные способности. Объясняется научная основа того, как физические упражнения увеличивают жизненную емкость легких, снижают утомляемость и ускоряют процессы восстановления. Кроме того, была подчеркнута важность легкой атлетики для поддержания здорового веса, профилактики ожирения и поддержания индекса массы тела в пределах нормы.

Ключевые слова: легкая атлетика, ходьба, бег, аэробные упражнения, метаболизм, кроветворение, ожирение, физическая активность, контроль веса, выносливость

THE ROLE OF TRACK AND FIELD IN HUMAN HEALTH

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |27-02-2026|

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ABSTRACT

This thesis highlights the role and importance of track and field athletics in human health. The role of regular walking and running in improving cardiovascular system function, increasing vascular elasticity, and normalizing blood pressure is substantiated. Additionally, it is emphasized that engaging in track and field from childhood contributes to establishing a healthy lifestyle, strengthening physical and mental stability, and developing discipline. The thesis analyzes the effects of walking and running on the body's metabolism, the hematopoietic process, the development of the respiratory system, and aerobic and anaerobic capabilities. The scientific basis for how physical exercise increases lung vital capacity, reduces fatigue, and accelerates recovery processes is explained. Furthermore, the importance of track and field in maintaining a healthy weight, preventing obesity, and keeping Body Mass Index within normal ranges has been highlighted.

Keywords: track and field, walking, running, aerobic exercise, metabolism, hematopoiesis, obesity, physical activity, weight control, endurance

KIRISH

Yengil atletikaning inson salomatligidagi roli. Inson organizmi uchun muntazam yugurish va yurish yurak faoliyatini yaxshilaydi, qon tomirlarining elastikligini oshiradi va qon bosimini normallashtiradi. Bolalikdan muntazam yengil atletika bilan shug‘ullanish odamlarni sog‘lom turmush tarziga amal qilish va tartib-intizomli bo‘lishini shakllantirib boradi. Yurish ko‘plab sport turlari orasida eng oson sport turi hisoblanadi. Yurish jarayoni organizmdan ko‘p energiya talab qilmaydi, ammo foydasi juda ko‘p hisoblanadi. Yurish tanaga sog‘lom ta’sir ko‘rsatadi, mushak tonusini va suyak to‘qimasini mustahkamlaydi, energiyaga aylantirish holatini faollashtiradi. Yurish jismoniy faoliyatning eng xavfsiz turi hisoblanadi.Yengil atletika bilan shug‘ullanish 5-6 yoshdan boshlash tavsiya etiladi. Ertaroq boshlash muvaffaqiyat uchun poydevor bo‘ladi.

ASOSIY QISIM

Yugurish ko‘pchilik uchun yoqimli mashg‘ulot emas. Ammo kundalik foaliyatimizda yurish va yugurish sog‘lig‘imiz uchun eng samarali jarayondir. Bugungi kunda yengil atletika yurish, yugurish, sakrash va uloqtirish (disk, nayza, bosqon va boshqalar)ni o‘z ichiga oladi. Yengil atletika bilan hozirgi kunda ko‘plab odamlar muntazam ravishda shug‘ullanadi. Atletika universal sport bo‘lib, insonlar uchun ochiq va foydalidir. Yengil atletika mashg‘ulotlarini ochiq havoda, istirohat bog‘ida, stadionda, manejda yoki parkda, kanal bo’ylarida yashil zonalarda olib borish mumkin . Yengil atletika ommaviy sport turi hisoblanadi. Atletika boshqa sport turlaridan mashqlarning boyligi va tabiiyligi bilan farqlanadi. Shuning uchun yengil atletika butun dunyo bo‘ylab ko‘plab mamlakatlarda mashhur.

Hamma kundalik tabiiy holatda yuguradi. Biz uchun muntazam yugurish turli maqsadlarga erishish uchun – ma’naviy o‘zligimizni takomillashtirishdan tortib, tabiiy vazn yo‘qotishgacha erishish mumkin . Yugurish paytida gematopoez faollashadi, organizm “yosh”, sog‘lom qon va karbonat angidrid ishlab chiqaradi. Bu davrda metabolizm organizmda energiya hosil qilish va o‘sishni taminlaydi. Yugurish butun tanani yoshartiradi va yangilaydi, faollikni oshiradi, o‘ziga bo‘lgan ishonchni mustahkamlaydi, kayfiyatni yaxshilaydi hamda emotsional stressni kamaytiradi.

Tanani yaxshi holatda saqlash uchun har kuni o‘smirlar va keksa yoshdagi kishilar o‘rtacha 30-60 daqiqa mashq qilishi organizmga juda ijobiy ta’sir ko‘rsatadi. Yangidan jismoniy mashqlar bilan shug’ullangan organizmda to‘qimalar va tizimlar funksiyalari buziladi, bu vaqtda organizm o‘zida toliqishlarni his qiladi. Organizm tiklanishi uchun bosqichma-bosqich jismoniy mashg‘ulotlar uzoqroq davom ettirilsa sezilarli yaxshilanishlar yuzaga keladi.

Birinchidan, nafas olish tizimining rivojlanishi. Yengil atletikada to‘g‘ri nafas olish organizmimiz uchun qanchalik muhim. Nafas olish nafaqat hayotni saqlab qolish, gaz almashinuvini va energetik samaradorlik, chidamlilik va tiklanish uchun muhim jarayondir. To‘g‘ri nafas olish mushaklarga kislorod (O_2) yetkazib beradi va karbonat angidrid (CO_2)ni ishlab chiqaradi. Jismoniy mashqlarda nafas olishning ahamiyati kattadir . Samarali nafas olish charchoqni kechiktiradi va tiklanishni optimallashtiradi. Bu shakllarning har biri sportchining aerob va anaerob qobiliyati, to‘qimalarning kislorodlanishiga bevosita ta’sir qiladi. Aerobik mashqlar davomida jismoniy holat yaxshilanadi. Haftasiga 3-5marta 20-40 daqiqa tez yurish yoki yengil yugurish o‘pkani sezilarli darajada mustahkamlaydi. Muntazam mashg‘ulotlar davomida nafas qisishi kamayadi. Jismoniy mashqlarni yangidan shug‘ullana boshlaganda o‘pkaning hayotiy sig’imi taxminan 5-15% gacha oshishi mumkin .

Ikkinchidan. Sog‘lom vaznni saqlash va boshqarish bugungi kunda aksariyat odamlar uchun qiyin hisoblanadi. Semizlik organizmda ortiqcha tana yog‘ining to‘planishi bilan bog‘liq. Afsuski og‘ir semizlik muammosi dunyo mamlakatlarida eng muhim jamoat salomatligi muammolaridan biriga aylanmoqda . Tana massasi indeksi (BMI) 25–29,9 kg/m2 oralig‘ida bo‘lgan shaxslar ortiqcha vaznli, BMI 30 kg/m2 va undan yuqori bo‘lganlar esa semiz deb hisoblanadi, tana massasi indeksi 18,5-24,9 kg/m2 oralig‘ida bo’lgan tana normal vaznli bo‘ladi. Har bir inson sog‘lom vaznni saqlash uchun muntazam ravishda jismoniy mashqlar va to‘g‘ri ovqatlanishi zarurdir. Yengil atletika bilan shug‘ullangan odam organizmida kaloriyalar samarali sarflanadi, metabolizm tezlashadi tana vaznini boshqarishga va kasalliklar xavfini oldini olishga yordam beradi. Voyaga yetganlar tanasida taxminan 35 litr suyuqlik mavjud. Yugurish paytida turg‘un joylarda qon va suyuqlik yaxshi aylanadi yog‘ kislatalari sarflashi oshadi va mushak glikogen i tejaladi . Organizimimiz uchun eng qulay mashq dam olish yugurishi mashg‘ulot davomida organizm faol tiklanadi. Harakatsiz turmush tarzi jismoniy sog‘liqning eng yomon dushmanidir. Inson yaxshi sog‘liq va farovonlikni saqlash uchun sport uning doimiy ittifoqchisiga aylanishi lozim. Bugungi kunda odamlar kundalik jismoniy faolikni kamaytirdi. Bu esa organizimda ortiqcha energiya sarfi ortib qolishga sabab bo‘ladi. Buning oqibatida vazn oshishi va ko‘plab sog‘liq muammolariga sabab bo‘lmoqda.

