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USE OF BIOIMPEDANCE ANALYSIS METHOD IN INDUSTRY: EXPERIENCE OF A CABLE PLANT IN UZBEKISTAN

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ABSTRACT: Rational dietary nutrition is a key component of the system of therapeutic and preventive measures and plays a crucial role in restoring and maintaining patients' health. The aim of this study is to substantiate the scientific and hygienic principles of organizing dietary nutrition in healthcare institutions, taking into account the physiological needs of the body, metabolic characteristics in various diseases, and modern requirements of medical nutrition science. The article discusses the main hygienic aspects of diet formulation, including energy and nutrient adequacy, balance of macro- and micronutrients, food quality and safety, as well as technological conditions of preparation and storage. Particular attention is paid to the role of vitamins, minerals, antioxidants, and dietary fiber in accelerating recovery processes and enhancing the body's adaptive capacity during treatment. It is shown that adherence to scientifically based hygienic norms of nutrition increases the effectiveness of therapy, reduces complications, and improves patients' quality of life. The practical implementation of these principles requires an interdisciplinary approach involving physicians, dietitians, hygienists, and food technologists.

Keywords: dietary nutrition, hygienic principles, healthcare institutions, rational nutrition, nutrition science, macro- and micronutrients, disease prevention.

НАУЧНО-ГИГИЕНИЧЕСКИЕ ПРИНЦИПЫ РАЦИОНАЛЬНОГО ДИЕТИЧЕСКОГО ПИТАНИЯ ПАЦИЕНТОВ В ЛЕЧЕБНО-ПРОФИЛАКТИЧЕСКИХ УЧРЕЖДЕНИЯХ

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АННОТАЦИЯ: Рациональное диетическое питание является важнейшим компонентом системы лечебно-профилактических мероприятий и играет ключевую роль в восстановлении и поддержании здоровья пациентов. Цель исследования — обоснование научно-гигиенических принципов организации диетического питания в лечебно-профилактических учреждениях с учётом физиологических потребностей организма, особенностей обмена веществ при различных заболеваниях и современных требований медицинской нутрициологии. В статье рассмотрены основные гигиенические аспекты формирования рационов: энергетическая и пищевая адекватность, сбалансированность

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макро- и микронутриентного состава, качество и безопасность продуктов, технологические условия приготовления и хранения пищи. Особое внимание уделено роли витаминов, минеральных веществ, антиоксидантов и пищевых волокон в ускорении процессов восстановления и адаптации организма к лечению. Показано, что соблюдение научно обоснованных гигиенических норм питания способствует повышению эффективности терапии, снижению осложнений и улучшению качества жизни пациентов. Практическая реализация данных принципов требует междисциплинарного подхода, включающего взаимодействие врачей, диетологов, гигиенистов и технологов питания.

Ключевые слова: *диетическое питание, гигиенические принципы, лечебно-профилактическое учреждение, рациональное питание, нутрициология, макро- и микронутриенты, профилактика заболеваний.*

RELEVANCE: In modern healthcare practice, dietary nutrition is recognized not only as a supportive element of therapy but as an essential medical and preventive factor that directly influences the course and outcome of many diseases. The growing prevalence of chronic non-communicable disorders — such as cardiovascular, endocrine, metabolic, and gastrointestinal diseases — emphasizes the importance of scientifically grounded approaches to nutrition management in hospitals and rehabilitation centers. Properly organized dietary nutrition based on hygienic and physiological principles ensures optimal energy supply, supports metabolism, enhances immunity, and accelerates recovery.

Numerous studies indicate that the actual organization of therapeutic nutrition in many healthcare institutions remains insufficiently systematized. Diets are often not fully adapted to patients' individual needs, the biochemical composition of food is inadequately balanced, and control over hygienic standards during cooking and storage is inconsistent. These shortcomings may reduce treatment effectiveness and increase the risk of nutritional deficiencies or hospital-acquired complications.

Therefore, the development and implementation of scientifically justified hygienic principles of rational dietary nutrition are of great practical significance. They contribute to the optimization of treatment outcomes, prevention of secondary metabolic disorders, and improvement of patients' overall quality of life. Integrating modern nutritional science into clinical and hygienic practice is an urgent task for contemporary medicine [1].