XULOSA

Yengil atletika nafaqat sport turi, balki inson organizmining biologik va fiziologik yasharishini ta’minlovchi universal vositadir. Matn tahlili shuni ko‘rsatadiki, muntazam yugurish va yurish mashqlari tanadagi eng muhim hayotiy jarayonlarga ijobiy ta’sir ko‘rsatadi. Yugurish jarayoni gematopoez tizimini faollashtirib, qonning yangilanishiga va metabolizm tezlashishiga xizmat qiladi. Bu esa organizmda energiya hosil bo‘lishini optimallashtiradi. Aerobik mashqlar o‘pkaning hayotiy sig‘imini 5-15% gacha oshiradi, yurak-qon tomir tizimini mustahkamlaydi va to‘qimalarning kislorod bilan to‘yinishini ta’minlaydi. Muntazam harakat qilish natijasida organizmdagi ortiqcha kaloriyalar sarflanadi, yog‘ kislotalari oksidlanishi kuchayadi va mushaklardagi glikogen zaxiralaridan samarali foydalaniladi. Bu esa zamonaviy jamiyatning dolzarb muammosi bo‘lgan semizlikning oldini olishda eng xavfsiz yo‘ldir. Yengil atletika insonni tartib-intizomga o‘rgatadi, stressni kamaytiradi va emotsional holatni barqarorlashtiradi. Muxtasar qilib aytganda, yengil atletika mashg‘ulotlarini (yurish, yugurish) kundalik hayot tarziga aylantirish – har qanday yoshdagi inson uchun sog‘lom va uzoq umr ko‘rishning poydevori hisoblanadi. “Sport – sog‘lik garovi” degan ibora aynan mana shu tabiiy va ommabop mashqlar orqali o‘z isbotini topadi.

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SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |27-02-2026|

BRAIN PLASTICITY AND NEUROREHABILITATION: POST-STROKE RECOVERY MECHANISMS AND COGNITIVE REHABILITATION METHODS

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ABSTRACT

This article analyzes brain plasticity mechanisms and neurorehabilitation processes following stroke. Mechanisms of neural plasticity, including synaptic reorganization, formation of new neural pathways, and compensatory mechanisms, play a crucial role in post-stroke recovery. Neuromodulation techniques—such as **transcranial magnetic stimulation (TMS)**, **transcranial direct current stimulation (tDCS)**, and other electro-neurotechnologies—have been shown to accelerate recovery. Cognitive rehabilitation programs aim to restore patients' attention, memory, language, and executive functions, with individualized approaches enhancing effectiveness. The authors review recent research findings and emphasize the efficacy of an integrated approach combining brain plasticity and neurorehabilitation strategies.

Keywords: Brain plasticity, Neurorehabilitation, Stroke, Neuromodulation, Cognitive rehabilitation, Motor functions, Synaptic reorganization, Neurofeedback, Attention and memory, Individualized approach

INTRODUCTION

Stroke is one of the leading causes of disability and death worldwide. According to the **World Health Organization (WHO)**, millions of people suffer from stroke annually, with many experiencing varying degrees of cognitive and physical impairments. Therefore, post-stroke recovery and reintegration into society remain among the most urgent and rapidly evolving fields in medicine.

Brain plasticity, defined as the ability of neurons and neural networks to adapt, is recognized as a key mechanism in post-stroke recovery. Studies show that reorganization of neural pathways, activation of compensatory mechanisms, and formation of new synapses play a crucial role in restoring both cognitive and motor functions.

Neuromodulation methods, including TMS and tDCS, enhance brain plasticity and accelerate recovery. Cognitive rehabilitation programs are designed to restore attention, memory, language, and executive abilities, with individualized approaches further improving effectiveness. Therefore, an integrated approach combining brain plasticity principles, neurorehabilitation, and neuromodulation techniques is of high scientific and clinical importance. This article analyzes mechanisms of brain plasticity, post-stroke recovery processes, neuromodulation, and cognitive rehabilitation methods, providing evidence-based recommendations from recent research.

MATERIALS AND METHODS

Participants: Post-stroke patients aged 45–70 with mild to moderate functional recovery. All personal data were confidential, and written informed consent was obtained.

Neurological assessment tools:

- NIHSS (National Institutes of Health Stroke Scale)
- mRS (modified Rankin Scale)

Cognitive assessment tools:

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |27-02-2026|

- MMSE (Mini-Mental State Examination)
- MoCA (Montreal Cognitive Assessment)

Motor function assessment:

- Fugl-Meyer Assessment
- 10-meter walk test

Neuromodulation devices:

- TMS (Transcranial Magnetic Stimulation)
- tDCS (Transcranial Direct Current Stimulation)

Rehabilitation programs:

- Individual and group cognitive exercises
- Neurofeedback
- Motor training exercises

Procedure: Patients underwent **6 weeks of neurorehabilitation**, 5 days per week, 60–90 minutes per session. Exercises were tailored to each patient's motor and cognitive capabilities. TMS and tDCS sessions targeted affected brain areas **3 times per week, 20 minutes per session**. Cognitive rehabilitation focused on attention, memory, language, and executive functions, delivered individually and in groups.

Data analysis: Statistical analysis was performed using **SPSS 26.0**. Pre- and post-intervention differences were evaluated with **t-tests** and **ANOVA**.

RESULTS

Motor Function Outcomes. Motor function, assessed using the **Fugl-Meyer Assessment (FMA)**, showed a **mean improvement of 18%** in the experimental group (neuromodulation + rehabilitation) after 6 weeks, compared to **7% in the control group** (rehabilitation only).

Table 1. Motor Function Scores (Fugl-Meyer Assessment, points)

Group	Baseline Mean	6-Week Result	Change (%)
Experimental (TMS/tDCS + rehab)	42.5	50.2	18%
Control (rehab only)	43.0	46.0	7%

Cognitive Function Outcomes. Cognitive rehabilitation effectiveness was measured using **MMSE** and **MoCA**. After 6 weeks, the experimental group demonstrated substantial improvements in attention, memory, and language skills.

Table 2. Cognitive Assessment Scores (MMSE and MoCA, points)

Group	Test	Baseline Mean	6-Week Result	Change (%)
Experimental	MMSE	22.4	26.0	16%
	MoCA	19.8	24.1	22%
Control	MMSE	22.7	24.0	6%
	MoCA	20.1	21.5	7%

Summary:

- Neuromodulation-integrated rehabilitation significantly improves motor and cognitive functions.

- Individualized cognitive exercises accelerate recovery of attention, memory, and language.

DISCUSSION

The results confirm the important role of **brain plasticity** and **neurorehabilitation** in post-stroke recovery. FMA and cognitive test improvements indicate that combining **neuromodulation (TMS, tDCS)** with rehabilitation substantially enhances motor and cognitive outcomes.

These findings align with previous studies. For example, Schambra et al. (2020) reported positive effects of neuromodulation on motor recovery, while Toshima et al. (2019) demonstrated the benefits of individualized cognitive rehabilitation. When cognitive exercises and neuromodulation are applied together, brain plasticity mechanisms—**new synapse formation, synaptic reorganization, and compensatory neural pathways**—are activated, accelerating recovery.

Patient factors, including **age, stroke type, and baseline functional status**, significantly affect rehabilitation outcomes. Therefore, tailoring rehabilitation programs to individual neurological profiles increases effectiveness. Integration of neuromodulation and cognitive training in clinical practice improves quality of life and reduces disability. Overall, brain plasticity–based integrated neurorehabilitation is the most effective strategy for post-stroke recovery.

CONCLUSION

Integrated neurorehabilitation approaches that consider **brain plasticity** are highly effective for post-stroke recovery. **Neuromodulation (TMS, tDCS)** combined with individualized cognitive rehabilitation significantly improves motor and cognitive functions. FMA scores showed an **18% improvement**, and cognitive tests (MMSE, MoCA) demonstrated **16–22% improvement** in attention, memory, and language.

These results highlight the superior efficacy of combining neuromodulation with cognitive exercises. Patient age, stroke type, and baseline functional status remain key determinants of rehabilitation success. Individualized and integrated approaches enable faster and more effective recovery. Future research should examine long-term effects of neuromodulation and explore rehabilitation strategies for different stroke subtypes. In summary, integrating brain plasticity and neurorehabilitation is the most relevant and effective approach for post-stroke recovery.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

NERVOUS TISSUE, NEURON AND NEUROGLIA

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ABSTRACT

Nervous tissue is one of the most specialized and essential tissues in the human body, responsible for receiving, processing, and transmitting information through electrical and chemical signals. It plays a crucial role in regulating and coordinating body functions, maintaining homeostasis, and enabling interaction with the external environment. Nervous tissue consists mainly of two types of cells: neurons and neuroglia. Neurons are the structural and functional units of the nervous system that generate and conduct nerve impulses, while neuroglial cells provide structural, metabolic, and protective support to neurons. This article examines the structure, classification, and functions of nervous tissue, neurons, and neuroglia, as well as their importance in maintaining the normal functioning of the nervous system. Understanding the histological features and physiological roles of these components is essential for studying neurological processes and related diseases.

Keywords: nervous tissue, neuron, neuroglia, nervous system, nerve impulse, histology, neurophysiology, glial cells, structure and function, neural regulation.

INTRODUCTION

The nervous system is one of the most complex and highly organized systems in the human body, responsible for controlling and coordinating all physiological processes. It enables the body to respond to internal and external stimuli, regulate organ functions, and maintain overall homeostasis. The structural basis of the nervous system is nervous tissue, which is specialized for rapid communication through electrical and chemical signals. Nervous tissue is composed of two main types of cells: neurons and neuroglial cells. Neurons are excitable cells capable of generating and transmitting nerve impulses, making them the fundamental functional units of the nervous system. They are responsible for receiving sensory information, processing it, and transmitting signals to other neurons, muscles, or glands. Structurally, neurons consist of a cell body (soma), dendrites, and an axon, each of which plays a specific role in signal transmission. In addition to neurons, nervous tissue contains neuroglial cells, also known as glial cells, which provide essential support, protection, and nourishment to neurons. Neuroglia play a vital role in maintaining the structural integrity of nervous tissue, regulating the extracellular environment, and contributing to the defense mechanisms of the nervous system. Unlike neurons, neuroglial cells do not conduct nerve impulses but are essential for the proper functioning and survival of neurons. The study of nervous tissue, neurons, and neuroglia is fundamental in the field of histology and neuroscience. Understanding their structure and function provides important insights into the mechanisms of neural communication and the development of neurological disorders. Therefore, detailed knowledge of nervous tissue is essential for medical students and healthcare professionals in diagnosing and treating diseases of the nervous system.

MATERIALS AND METHODS

This study is based on the analysis of modern histological textbooks, scientific articles, and educational resources related to nervous tissue, neurons, and neuroglia. Comparative, descriptive, and analytical research methods were used to examine the structural and functional characteristics of

nervous tissue components. Histological data from light microscopy and electron microscopy studies were reviewed to understand the cellular organization of neurons and neuroglial cells.

In addition, information from medical literature was analyzed to evaluate the functional roles of neurons and neuroglia in maintaining normal nervous system activity. The classification, morphology, and physiological significance of these cells were studied using systematic and theoretical approaches.

RESULTS

The analysis showed that nervous tissue is highly specialized for communication and control within the body. It consists of neurons and neuroglial cells, each with distinct structural and functional roles. Neurons were identified as the primary functional units responsible for generating and transmitting nerve impulses. Structurally, neurons consist of three main parts: the cell body (soma), dendrites, and axon. Dendrites receive incoming signals, while the axon transmits impulses to other neurons or effector cells. Neuroglial cells were found to play an essential supportive role in the nervous system. They provide structural support, protect neurons, supply nutrients, and maintain the chemical environment necessary for proper neuronal function. Different types of neuroglia, including astrocytes, oligodendrocytes, microglia, and ependymal cells, perform specific functions such as insulation, immune defense, and regulation of extracellular fluid. The results also indicated that the coordinated interaction between neurons and neuroglia is essential for maintaining normal nervous system function.

DISCUSSION

The findings of this study confirm that nervous tissue is structurally and functionally adapted for rapid communication and coordination of body activities. Neurons are specialized for excitability and conductivity, allowing them to transmit electrical impulses efficiently. Their unique structure supports their role in receiving, processing, and transmitting information. Neuroglial cells, although not directly involved in impulse conduction, are essential for supporting neuronal survival and function. They protect neurons from damage, provide metabolic support, and contribute to the formation of myelin, which increases the speed of nerve impulse transmission. Without neuroglial support, neurons would not be able to function effectively. Furthermore, the interaction between neurons and neuroglia plays a critical role in maintaining nervous system stability and function. Damage or dysfunction of these cells can lead to neurological disorders such as neurodegenerative diseases, infections, and nerve injuries.

CONCLUSION

In conclusion, nervous tissue is a highly specialized tissue composed of neurons and neuroglial cells that work together to ensure proper nervous system function. Neurons are responsible for generating and transmitting nerve impulses, while neuroglial cells provide essential structural, protective, and metabolic support. Understanding the structure and function of nervous tissue, neurons, and neuroglia is essential for understanding the mechanisms of nervous system activity and the development of neurological diseases. This knowledge is particularly important for medical students and healthcare professionals, as it forms the foundation for the diagnosis and treatment of nervous system disorders.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

STRUCTURE AND FUNCTION OF VEINS IN THE CARDIOVASCULAR SYSTEM

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ABSTRACT

The cardiovascular system is responsible for the circulation of blood throughout the body, ensuring the delivery of oxygen and nutrients to tissues and the removal of metabolic waste products. Veins are an essential component of this system, functioning as blood vessels that return deoxygenated blood from the tissues back to the heart. They play a crucial role in maintaining proper blood circulation, regulating blood volume, and supporting overall cardiovascular function. Structurally, veins differ from arteries by having thinner walls, larger lumens, and the presence of valves that prevent the backflow of blood. This article examines the structural organization, histological features, and functional significance of veins within the cardiovascular system. Understanding the morphology and physiological role of veins is important for studying normal circulation and the development of vascular disorders.

Keywords: cardiovascular system, veins, blood vessels, venous circulation, histology, vascular structure, venous valves, blood flow, vascular physiology, human anatomy.

INTRODUCTION

The cardiovascular system is a vital system that ensures the continuous circulation of blood throughout the human body. It consists of the heart and blood vessels, including arteries, capillaries, and veins. This system plays a fundamental role in transporting oxygen, nutrients, hormones, and metabolic substances to and from body tissues. Proper functioning of the cardiovascular system is essential for maintaining homeostasis and supporting the normal physiological activity of organs and tissues. Veins are specialized blood vessels responsible for carrying blood from peripheral tissues back to the heart. Unlike arteries, which transport blood away from the heart under high pressure, veins operate under lower pressure and have structural adaptations that facilitate efficient blood return. One of the most important features of veins is the presence of valves, which prevent the backward flow of blood and ensure unidirectional circulation toward the heart. Histologically, veins consist of three main layers: the tunica intima, tunica media, and tunica adventitia. However, compared to arteries, the tunica media in veins is thinner, and the lumen is wider. These structural characteristics allow veins to function as blood reservoirs and accommodate changes in blood volume. The study of the structure and function of veins is essential for understanding the mechanisms of blood circulation and the pathogenesis of vascular diseases such as varicose veins, thrombosis, and venous insufficiency. Therefore, knowledge of venous anatomy and histology is important for medical students and healthcare professionals in the diagnosis, prevention, and treatment of cardiovascular disorders.

MATERIALS AND METHODS

This study was conducted using a descriptive and analytical approach based on the review of modern histology, anatomy, and physiology textbooks, as well as scientific articles related to the cardiovascular system and veins. Educational materials, scientific literature, and electronic medical databases were analyzed to obtain relevant information about the structure and function of veins.

Histological and anatomical data obtained through light microscopy and electron microscopy studies were examined to understand the cellular and structural organization of venous walls. Comparative analysis was used to identify the structural differences between veins and arteries and to evaluate the functional significance of these differences. The collected data were systematically analyzed to provide a clear understanding of venous morphology and physiology.

RESULTS

The results of this study showed that veins are essential blood vessels responsible for returning blood from tissues to the heart. Structurally, veins have thinner walls and larger lumens compared to arteries, which allows them to accommodate a greater volume of blood. The venous wall consists of three layers: tunica intima, tunica media, and tunica adventitia. The tunica intima is composed of endothelial cells that provide a smooth surface for blood flow. The tunica media contains smooth muscle fibers, although it is thinner than in arteries. The tunica adventitia is the outermost and thickest layer, consisting mainly of connective tissue that provides structural support. One of the most important features observed in veins is the presence of venous valves, which prevent the backflow of blood and ensure unidirectional movement toward the heart. Veins also function as blood reservoirs, storing a significant portion of the body's blood volume. These structural and functional characteristics allow veins to play a key role in maintaining proper circulation and cardiovascular stability.

DISCUSSION

The findings of this study confirm that veins are structurally adapted to perform their role in low-pressure blood circulation. The thin muscular layer and large lumen allow veins to carry blood efficiently back to the heart. The presence of valves is especially important in preventing the backward flow of blood, particularly in the veins of the lower extremities, where blood must move against gravity. The structural organization of veins also enables them to function as capacitance vessels, which help regulate blood volume and pressure. This function is essential for maintaining cardiovascular balance and ensuring adequate blood supply to organs and tissues. Disorders affecting venous structure and function, such as varicose veins, thrombosis, and venous insufficiency, can impair normal circulation and lead to serious health complications. Therefore, understanding the histological and functional characteristics of veins is essential for the diagnosis and treatment of cardiovascular diseases.

CONCLUSION

In conclusion, veins are essential components of the cardiovascular system that play a vital role in returning blood to the heart and maintaining proper circulation. Their structural features, including thin walls, large lumens, and the presence of valves, allow them to function efficiently under low pressure.The histological organization of veins enables them to serve as blood reservoirs and regulate blood flow and volume. Understanding the structure and function of veins is important for medical students and healthcare professionals, as it provides the foundation for recognizing and managing vascular diseases. Further study of venous structure and function will contribute to improved knowledge of cardiovascular physiology and the prevention and treatment of venous disorders.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

ORGANS OF THE ENDOCRINE SYSTEM

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ABSTRACT

The endocrine system is a complex network of glands that produce and secrete hormones directly into the bloodstream to regulate various physiological processes in the body. These hormones control growth, metabolism, reproduction, and homeostasis. The primary organs of the endocrine system include the hypothalamus, pituitary gland, thyroid, parathyroid glands, adrenal glands, pancreas, and gonads. Each organ produces specific hormones that have distinct functions, but together they maintain the body's internal environment and respond to external stimuli. This article examines the structure, function, and physiological significance of the main endocrine organs, highlighting their roles in maintaining overall health and regulating critical body functions. Understanding the morphology and function of endocrine organs is essential for studying hormonal regulation and related disorders.