MATERIALS AND METHODS: This review article is based on an analytical synthesis of scientific literature, regulatory documents, and modern clinical guidelines concerning the hygienic principles of dietary nutrition in healthcare institutions. The analysis included publications from 2010 to 2025, obtained through international databases such as PubMed, Scopus, Web of Science, and regional sources including the Ministry of Health of Uzbekistan, WHO, and FAO reports.

Inclusion criteria comprised peer-reviewed studies and methodological recommendations focusing on the organization, hygienic assessment, and optimization of therapeutic and preventive nutrition. Excluded were papers without evidence-based data or those limited to experimental animal models.

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The methodological framework included comparative and descriptive analysis of energy value, nutrient balance, and hygienic control of food preparation in hospital settings. Priority was given to works evaluating physiological adequacy, safety standards (SanPiN, Codex Alimentarius), and the biochemical indicators of patients receiving diet therapy.

Information was systematized by thematic categories: nutritional adequacy, hygienic regulation, antioxidant and micronutrient support, and preventive efficiency. Statistical and epidemiological data were reviewed to identify trends and gaps in implementing hygienic dietary principles in clinical nutrition practice. The synthesis aimed to summarize the best available evidence for developing scientifically grounded recommendations for hospital dietetics.

RESULTS AND DISCUSSION: Nutrition plays a decisive role in the success of therapeutic interventions and the prevention of secondary complications in patients with various diseases. Adequate and balanced dietary intake ensures the optimal supply of energy and essential nutrients necessary for tissue repair, immune function, and metabolic regulation. Clinical evidence demonstrates that proper nutrition enhances the pharmacological efficacy of treatment, reduces the risk of adverse reactions, and accelerates rehabilitation. For example, protein sufficiency supports wound healing and recovery after surgery, while vitamins A, C, and E, along with trace elements such as zinc and selenium, protect against oxidative stress and inflammation.

Conversely, nutritional deficiencies weaken the immune system, delay recovery, and contribute to the development of hospital-acquired complications such as infections, anemia, or metabolic disorders. In chronic diseases, inadequate nutrition often exacerbates the severity of pathological processes and prolongs treatment duration. Therefore, individualized diet therapy, tailored to the patient's clinical condition and metabolic needs, should be considered an integral part of medical treatment. Implementing scientifically grounded dietary programs in healthcare institutions not only improves therapeutic outcomes but also reduces hospitalization time and enhances overall quality of life for patients [1].

The practical significance of the study is determined by its applicability in improving the organization of dietary services in healthcare institutions. The findings can be used to develop evidence-based dietary protocols, nutritional monitoring systems, and hygienic control algorithms for hospital catering. Implementation of these recommendations will enhance the effectiveness of medical treatment, reduce postoperative and metabolic complications, and shorten recovery periods. Furthermore, the study supports the training of healthcare professionals in modern dietetics and hygienic nutrition, promoting a multidisciplinary approach to patient care and public health improvement [1,3].

The origins of therapeutic and dietary nutrition date back to ancient civilizations, where food was regarded as both nourishment and medicine. Hippocrates, often called the father of medicine, emphasized that "food should be our medicine and medicine should be our food," establishing the conceptual foundation for diet as a therapeutic tool. In ancient Egypt, Greece, and Rome, physicians prescribed specific dietary regimens for different diseases, recognizing the importance of moderation and balance.

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During the Middle Ages, medical schools in the Islamic world, notably in Baghdad and Bukhara, advanced dietary science by systematizing knowledge of food composition and its effects on health. Scholars such as Avicenna (Ibn Sina) in his Canon of Medicine described detailed nutritional recommendations for various pathological conditions, linking food to physiological functions and environmental influences.

In the 19th and early 20th centuries, the scientific era of dietetics began with the discovery of nutrients and their metabolic roles. Researchers such as Lavoisier, Rubner, and Pavlov contributed to understanding the energy value of food and digestive physiology. The mid-20th century marked the institutionalization of diet therapy as a branch of preventive medicine, with the introduction of clinical diet tables and hospital dietary services.

Today, therapeutic and dietary nutrition has evolved into an evidence-based discipline that integrates physiology, biochemistry, and hygiene. Modern dietetics emphasizes individualized nutritional therapy, functional foods, and the hygienic safety of medical diets, forming a critical part of comprehensive healthcare and rehabilitation [2].