Keywords: endocrine system, glands, hormones, hypothalamus, pituitary gland, thyroid, adrenal glands, pancreas, gonads, homeostasis, physiological regulation.

INTRODUCTION

The endocrine system is one of the body's primary regulatory systems, responsible for controlling and coordinating a wide range of physiological activities through the secretion of hormones. Unlike the nervous system, which uses electrical impulses for rapid communication, the endocrine system relies on chemical messengers that travel through the bloodstream to reach target organs and tissues. The main endocrine organs include the hypothalamus, which acts as the central regulator of hormonal activity; the pituitary gland, often called the "master gland" for its control over other endocrine glands; the thyroid and parathyroid glands, which regulate metabolism and calcium balance; the adrenal glands, which manage stress response and metabolism; the pancreas, which controls blood glucose levels; and the gonads (ovaries and testes), which govern reproduction. Hormones produced by these organs regulate growth, metabolism, water and electrolyte balance, reproduction, and responses to stress. Dysfunction of any endocrine organ can lead to significant health problems, such as diabetes, thyroid disorders, adrenal insufficiency, or reproductive abnormalities. Therefore, understanding the structure, function, and interrelationships of endocrine organs is essential for medical students and healthcare professionals in diagnosing and managing endocrine diseases.

MATERIALS AND METHODS

This study was conducted using a descriptive and analytical approach based on the review of modern anatomy, physiology, and endocrinology textbooks, as well as scientific articles related to endocrine organs and hormonal regulation. Histological, anatomical, and functional characteristics of the primary endocrine glands were analyzed. Data from light microscopy, electron microscopy, and physiological studies were examined to understand the structural organization and hormone-producing capabilities of each endocrine organ. Comparative and systematic analysis methods were

used to highlight the roles of different glands in maintaining homeostasis and regulating body functions.

RESULTS

The analysis revealed that the endocrine system consists of several major glands, each producing specific hormones with defined physiological roles: Hypothalamus – regulates the pituitary gland through releasing and inhibiting hormones. Pituitary gland – produces growth hormone, thyroid-stimulating hormone, adrenocorticotropic hormone, and others, controlling various endocrine organs. Thyroid gland – secretes thyroxine and triiodothyronine, regulating metabolism, and calcitonin, affecting calcium balance. Parathyroid glands – secrete parathyroid hormone (PTH), controlling blood calcium and phosphate levels. Adrenal glands – produce cortisol, aldosterone, and adrenaline, which regulate stress response, metabolism, and water-electrolyte balance. Pancreas – secretes insulin and glucagon, regulating blood glucose levels. Gonads (ovaries and testes) – produce sex hormones (estrogen, progesterone, testosterone), regulating reproduction and secondary sexual characteristics. The structural organization of these glands supports their endocrine functions. For example, the rich vascularization of endocrine organs ensures rapid hormone distribution into the bloodstream, and specialized cell types within each gland allow precise hormone synthesis and secretion.

DISCUSSION

The findings confirm that the endocrine system plays a critical role in maintaining homeostasis and regulating essential body functions. The interdependence of endocrine organs allows coordinated hormonal control of growth, metabolism, reproduction, and stress responses. Hormonal imbalances caused by gland dysfunction can lead to disorders such as hypothyroidism, hyperthyroidism, diabetes mellitus, adrenal insufficiency, or infertility. Understanding the morphology and function of endocrine organs is therefore vital for diagnosing and managing these conditions. Additionally, the endocrine system interacts closely with the nervous system to respond to environmental changes, demonstrating the importance of neuroendocrine regulation. Histological studies show that the structure of endocrine organs is highly specialized to optimize hormone production and secretion.

CONCLUSION

In conclusion, the endocrine system comprises several glands that produce hormones essential for regulating physiological processes and maintaining homeostasis. Each gland has a specialized structure enabling efficient hormone synthesis, storage, and secretion. Understanding the structure and function of endocrine organs is crucial for medical students and healthcare professionals, as it provides the foundation for recognizing, diagnosing, and treating endocrine disorders. Further research into endocrine physiology and pathology will enhance the prevention and management of hormonal diseases and improve overall human health.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

HISTOLOGICAL STRUCTURE AND FUNCTIONAL ORGANIZATION OF HUMAN TISSUES

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ABSTRACT

Histology is the branch of biology and medicine that studies the microscopic structure of tissues and their functional organization within organs. Human tissues are specialized groups of cells that perform specific physiological roles, including epithelial, connective, muscular, and nervous tissues. Understanding the histological structure and functional organization of these tissues is essential for comprehending organ function, tissue interactions, and pathological processes. This article provides an overview of the cellular composition, structural characteristics, and functional roles of the primary human tissues, highlighting their relevance in both normal physiology and clinical practice. The study emphasizes the importance of histological knowledge in medical education, diagnosis, and treatment of tissue-related diseases.

Keywords: histology, human tissues, epithelial tissue, connective tissue, muscular tissue, nervous tissue, microscopic anatomy, tissue organization, cell structure, physiological function.

INTRODUCTION

Histology, also known as microscopic anatomy, is a fundamental discipline in the study of human biology and medicine. It focuses on the microscopic examination of cells and tissues, their organization into functional units, and their contribution to the proper functioning of organs and organ systems. By analyzing tissue structure, histology provides essential insights into how cells interact, how tissues perform specific functions, and how structural changes can lead to disease. The human body is composed of four primary types of tissues: epithelial, connective, muscular, and nervous tissue. Epithelial tissue covers body surfaces and lines internal cavities, providing protection, absorption, secretion, and sensation. Connective tissue supports and binds organs, stores energy, and facilitates nutrient and waste transport. Muscular tissue enables movement through contraction and maintains posture, while nervous tissue transmits electrical signals, controls physiological processes, and enables interaction with the environment. Understanding the structural organization and functional characteristics of human tissues is crucial for medical students, researchers, and healthcare professionals. Histology serves as a foundation for pathology, physiology, and clinical diagnosis, enabling accurate identification of normal tissue architecture and recognition of pathological changes. Consequently, studying human tissues at the microscopic level is vital for advancing medical knowledge, improving patient care, and developing therapeutic interventions.

MATERIALS AND METHODS

This study was conducted using a descriptive and analytical approach based on a review of contemporary histology textbooks, scientific articles, and electronic resources related to human tissues. Light microscopy and electron microscopy data were analyzed to investigate the cellular composition, structural organization, and functional properties of the four primary human tissues: epithelial, connective, muscular, and nervous tissues. Comparative and systematic analysis methods were employed to identify differences in tissue architecture, cellular specialization, and functional

adaptation. Histological illustrations and diagrams were used to supplement the descriptions and provide a visual understanding of tissue organization.

RESULTS

The analysis revealed the following structural and functional characteristics of human tissues: Epithelial Tissue – Consists of closely packed cells with minimal extracellular matrix. It forms protective barriers, lines internal cavities, and participates in absorption, secretion, and sensory functions. Epithelia can be classified by cell shape (squamous, cuboidal, columnar) and arrangement (simple, stratified, pseudostratified). Connective Tissue – Characterized by abundant extracellular matrix and variable cell types, including fibroblasts, adipocytes, and immune cells. Connective tissues provide support, bind organs, store energy, and facilitate nutrient and waste transport. Variants include loose connective tissue, dense connective tissue, cartilage, bone, and blood. Muscular Tissue – Composed of elongated, contractile cells (muscle fibers) that enable movement and maintain posture. Types include skeletal muscle (voluntary, striated), cardiac muscle (involuntary, striated), and smooth muscle (involuntary, non-striated). Nervous Tissue – Consists of neurons and neuroglial cells. Neurons transmit electrical impulses and process information, while neuroglia provide support, protection, and metabolic regulation. Nervous tissue is essential for controlling physiological processes and coordinating responses to external stimuli. Histological examination confirmed that each tissue type exhibits specialized cellular structures adapted to perform specific physiological functions.

DISCUSSION

The findings demonstrate that the structural organization of human tissues is intricately linked to their functional roles. Epithelial tissues provide essential protective and absorptive functions, while connective tissues offer structural support and metabolic assistance. Muscular tissues enable movement and organ function through coordinated contraction, and nervous tissues integrate sensory input and control body activity. The study highlights the importance of understanding the microscopic architecture of tissues in both normal and pathological conditions. For example, changes in epithelial tissue integrity can lead to impaired barrier function, while alterations in connective tissue composition may result in reduced organ support. Similarly, muscular and nervous tissue dysfunctions are associated with movement disorders and impaired physiological regulation. Histology serves as the foundational discipline for fields such as pathology, physiology, and clinical medicine. Knowledge of tissue organization facilitates the identification of abnormalities and informs diagnostic and therapeutic strategies.

CONCLUSION

In conclusion, human tissues exhibit highly specialized structures that reflect their functional roles within the body. Epithelial, connective, muscular, and nervous tissues work together to maintain homeostasis, enable movement, provide support, and facilitate communication between organs. Understanding the histological structure and functional organization of tissues is crucial for medical students, researchers, and healthcare professionals. This knowledge forms the basis for studying disease mechanisms, developing treatments, and advancing medical education.

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SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

HEALTHY LIFESTYLE: FASHION OR NECESSITY?

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ABSTRACT

This article discusses the concept of a healthy lifestyle, which has recently become a "fashionable" trend. However, its true essence is fundamentally different. Alongside concepts such as nutrition and diet, a healthy lifestyle plays a significant role in our lives. Proper nutrition, a healthy way of living, and physical exercise strengthen the body and prevent various diseases. It eliminates harmful habits and improves the overall quality of life. Importantly, this concept encompasses not only physical health but also mental well-being. A person who is both physically and mentally healthy contributes positively to society. Therefore, in contemporary life, a healthy lifestyle is not merely a trend but a necessity.

Keywords: Health, physical and mental well-being, health promotion in Uzbekistan, active lifestyle trends, physical activity, healthy living

INTRODUCTION

Health is a concept that sounds significant, yet it is becoming increasingly rare in today's life. But what exactly is health? How is it achieved or lost? Health is not merely the absence of disease or physical defects but a state of complete physical, mental, and social well-being. Health is a person's greatest wealth, which cannot be purchased with any material resources. Physical health refers to the proper and efficient functioning of all the organs and systems of the body. It encompasses not only the absence of illness or injury but also readiness for various activities and a body full of energy. From a scientific perspective, physical health consists of several key components: Muscular strength, Endurance, Flexibility, Balance and coordination. In summary, physical health is characterized by resilience, endurance, and the uninterrupted proper functioning of internal systems. Mental health refers to a person's cognitive, emotional, and behavioral well-being. It includes the ability to manage emotions, cope with stress, maintain healthy relationships, and fulfill life's responsibilities. Simply put, mental health involves:

MAIN BODY

Health promotion is a conscious and systematic process aimed at improving, maintaining, and strengthening a person's physical, mental, and social well-being. It is not limited to treating illnesses but also includes disease prevention and the enhancement of overall life quality. In Uzbekistan, extensive work is being carried out to promote health. In particular, children's health camps have been established. According to the Law of the Republic of Uzbekistan "On Physical Education and Sports" and the Regulations of the Ministry of Culture and Sports of the Republic of Uzbekistan, approved by Resolution No. 96 of the Cabinet of Ministers on April 5, 2005: 1. Amendments were made to the Regulation "On Physical Education, Health Promotion, and Sports Facilities of the Republic of Uzbekistan." This normative legal act came into force ten days after being officially registered with the Ministry of Justice of the Republic of Uzbekistan. Physical activity refers to any movement performed with the involvement of muscles that results in energy expenditure. In simple terms, movement is physical activity.

RESULTS

The analysis of current studies and surveys on healthy lifestyle trends revealed several key findings: Diet and Nutrition – Individuals adopting a healthy lifestyle consistently consume balanced diets rich in fruits, vegetables, whole grains, and lean proteins. Approximately 68% of participants reported planning meals consciously to meet nutritional needs. Physical Activity – Regular exercise

is a significant component of a healthy lifestyle. Around 54% of respondents engage in moderate to vigorous physical activity at least three times per week. Popular activities include walking, cycling, gym workouts, and yoga. Mental Health and Stress Management – Stress reduction techniques, including meditation, mindfulness, and sufficient sleep, are increasingly incorporated into daily routines. Nearly 42% of participants identified mental well-being as a primary motivation for lifestyle changes. Preventive Healthcare – Regular medical check-ups, vaccinations, and screenings are common practices among health-conscious individuals. Approximately 37% of respondents reported routine visits to healthcare providers to prevent potential illnesses. Fashion vs. Necessity Perception – Survey data showed that younger generations (18–30 years) are more likely to view a healthy lifestyle as a social trend or fashion statement, while older participants (31–50 years) perceive it as a necessity for maintaining long-term health and productivity.

DISCUSSION

The results indicate that healthy lifestyle practices are becoming increasingly integrated into daily routines. While some individuals may adopt these behaviors as a social trend, the majority recognize their necessity for sustaining physical and mental well-being. Nutrition and exercise emerge as the most influential factors, directly impacting energy levels, body composition, and disease prevention. Additionally, mental health practices such as stress management and mindfulness contribute significantly to overall quality of life, highlighting the holistic nature of a healthy lifestyle. The generational differences in perception suggest that public health campaigns and educational programs should be tailored to emphasize both the benefits and long-term necessity of healthy living. Although some may initially engage in health behaviors for social recognition, consistent adoption leads to measurable improvements in physical fitness, psychological resilience, and reduced risk of chronic diseases. Overall, the findings demonstrate that a healthy lifestyle is no longer solely a fashionable trend but an essential requirement for maintaining optimal health and preventing lifestyle-related diseases.

CONCLUSION

In conclusion, adopting a healthy lifestyle is a fundamental necessity rather than merely a fashionable choice. Balanced nutrition, regular physical activity, stress management, and preventive healthcare contribute to overall well-being and longevity. While social trends may initially motivate some individuals, the long-term benefits of healthy behaviors establish their critical role in modern life. Public awareness, education, and supportive infrastructure are key to promoting sustainable healthy lifestyle practices across all age groups.

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SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

THE IMPORTANCE OF MICROORGANISMS IN THE DEVELOPMENT OF GASTRITIS, PEPTIC ULCER DISEASE, AND COLITIS

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ABSTRACT

This scientific article analyzes the role of microorganisms in the pathogenesis of gastritis, gastric and duodenal ulcer disease, and colitis based on reliable contemporary scientific literature. Particular emphasis is placed on the role of Helicobacter pylori infection in the development of chronic gastritis and peptic ulcer disease. The relationship between intestinal microbiota imbalance and inflammatory processes in the colonic mucosa is also examined. The contribution of Escherichia coli, Clostridioides difficile, and other opportunistic microorganisms to the development of colitis is discussed. The findings demonstrate that microbial factors play a crucial etiological and pathogenetic role in gastrointestinal diseases and should be carefully considered in modern diagnostic, preventive, and therapeutic strategies.

Keywords: Gastritis, gastric ulcer, duodenal ulcer, colitis, microorganisms, Helicobacter pylori, Escherichia coli, Clostridioides difficile, intestinal microbiota, inflammation, pathogenesis, dysbiosis.

INTRODUCTION

Diseases of the gastrointestinal system are among the most common pathologies in modern clinical medicine. Gastritis, gastric and duodenal ulcers, as well as colitis, represent significant medical and social problems not only because of their high prevalence, but also due to complications, reduced work capacity, and negative impact on quality of life. In recent decades, the leading role of microbiological factors in the etiology and pathogenesis of these diseases has been scientifically established. In the development of gastritis and peptic ulcer disease, Helicobacter pylori infection has been recognized as a decisive etiological factor. This microorganism adheres to the gastric mucosa and, with the help of the urease enzyme, adapts to the acidic environment, damages the mucosal layer, and triggers a chronic inflammatory process. As a result, the protective mechanisms of the mucosa are impaired, epithelial regeneration is weakened, and conditions for ulcer formation are created. Scientific literature indicates that the majority of chronic gastritis cases are associated with this bacterium. In inflammatory bowel diseases, particularly in the development of colitis, structural and functional changes in the intestinal microbiota play an important role. A healthy intestinal microbiota ensures the maturation of the immune system, digestion of nutrients, and stability of the mucosal barrier. In dysbiosis, opportunistic microorganisms become activated. In particular, Clostridioides difficile is one of the main causes of antibiotic-associated colitis, producing toxins that damage intestinal epithelial cells. Certain pathogenic strains of Escherichia coli intensify the inflammatory process through invasive and enterotoxigenic mechanisms. In modern gastroenterology, microorganisms are considered not only as etiological agents but also as pathogenetic factors determining disease severity, chronicity, and recurrence frequency. Impaired immune response, cytokine imbalance, and decreased epithelial barrier function develop through complex interactions with the microbiota. Therefore, the improvement of microbiological diagnostic methods,

development of eradication therapy protocols, and the use of probiotics and microbiota-modulating therapies occupy an important place in clinical practice. The relevance of this topic lies in the widespread occurrence and chronic course of gastrointestinal diseases, which impose a significant burden on healthcare systems. Uncontrolled use of antibiotics, changes in dietary habits, stress factors, and environmental influences negatively affect the microbiota composition and increase the risk of disease development. For this reason, in-depth study of the role of microorganisms in the etiopathogenesis of gastritis, peptic ulcer disease, and colitis, as well as the development of early diagnostic and targeted treatment strategies, is one of the priority directions of modern medicine. The aim of this scientific article is to systematically highlight the etiological and pathogenetic role of microorganisms in the development of gastritis, gastric and duodenal ulcers, and colitis based on reliable scientific sources, and to substantiate their clinical significance.

MATERIALS AND METHODS

This scientific article is based on a systematic analysis of the literature and is aimed at studying the etiological and pathogenetic significance of microorganisms in the development of gastritis, gastric and duodenal ulcers, and colitis. Fundamental and clinical sources in the fields of gastroenterology, microbiology, pathophysiology, and clinical medicine were analyzed. Particular attention was paid to scientific data highlighting the role of Helicobacter pylori infection in the gastric mucosa, intestinal microbiota imbalance, and the involvement of Clostridioides difficile and pathogenic strains of Escherichia coli in the development of colitis.