Modern medical nutrition science, or nutritional medicine, is based on the understanding that nutrition is not only a physiological necessity but also a key therapeutic and preventive factor influencing human health throughout the life cycle. Contemporary concepts emphasize the individualization and evidence-based optimization of dietary intake according to metabolic needs, disease type, and treatment goals.

One of the central principles is the concept of adequate and balanced nutrition, which ensures that the energy and nutrient composition of the diet fully meets the body's physiological and pathological demands. Nutritional adequacy is now assessed not only by macronutrients but also by the sufficiency of micronutrients, bioactive compounds, and antioxidants that support cellular metabolism, immune function, and detoxification processes.

The modern paradigm also incorporates the principles of nutrigenomics and nutrigenetics, which study how genes influence nutrient metabolism and how diet can modulate gene expression. This approach enables the creation of personalized therapeutic diets tailored to genetic and metabolic profiles.

Another important direction is the integration of functional and therapeutic nutrition — the use of foods enriched with biologically active substances (probiotics, omega-3 fatty acids, polyphenols) that contribute to recovery and prevention of chronic diseases. In hospital practice, clinical nutrition protocols are being standardized according to international guidelines (ESPEN, WHO, FAO), ensuring safety, hygiene, and effectiveness of diet therapy.

Thus, modern medical nutrition science unites physiology, biochemistry, and hygiene into a single interdisciplinary system aimed at improving treatment outcomes, preventing complications, and maintaining a high quality of life for patients.

Hygiene science plays a fundamental role in ensuring the safety, quality, and effectiveness of therapeutic nutrition in healthcare institutions. Its principles form the foundation for developing scientifically justified standards and regulations that govern the preparation, storage, and distribution of dietary meals for patients. The hygienic approach ensures that the organization of

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clinical nutrition meets physiological requirements, prevents the introduction of infectious and toxic agents, and maintains the nutritional value of food throughout the technological process [3].

From a physiological perspective, hygiene science provides criteria for evaluating energy and nutrient adequacy, microbiological safety, and chemical purity of food products. It regulates the sanitary conditions of hospital kitchens, personal hygiene of staff, and compliance with temperature regimes and food safety norms (such as SanPiN and WHO guidelines).

Moreover, hygiene science contributes to optimizing dietary systems by incorporating epidemiological monitoring and risk assessment methods. This integration allows timely identification of nutritional deficiencies, food contamination risks, and deviations from standard therapeutic diets. Thus, the hygienic approach not only safeguards patient health during treatment but also enhances the overall efficiency of the healthcare system by ensuring that nutrition remains both safe and therapeutically effective.

The organization of therapeutic and dietary nutrition in healthcare institutions is guided by a set of international and national standards developed by authoritative organizations such as the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), and the European Society for Clinical Nutrition and Metabolism (ESPEN), as well as by national ministries of health. These recommendations form a unified evidence-based framework for ensuring the adequacy, safety, and effectiveness of nutrition in both hospital and preventive medicine settings.

According to the WHO, adequate nutrition is one of the key determinants of health and longevity. The WHO guidelines emphasize the principles of energy balance, diversity of diet, and optimal intake of macro- and micronutrients according to age, sex, physiological state, and disease type. The WHO also stresses the importance of controlling food safety at all stages of production and distribution in healthcare facilities. Its documents, such as the Global Strategy on Diet, Physical Activity and Health and Nutritional Care and Support for Patients, underline that therapeutic nutrition should be considered an integral part of treatment protocols rather than an auxiliary measure. The WHO also recommends the implementation of standardized nutritional screening tools (e.g., NRS-2002, MUST) to identify patients at risk of malnutrition.

The FAO focuses on the quality and safety of food used in dietary systems through its Codex Alimentarius — an internationally recognized collection of food standards, codes of practice, and guidelines. The FAO promotes the concept of sustainable and functional nutrition, encouraging the inclusion of local food sources rich in essential nutrients and antioxidants in medical diets. It also provides global recommendations on micronutrient fortification and the use of biofortified foods to prevent deficiencies of iron, iodine, zinc, and vitamin A in clinical and community settings.