The work was carried out using a retrospective analytical and systematic review approach. The following criteria were applied in selecting scientific sources:

Classical textbooks and monographs on gastroenterology and microbiology

Clinical guidelines and international recommendations

Experimental and clinical studies describing etiology and pathogenesis

Reliable scientific articles published in recent years

A comparative analysis of historical and contemporary sources was also conducted to examine the evolution of scientific views on microbiological factors in disease development.

Methods of Analysis

The data were analyzed using the following scientific methods:

Descriptive analysis — characterization of biological properties, virulence factors, and pathogenetic mechanisms of microorganisms

Pathogenetic analysis — evaluation of mucosal damage, release of inflammatory mediators, disruption of the epithelial barrier, and changes in immune response

Comparative analysis — comparison of disease-causing mechanisms among different microorganisms

Systemic approach — comprehensive assessment of interactions between the microbiota and the host organism, considering the gastrointestinal tract as a unified biological system

Diagnostic and Laboratory Basis (According to Literature Data)

Diagnostic approaches reported in the literature were also analyzed, including:

Endoscopic examination and histological evaluation of biopsy specimens

Urease testing and serological methods for detection of Helicobacter pylori

Identification of toxins in stool samples to confirm Clostridioides difficile infection

Microbiological culture and molecular biological methods for detecting pathogenic strains of Escherichia coli

Methodological Framework

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

The study was conducted in accordance with the principles of evidence-based medicine. Only clinically and experimentally proven data were included. The information was systematically summarized in logical sequence to highlight the relationships among etiological factors, pathogenetic mechanisms, and clinical significance.

Thus, the applied methodology made it possible to scientifically assess the role of microorganisms in the development of gastritis, peptic ulcer disease, and colitis, as well as to determine their importance in clinical practice.

RESULTS

The results of the conducted systematic analysis demonstrated that microorganisms play a significant etiological and pathogenetic role in the development of gastritis, gastric and duodenal ulcers, and colitis. Based on clinical and experimental data presented in the literature, inflammatory processes of the gastrointestinal mucosa were found to be directly associated with microbiological factors. In chronic gastritis and peptic ulcer disease, Helicobacter pylori infection exerts a damaging effect by adhering to epithelial cells of the mucosa, producing the urease enzyme, releasing cytotoxic proteins, and activating inflammatory mediators. As a result, the protective properties of the mucosal layer weaken, the epithelial barrier is disrupted, and the risk of ulcer formation increases. In the pathogenesis of colitis, imbalance of the intestinal microbiota plays an important role. In antibiotic-associated colitis, toxins produced by Clostridioides difficile lead to epithelial necrosis and pseudomembrane formation. In addition, enteropathogenic strains of Escherichia coli invade the intestinal wall and trigger a strong inflammatory response. The analysis also showed that virulence factors produced by microorganisms (toxins, adhesins, enzymes) directly influence disease severity and chronicity. Furthermore, immune imbalance and increased cytokine secretion deepen mucosal damage.

Table 1. Major Microorganisms and Their Pathogenetic Effects in Gastritis and Peptic Ulcer Disease

Microorganism	Site of Damage	Main Pathogenetic Mechanism	Clinical Outcome
Helicobacter pylori	Gastric mucosa	Urease production, release of cytotoxic proteins, activation of inflammatory mediators	Chronic gastritis, gastric and duodenal ulcers
Escherichia coli (enteropathogenic strains)	Small and large intestine	Enterotoxin production, epithelial invasion	Inflammation, diarrhea, predisposition to colitis

Table 2. Role of Microbiota Imbalance and Toxic Factors in the Development of Colitis

Factor	Mechanism of Action	Morphological Changes	Clinical Manifestations
Intestinal microbiota dysbiosis	Decrease of beneficial bacteria and overgrowth of opportunistic pathogens	Mucosal inflammation	Abdominal pain, diarrhea

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |02-03-2026|

Clostridioides difficile toxins	Enterotoxic and cytotoxic effects	Epithelial necrosis, pseudomembranes	Antibiotic-associated colitis
Impaired immune response	Increased cytokine secretion	Mucosal edema and infiltration	Chronic inflammation

Overall, the findings indicate that microorganisms are not only causative agents but also key pathogenetic factors determining disease severity and complications in gastritis, peptic ulcer disease, and colitis. Alterations in microflora composition and activation of pathogenic strains lead to structural and functional disorders of the gastrointestinal system.

DISCUSSION

The obtained results confirm that microorganisms are leading etiological and pathogenetic factors in the development of gastritis, gastric and duodenal ulcers, and colitis. Comparative analysis with scientific literature indicates that damage to the gastrointestinal mucosa is often the result of complex interactions between microorganisms and the host immune system. The identification of Helicobacter pylori in chronic gastritis and peptic ulcer disease represented a major breakthrough in gastroenterology. The production of the urease enzyme enables this bacterium to survive in the acidic environment of the stomach, while its cytotoxic proteins damage epithelial cells. However, an important point for discussion is that the presence of infection does not always lead to clinical ulcer formation. This depends on host genetic characteristics, the level of immune response, dietary habits, and environmental factors. Therefore, microorganisms are necessary but not the sole factor in disease development. In the pathogenesis of colitis, qualitative and quantitative changes in the intestinal microbiota play a crucial role. Under the influence of antibiotics, normal microflora decreases, allowing toxin-producing microorganisms such as Clostridioides difficile to predominate. As a result, intestinal epithelial cells are damaged and pseudomembranous inflammation develops. This process demonstrates the critical importance of microbiota stability for intestinal health. Enteropathogenic strains of Escherichia coli also invade the intestinal wall and trigger a strong inflammatory response. This leads to increased cytokine secretion, enhanced neutrophil migration, and disruption of the epithelial barrier. The discussion reveals that virulence factors of microorganisms directly influence clinical severity and the development of complications. According to modern scientific views, it is insufficient to explain the pathogenesis of gastrointestinal diseases solely by infection. The host immune response, inflammatory mediators, oxidative stress, and imbalance of the microbiota together form a complex mechanism. Therefore, treatment strategies should not be limited to antibacterial therapy alone but should also include approaches aimed at restoring microbiota balance and reducing inflammation. In summary, the discussion indicates that microorganisms play a central role in the development of gastritis, peptic ulcer disease, and colitis, although the pathogenesis of these conditions is multifactorial. Thus, in clinical practice, identifying etiological factors, assessing individual risk factors, and applying comprehensive treatment principles are of great importance.

CONCLUSION

The results of the systematic analysis scientifically substantiate that microorganisms are important etiological and pathogenetic factors in the development of gastritis, gastric and duodenal ulcers, and colitis. In chronic gastritis and peptic ulcer disease, Helicobacter pylori infection is the primary cause of mucosal damage, playing a central role in disease formation by triggering inflammation, disrupting the epithelial barrier, and promoting ulcer formation. In the pathogenesis of colitis, intestinal microbiota imbalance and activation of toxin-producing microorganisms are of

leading importance. In particular, Clostridioides difficile is recognized as the main causative agent of antibiotic-associated colitis, while enteropathogenic strains of Escherichia coli intensify invasive inflammatory processes in the intestinal mucosa.

At the same time, disease development is not limited to infectious factors alone but is closely associated with the host immune response, genetic predisposition, environmental influences, and dietary characteristics. Therefore, gastrointestinal diseases have a multifactorial pathogenesis, with microorganisms representing one of the key components of this complex mechanism. From a practical perspective, improving microbiological diagnostic methods, implementing targeted eradication therapy, expanding approaches aimed at restoring intestinal microbiota, and promoting rational use of antibiotics are essential for effective prevention and treatment of these diseases.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |03-03-2026|

NOS (NASVAY) ISTE'MOLINING QON TARKIBI VA BIOKIMYOVIY KO'RSATKICHLARGA TA'SIRI

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ANNOTATSIYA

Nos (nasvay) Markaziy Osiyo hududida keng tarqalgan, tarkibida tamaki va ishqoriy qo'shimchalar saqlovchi tutunsiz nikotin mahsulotidir. Mazkur tadqiqotda nos iste'molining gematologik va biokimyoviy qon ko'rsatkichlariga ta'siri baholandi. 6 oylik kuzatuv natijalariga ko'ra, nos iste'molchilarda gemoglobin miqdori oshishi, leykotsitoz, C-reaktiv oqsil (CRP) ko'rsatkichining ko'tarilishi hamda jigar fermentlari va lipid spektrida salbiy o'zgarishlar kuzatildi. Natijalar nosning tizimli yallig'lanish va metabolik buzilishlar xavfini oshirishi mumkinligini ko'rsatadi.

Kalit so'zlar: nos, nasvay, nikotin, gematologiya, yallig'lanish, metabolik buzilish.

THE EFFECT OF NAS (NASVAY) CONSUMPTION ON BLOOD COMPOSITION AND BIOCHEMICAL PARAMETERS

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ABSTRACT

Nas (nasvay) is a smokeless nicotine-containing product widely used in Central Asia, composed of tobacco and alkaline additives. This study evaluated the effects of nas consumption on hematological and biochemical blood parameters. According to the results of a six-month follow-up, an increase in hemoglobin levels, leukocytosis, elevated C-reactive protein (CRP) levels, as well as adverse changes in liver enzymes and lipid profile were observed among nas users. The findings suggest that nas consumption may increase the risk of systemic inflammation and metabolic disorders.