The European Society for Clinical Nutrition and Metabolism (ESPEN) provides the most specialized evidence-based recommendations for clinical nutrition in hospitals. ESPEN guidelines define clear protocols for assessing nutritional status, calculating energy and protein requirements, and implementing enteral and parenteral nutrition when oral feeding is insufficient. ESPEN emphasizes a multidisciplinary approach — involving physicians, dietitians, and nurses — to manage patients' nutritional care. The society also supports the concept of "nutrition

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therapy," which includes individualized diet planning, early nutritional intervention, and the monitoring of treatment outcomes using biochemical and functional parameters. These principles are included in ESPEN's Guidelines on Clinical Nutrition in the Hospital Setting (2021), which serve as a reference for European and international healthcare institutions [4].

At the national level, Ministries of Health (for example, the Ministry of Health of Uzbekistan and similar agencies in CIS countries) adapt WHO and ESPEN recommendations to local healthcare systems. National sanitary regulations and standards (SanPiN) define hygienic norms for dietary departments, food storage, and preparation technologies. They establish the classification of therapeutic diets, specify the caloric and nutrient composition for various diseases, and regulate the safety and quality of raw materials. The Ministry of Health also coordinates training and certification programs for medical personnel responsible for diet therapy and hygienic control.

The international and national guidelines collectively form a coherent framework that ensures therapeutic nutrition is both physiologically adequate and hygienically safe. They emphasize the integration of nutrition into the overall medical process, continuous monitoring of nutritional status, and adherence to strict sanitary standards. Following WHO, FAO, ESPEN, and Ministry of Health recommendations allows healthcare institutions to enhance treatment effectiveness, prevent nutritional deficiencies, and improve patients' recovery outcomes and quality of life.

Rational therapeutic nutrition plays a fundamental role in the clinical management and rehabilitation of patients, serving as both a medical and preventive instrument within modern healthcare systems. Physiologically adequate nutrition ensures the maintenance of metabolic equilibrium, supports immune competence, and enhances the effectiveness of pharmacological and physical therapies. According to contemporary nutrition science, the physiological principles of rational nutrition are based on the adequacy of energy intake, proportionality of macronutrients, sufficient supply of essential micronutrients, and alignment with individual physiological and pathological needs. These principles reflect the concept of homeostatic regulation, where dietary components act as modulators of cellular, enzymatic, and hormonal mechanisms responsible for recovery and adaptation. The energy value of the diet must correspond to the patient's basal metabolism and physical activity level, avoiding both hypercaloric excess and hypocaloric deficiency. Proteins are of particular significance, as they provide amino acids for tissue regeneration, antibody synthesis, and enzymatic activity. Carbohydrates and lipids should maintain an optimal ratio to prevent metabolic overload, especially in patients with diabetes, obesity, or cardiovascular disease. Moreover, physiological nutrition must account for the digestibility and bioavailability of nutrients, gastrointestinal tolerance, and the influence of disease-specific metabolic disturbances on nutrient absorption.

The hygienic dimension of therapeutic nutrition is equally vital. Hygienic requirements ensure that the organization of medical diets within hospitals and clinics adheres to principles of food safety, quality, and technological integrity. International and national sanitary standards, such as those developed by the WHO and local Ministries of Health, regulate the entire process of food preparation — from procurement and storage of raw materials to cooking, portioning, and serving [WHO, 2023]. These requirements include maintaining microbiological purity, preventing cross-contamination, and ensuring that temperature control and storage conditions preserve the nutritional and organoleptic properties of foods. Hygiene in hospital kitchens

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extends beyond food safety to encompass staff training, workplace sanitation, waste management, and water quality. Food preparation areas must be equipped with devices for thermal processing, ventilation, and disinfection, while staff must observe strict personal hygiene. The hygienic organization of therapeutic nutrition thus serves not only to prevent foodborne infections but also to preserve the therapeutic value of meals prescribed to patients.