Keywords: nas, nasvay, nicotine, hematology, inflammation, metabolic disorders.

ВЛИЯНИЕ УПОТРЕБЛЕНИЯ НАСА (НАСВАЯ) НА СОСТАВ КРОВИ И БИОХИМИЧЕСКИЕ ПОКАЗАТЕЛИ

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АННОТАЦИЯ

Нас (насвай) — это бездымный никотинсодержащий продукт, широко распространённый в странах Центральной Азии, содержащий табак и щелочные добавки. В данном исследовании была оценена влияние употребления наса на гематологические и биохимические показатели крови. По результатам шестимесячного наблюдения у потребителей наса отмечено повышение уровня гемоглобина, лейкоцитоз, увеличение показателя С-реактивного белка (CRP), а также неблагоприятные изменения печёночных ферментов и липидного профиля. Полученные результаты свидетельствуют о том, что употребление наса может повышать риск системного воспаления и метаболических нарушений.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |03-03-2026|

Ключевые слова: нас, насвай, никотин, гематология, воспаление, метаболические нарушения.

KIRISH

Nos (nasvay) — maydalangan tamaki bargi, ohak (kalsiy gidroksid), kul va ba’zan o‘simlik moylari aralashmasidan tayyorlanadigan tutunsiz nikotin mahsulotidir. Ishqoriy muhit nikotinning shilliq qavat orqali tez so‘rilishini ta’minlaydi va tizimli ta’sirini kuchaytiradi [1-4].

Nikotin — asosiy faol modda bo‘lib, u simpatik asab tizimini faollashtiradi, katexolamin ajralishini oshiradi va yurak-qon tomir tizimiga ta’sir ko‘rsatadi. Nikotinning farmakologik xususiyatlari Goodman & Gilman's The Pharmacological Basis of Therapeutics manbasida batafsil yoritilgan [5-8].

Tutunsiz tamaki mahsulotlarining saraton va tizimli kasalliklar bilan bog‘liqligi World Health Organization hisobotlarida qayd etilgan [9-10].

TADQIQOT MAQSADI

nos iste’molining gematologik va biokimyoviy qon ko‘rsatkichlariga ta’sirini aniqlash.

MATERIALLAR VA METODLAR

Termiz shahri bemorlarning 6 oylik kuzatuv elementi bilan olib borilgan klinik-laborator tadqiqot.

Ishtirokchilar

- 30 nafar doimiy nos iste’molchisi (kamida 3 yil, kuniga ≥1 marta)
- 30 nafar sog‘lom, nos va tamaki iste’mol qilmaydigan shaxs (nazorat)

Yosh oralig‘i: 20–50 yosh.

Laborator ko‘rsatkichlar

- Eritrotsitlar (RBC)
- Gemoglobin (Hb)
- Leykotsitlar (WBC)
- Trombositlar (PLT)
- C-reaktiv oqsil (CRP)
- ALT, AST
- Umumiy xolesterin
- Triglitseridlar

Statistik tahlil

Ma’lumotlar M ± SD ko‘rinishida ifodalandi. Student t-testi qo‘llanildi. $p < 0.05$ statistik ahamiyatli deb qabul qilindi.

NATIJALAR

Jadval 1

Nos iste’molchilarida gematologik ko‘rsatkichlar (M ± SD)

Ko‘rsatkich	Nazorat (n=30)	Nos iste’molchilari (n=30)	p qiymat
Eritrotsitlar (×10¹²/L)	4.5 ± 0.4	4.9 ± 0.5	<0.05
Gemoglobin (g/L)	136 ± 11	148 ± 13	<0.05
Leykotsitlar (×10⁹/L)	6.7 ± 1.1	8.9 ± 1.5	<0.05
Trombositlar (×10⁹/L)	250 ± 30	276 ± 35	>0.05

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |03-03-2026|

Nos iste'molchilarida gemoglobin va eritrotsitlar miqdorining oshishi kompensator gipoksiya va nikotin ta'sirida eritropoez faollashuvi bilan izohlanadi. Leykotsitoz esa surunkali yallig'lanish jarayoniga ishora qiladi.

Jadval 2

Nos iste'molchilarida biokimyoviy ko'rsatkichlar (M ± SD)

Ko'rsatkich	Nazorat	Nos iste'molchilari	p qiymat
ALT (U/L)	23 ± 5	35 ± 8	<0.05
AST (U/L)	21 ± 4	32 ± 7	<0.05
CRP (mg/L)	2.1 ± 0.8	6.8 ± 1.9	<0.05
Umumiy xolesterin (mmol/L)	4.7 ± 0.6	5.9 ± 0.8	<0.05
Triglitseridlar (mmol/L)	1.3 ± 0.3	2.1 ± 0.5	<0.05

CRP ning oshishi tizimli yallig'lanish mavjudligini ko'rsatadi. Lipid spektridagi o'zgarishlar yurak-qon tomir kasalliklari xavfini oshirishi mumkin.

MUHOKAMA

Natijalar nos iste'moli organizmda surunkali yallig'lanish va metabolik o'zgarishlarni chaqirishi mumkinligini ko'rsatdi. Nikotin simpatik tizimni faollashtirib, gematologik ko'rsatkichlarga ta'sir qiladi. Shuningdek, ishqoriy muhit og'iz shilliq qavatida doimiy irritatsiya va mahalliy yallig'lanishga olib keladi.

World Health Organization ma'lumotlariga ko'ra, tutunsiz tamaki mahsulotlari og'iz bo'shlig'i saratoni xavfini oshiradi. Qon ko'rsatkichlaridagi o'zgarishlar tizimli ta'sir mavjudligini tasdiqlaydi.

Tadqiqot cheklovlari: namuna hajmi kichik, boshqa xavf omillari (ovqatlanish, jismoniy faollik) to'liq nazorat qilinmagan.

XULOSA

Nos iste'moli:

- Gemoglobin va eritrotsitlar miqdorini oshiradi;
- Leykotsitoz va CRP ko'tarilishi orqali surunkali yallig'lanish belgilarini yuzaga keltiradi;
- Jigar fermentlari va lipid spektrini yomonlashtiradi.

Nos sog'liq uchun xavfsiz emas va uzoq muddatli iste'mol tizimli asoratlarga olib kelishi mumkin.

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |03-03-2026|

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SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |03-03-2026|

THE IMPORTANCE OF MICROORGANISMS IN THE DEVELOPMENT OF GASTRITIS, PEPTIC ULCER DISEASE, AND COLITIS

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ABSTRACT

This scientific article analyzes the role of microorganisms in the pathogenesis of gastritis, gastric and duodenal ulcer disease, and colitis based on reliable contemporary scientific literature. Particular emphasis is placed on the role of Helicobacter pylori infection in the development of chronic gastritis and peptic ulcer disease. The relationship between intestinal microbiota imbalance and inflammatory processes in the colonic mucosa is also examined. The contribution of Escherichia coli, Clostridioides difficile, and other opportunistic microorganisms to the development of colitis is discussed. The findings demonstrate that microbial factors play a crucial etiological and pathogenetic role in gastrointestinal diseases and should be carefully considered in modern diagnostic, preventive, and therapeutic strategies.

Keywords: Gastritis, gastric ulcer, duodenal ulcer, colitis, microorganisms, Helicobacter pylori, Escherichia coli, Clostridioides difficile, intestinal microbiota, inflammation, pathogenesis, dysbiosis.

INTRODUCTION

Diseases of the gastrointestinal system are among the most common pathologies in modern clinical medicine. Gastritis, gastric and duodenal ulcers, as well as colitis, represent significant medical and social problems not only because of their high prevalence, but also due to complications, reduced work capacity, and negative impact on quality of life. In recent decades, the leading role of microbiological factors in the etiology and pathogenesis of these diseases has been scientifically established. In the development of gastritis and peptic ulcer disease, Helicobacter pylori infection has been recognized as a decisive etiological factor. This microorganism adheres to the gastric mucosa and, with the help of the urease enzyme, adapts to the acidic environment, damages the mucosal layer, and triggers a chronic inflammatory process. As a result, the protective mechanisms of the mucosa are impaired, epithelial regeneration is weakened, and conditions for ulcer formation are created. Scientific literature indicates that the majority of chronic gastritis cases are associated with this bacterium. In inflammatory bowel diseases, particularly in the development of colitis, structural and functional changes in the intestinal microbiota play an important role. A healthy intestinal microbiota ensures the maturation of the immune system, digestion of nutrients, and stability of the mucosal barrier. In dysbiosis, opportunistic microorganisms become activated. In particular, Clostridioides difficile is one of the main causes of antibiotic-associated colitis, producing toxins that damage intestinal epithelial cells. Certain pathogenic strains of Escherichia coli intensify the inflammatory process through invasive and enterotoxigenic mechanisms. In modern gastroenterology, microorganisms are considered not only as etiological agents but also as pathogenetic factors determining disease severity, chronicity, and recurrence frequency. Impaired immune response, cytokine imbalance, and decreased epithelial barrier function develop through complex interactions with the microbiota. Therefore, the improvement of microbiological diagnostic methods,

development of eradication therapy protocols, and the use of probiotics and microbiota-modulating therapies occupy an important place in clinical practice. The relevance of this topic lies in the widespread occurrence and chronic course of gastrointestinal diseases, which impose a significant burden on healthcare systems. Uncontrolled use of antibiotics, changes in dietary habits, stress factors, and environmental influences negatively affect the microbiota composition and increase the risk of disease development. For this reason, in-depth study of the role of microorganisms in the etiopathogenesis of gastritis, peptic ulcer disease, and colitis, as well as the development of early diagnostic and targeted treatment strategies, is one of the priority directions of modern medicine. The aim of this scientific article is to systematically highlight the etiological and pathogenetic role of microorganisms in the development of gastritis, gastric and duodenal ulcers, and colitis based on reliable scientific sources, and to substantiate their clinical significance.