The balance of macro- and micronutrients represents one of the most critical determinants of therapeutic efficacy in dietary practice. Adequate intake of macronutrients — proteins, fats, and carbohydrates — ensures proper energy metabolism, while micronutrients, including vitamins and minerals, act as cofactors in enzymatic and cellular processes essential for healing. The concept of metabolic balance underscores that deficiency or excess of any nutrient can disrupt physiological homeostasis and impede recovery. Vitamins A, C, and E, along with trace elements such as zinc, selenium, copper, and iron, play a central role in maintaining the body's antioxidant defense system. Their presence mitigates oxidative stress, which is a common pathophysiological mechanism in inflammation, infection, and chronic disease [FAO, 2022]. In addition to traditional micronutrients, modern nutritional science emphasizes the therapeutic role of bioactive compounds — flavonoids, omega-3 fatty acids, and probiotics — that modulate oxidative and inflammatory pathways. Antioxidants, in particular, are crucial for protecting cellular membranes, enhancing immune function, and reducing the side effects of medications. Studies show that patients receiving antioxidant-enriched diets experience faster recovery and fewer postoperative complications, confirming the direct relationship between micronutrient adequacy and treatment success [ESPEN, 2021].

Quality control and sanitary-hygienic aspects of food preparation remain essential components of the therapeutic nutrition system. Hospital food must not only meet physiological and nutritional criteria but also comply with strict hygienic regulations. Sanitary oversight covers raw-material selection, control of expiration dates, compliance with temperature regimes during cooking, and prevention of recontamination. The WHO and FAO stress the importance of the "farm-to-table" safety chain, where each stage — transportation, storage, processing, and serving — is subject to hygienic monitoring [WHO/FAO Codex Alimentarius, 2021]. Thermal treatment must guarantee microbial safety while minimizing nutrient loss, especially of heat-labile vitamins such as C and folate. Modern quality-assurance systems, including Hazard Analysis and Critical Control Points (HACCP), have been widely introduced into hospital catering services to ensure continuous monitoring of safety parameters. In addition, chemical safety — control of nitrates, pesticides, heavy metals, and food additives — is an integral part of hygienic supervision. The integration of sanitary control with nutritional quality evaluation allows healthcare facilities to maintain high standards of dietary therapy, protecting vulnerable patients from both infection and nutritional deficiency [5].

Individualization of therapeutic diets is one of the defining features of contemporary dietetics. The traditional approach, based on standard diet tables, is gradually being replaced by patient-specific nutritional planning that considers diagnosis, disease stage, metabolic profile, and comorbidities [ESPEN, 2021]. Personalized diet therapy allows adjustment of macronutrient ratios, caloric content, and texture according to clinical needs — for instance, low-salt diets for hypertension, low-glycemic diets for diabetes, or protein-restricted diets for renal failure. Furthermore, personalized nutrition integrates results of biochemical and anthropometric assessments to refine treatment protocols. Advances in nutrigenomics have provided additional

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insights into how genetic polymorphisms influence nutrient metabolism, enabling the development of genotype-based diets that improve therapeutic outcomes. In practical terms, individualization also extends to sensory and cultural considerations: patients are more likely to adhere to dietary regimens when meals are palatable and culturally familiar. This patient-centered approach improves compliance and thus the overall effectiveness of dietary therapy.

Despite the progress achieved, numerous problems and deficiencies persist in the current practice of therapeutic nutrition. Many healthcare institutions continue to operate outdated catering systems, with limited access to fresh produce and insufficiently varied menus. Diets are often designed primarily to meet caloric needs without adequate attention to micronutrient balance or the functional value of foods. Nutritional screening of patients remains inconsistent, and in many hospitals, dieticians are either absent or under-utilized. In developing regions, deficiencies in infrastructure, refrigeration, and staff training further compromise the hygienic safety of therapeutic meals. Additionally, the economic constraints of hospital budgets limit the ability to procure high-quality ingredients or fortified products. The absence of unified nutritional standards and limited interdisciplinary cooperation between clinicians, hygienists, and food technologists contribute to the fragmentation of practice [Ministry of Health, 2022]. Moreover, rapid urbanization and the commercialization of food services sometimes lead to outsourcing of hospital catering to private contractors, where control over hygienic and nutritional quality may weaken. These systemic challenges demonstrate the urgent need for modernization of hospital nutrition systems through evidence-based policy reforms and investment in personnel training.