MATERIALS AND METHODS

This scientific article is based on a systematic analysis of the literature and is aimed at studying the etiological and pathogenetic significance of microorganisms in the development of gastritis, gastric and duodenal ulcers, and colitis. Fundamental and clinical sources in the fields of gastroenterology, microbiology, pathophysiology, and clinical medicine were analyzed. Particular attention was paid to scientific data highlighting the role of Helicobacter pylori infection in the gastric mucosa, intestinal microbiota imbalance, and the involvement of Clostridioides difficile and pathogenic strains of Escherichia coli in the development of colitis.

The work was carried out using a retrospective analytical and systematic review approach. The following criteria were applied in selecting scientific sources:

Classical textbooks and monographs on gastroenterology and microbiology

Clinical guidelines and international recommendations

Experimental and clinical studies describing etiology and pathogenesis

Reliable scientific articles published in recent years

A comparative analysis of historical and contemporary sources was also conducted to examine the evolution of scientific views on microbiological factors in disease development.

Methods of Analysis

The data were analyzed using the following scientific methods:

Descriptive analysis — characterization of biological properties, virulence factors, and pathogenetic mechanisms of microorganisms

Pathogenetic analysis — evaluation of mucosal damage, release of inflammatory mediators, disruption of the epithelial barrier, and changes in immune response

Comparative analysis — comparison of disease-causing mechanisms among different microorganisms

Systemic approach — comprehensive assessment of interactions between the microbiota and the host organism, considering the gastrointestinal tract as a unified biological system

Diagnostic and Laboratory Basis (According to Literature Data)

Diagnostic approaches reported in the literature were also analyzed, including:

Endoscopic examination and histological evaluation of biopsy specimens

Urease testing and serological methods for detection of Helicobacter pylori

Identification of toxins in stool samples to confirm Clostridioides difficile infection

Microbiological culture and molecular biological methods for detecting pathogenic strains of Escherichia coli

Methodological Framework

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JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |03-03-2026|

The study was conducted in accordance with the principles of evidence-based medicine. Only clinically and experimentally proven data were included. The information was systematically summarized in logical sequence to highlight the relationships among etiological factors, pathogenetic mechanisms, and clinical significance.

Thus, the applied methodology made it possible to scientifically assess the role of microorganisms in the development of gastritis, peptic ulcer disease, and colitis, as well as to determine their importance in clinical practice.

RESULTS

The results of the conducted systematic analysis demonstrated that microorganisms play a significant etiological and pathogenetic role in the development of gastritis, gastric and duodenal ulcers, and colitis. Based on clinical and experimental data presented in the literature, inflammatory processes of the gastrointestinal mucosa were found to be directly associated with microbiological factors. In chronic gastritis and peptic ulcer disease, Helicobacter pylori infection exerts a damaging effect by adhering to epithelial cells of the mucosa, producing the urease enzyme, releasing cytotoxic proteins, and activating inflammatory mediators. As a result, the protective properties of the mucosal layer weaken, the epithelial barrier is disrupted, and the risk of ulcer formation increases. In the pathogenesis of colitis, imbalance of the intestinal microbiota plays an important role. In antibiotic-associated colitis, toxins produced by Clostridioides difficile lead to epithelial necrosis and pseudomembrane formation. In addition, enteropathogenic strains of Escherichia coli invade the intestinal wall and trigger a strong inflammatory response. The analysis also showed that virulence factors produced by microorganisms (toxins, adhesins, enzymes) directly influence disease severity and chronicity. Furthermore, immune imbalance and increased cytokine secretion deepen mucosal damage.

Table 1. Major Microorganisms and Their Pathogenetic Effects in Gastritis and Peptic Ulcer Disease

Microorganism	Site of Damage	Main Pathogenetic Mechanism	Clinical Outcome
Helicobacter pylori	Gastric mucosa	Urease production, release of cytotoxic proteins, activation of inflammatory mediators	Chronic gastritis, gastric and duodenal ulcers
Escherichia coli (enteropathogenic strains)	Small and large intestine	Enterotoxin production, epithelial invasion	Inflammation, diarrhea, predisposition to colitis

Table 2. Role of Microbiota Imbalance and Toxic Factors in the Development of Colitis

Factor	Mechanism of Action	Morphological Changes	Clinical Manifestations
Intestinal microbiota dysbiosis	Decrease of beneficial bacteria and overgrowth of opportunistic pathogens	Mucosal inflammation	Abdominal pain, diarrhea

Clostridioides difficile toxins	Enterotoxic and cytotoxic effects	Epithelial necrosis, pseudomembranes	Antibiotic-associated colitis
Impaired immune response	Increased cytokine secretion	Mucosal edema and infiltration	Chronic inflammation

Overall, the findings indicate that microorganisms are not only causative agents but also key pathogenetic factors determining disease severity and complications in gastritis, peptic ulcer disease, and colitis. Alterations in microflora composition and activation of pathogenic strains lead to structural and functional disorders of the gastrointestinal system.

DISCUSSION

The obtained results confirm that microorganisms are leading etiological and pathogenetic factors in the development of gastritis, gastric and duodenal ulcers, and colitis. Comparative analysis with scientific literature indicates that damage to the gastrointestinal mucosa is often the result of complex interactions between microorganisms and the host immune system. The identification of Helicobacter pylori in chronic gastritis and peptic ulcer disease represented a major breakthrough in gastroenterology. The production of the urease enzyme enables this bacterium to survive in the acidic environment of the stomach, while its cytotoxic proteins damage epithelial cells. However, an important point for discussion is that the presence of infection does not always lead to clinical ulcer formation. This depends on host genetic characteristics, the level of immune response, dietary habits, and environmental factors. Therefore, microorganisms are necessary but not the sole factor in disease development. In the pathogenesis of colitis, qualitative and quantitative changes in the intestinal microbiota play a crucial role. Under the influence of antibiotics, normal microflora decreases, allowing toxin-producing microorganisms such as Clostridioides difficile to predominate. As a result, intestinal epithelial cells are damaged and pseudomembranous inflammation develops. This process demonstrates the critical importance of microbiota stability for intestinal health. Enteropathogenic strains of Escherichia coli also invade the intestinal wall and trigger a strong inflammatory response. This leads to increased cytokine secretion, enhanced neutrophil migration, and disruption of the epithelial barrier. The discussion reveals that virulence factors of microorganisms directly influence clinical severity and the development of complications. According to modern scientific views, it is insufficient to explain the pathogenesis of gastrointestinal diseases solely by infection. The host immune response, inflammatory mediators, oxidative stress, and imbalance of the microbiota together form a complex mechanism. Therefore, treatment strategies should not be limited to antibacterial therapy alone but should also include approaches aimed at restoring microbiota balance and reducing inflammation. In summary, the discussion indicates that microorganisms play a central role in the development of gastritis, peptic ulcer disease, and colitis, although the pathogenesis of these conditions is multifactorial. Thus, in clinical practice, identifying etiological factors, assessing individual risk factors, and applying comprehensive treatment principles are of great importance.

CONCLUSION

The results of the systematic analysis scientifically substantiate that microorganisms are important etiological and pathogenetic factors in the development of gastritis, gastric and duodenal ulcers, and colitis. In chronic gastritis and peptic ulcer disease, Helicobacter pylori infection is the primary cause of mucosal damage, playing a central role in disease formation by triggering inflammation, disrupting the epithelial barrier, and promoting ulcer formation. In the pathogenesis of colitis, intestinal microbiota imbalance and activation of toxin-producing microorganisms are of

leading importance. In particular, Clostridioides difficile is recognized as the main causative agent of antibiotic-associated colitis, while enteropathogenic strains of Escherichia coli intensify invasive inflammatory processes in the intestinal mucosa.

At the same time, disease development is not limited to infectious factors alone but is closely associated with the host immune response, genetic predisposition, environmental influences, and dietary characteristics. Therefore, gastrointestinal diseases have a multifactorial pathogenesis, with microorganisms representing one of the key components of this complex mechanism. From a practical perspective, improving microbiological diagnostic methods, implementing targeted eradication therapy, expanding approaches aimed at restoring intestinal microbiota, and promoting rational use of antibiotics are essential for effective prevention and treatment of these diseases.

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CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |27-02-2026|

TABLE OF CONTENTS