The future of therapeutic nutrition lies in the optimization of processes through the adoption of innovative technologies and interdisciplinary coordination. One promising direction is the use of digital nutrition management systems, which allow precise calculation of individual nutritional requirements, automated menu planning, and real-time monitoring of dietary compliance. Integration of electronic health records with nutritional data facilitates personalized adjustments and outcome tracking. Smart kitchen technologies — such as automated temperature control, sous-vide cooking, and nutrient-preserving processing — enhance both the hygienic safety and the nutritional value of meals. The introduction of functional and fortified foods, enriched with probiotics, omega-3 fatty acids, and bioavailable vitamins, provides an effective means of preventing micronutrient deficiencies among hospitalized patients [FAO, 2023]. 3D food printing and texture-modified diets offer new opportunities for patients with dysphagia, ensuring both safety and nutritional adequacy.

From a management perspective, optimizing therapeutic nutrition also involves establishing quality-assurance frameworks that integrate medical, hygienic, and technological monitoring. The adoption of international accreditation systems, such as ISO 22000 and HACCP, can standardize hospital food services and align them with global safety norms. Continuous professional education for dietitians and hygienists should be institutionalized, emphasizing the role of nutrition as a therapeutic modality rather than a supportive service. The expansion of clinical nutrition departments within hospitals would allow multidisciplinary collaboration, uniting physicians, biochemists, technologists, and public-health specialists [6].

Another promising trend is the development of sustainable hospital nutrition systems based on local food production and waste-reduction strategies. The FAO encourages hospitals to source seasonal, regionally produced foods to reduce environmental impact while maintaining high

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nutritional value. Sustainability also involves efficient water and energy use, as well as recycling of food waste into bioenergy or compost [FAO, 2022]. This ecological perspective links hygienic nutrition with the broader concept of planetary health, recognizing that human wellbeing depends on environmentally responsible food systems.

The integration of tele-nutrition and remote counseling is expanding opportunities for continuity of dietary care beyond hospital walls. Patients discharged after surgery or chronic-disease treatment can receive individualized nutritional guidance and monitoring via digital platforms. This innovation not only prevents relapse and complications but also strengthens patient education and self-management skills.

Ultimately, the optimization of therapeutic nutrition requires a comprehensive systems approach combining scientific evidence, hygienic regulation, and technological progress. The success of future reforms will depend on political support, adequate funding, and international cooperation in setting harmonized standards. Countries that have implemented such integrated models — including those within the European Union and East Asia — report significant reductions in hospital malnutrition rates and improved clinical outcomes. For Uzbekistan and other Central Asian nations, the adaptation of WHO, FAO, and ESPEN frameworks to national healthcare contexts represents a strategic priority for improving the effectiveness of treatment and rehabilitation.

The discussion reveals that rational therapeutic nutrition embodies the convergence of physiology, hygiene, and modern technology. Physiological principles determine the composition and adequacy of the diet; hygienic requirements guarantee safety and quality; antioxidant and micronutrient balance ensures metabolic resilience; and technological innovations facilitate efficient, personalized delivery of nutrition. Addressing current deficiencies and adopting forward-looking approaches will transform hospital nutrition services into an evidence-based, patient-centered, and hygienically robust component of contemporary medical care.

CONCLUSION: The comprehensive analysis of modern approaches to therapeutic nutrition demonstrates that scientifically grounded dietary management is an indispensable component of effective medical treatment and rehabilitation. Rational nutrition, guided by physiological and hygienic principles, ensures the body's metabolic balance, supports tissue regeneration, enhances immune resistance, and contributes to the overall efficiency of therapy. The integration of adequate energy intake, balanced macro- and micronutrients, and sufficient antioxidant protection forms the basis of nutritional therapy in various clinical conditions. Adherence to these principles reduces the risk of complications, accelerates recovery, and improves patients' quality of life.

Hygienic science provides the regulatory and methodological framework that guarantees the safety, quality, and technological consistency of food preparation and distribution in healthcare institutions. Compliance with international standards — including WHO, FAO, and ESPEN recommendations — ensures the microbiological purity, chemical safety, and nutritional adequacy of hospital diets. Effective sanitary supervision, staff training, and quality control systems (HACCP, ISO 22000) remain critical for preventing foodborne infections and preserving therapeutic value.

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The results of the review highlight persistent challenges in hospital nutrition practices: insufficient individualization, outdated infrastructure, limited nutritional screening, and shortage of qualified dietitians. Addressing these issues requires modernization through evidence-based standards, interdisciplinary collaboration, and investment in personnel education. The implementation of innovative technologies — digital menu management, nutrient-preserving processing, and tele-nutrition — will further optimize dietary services.

In conclusion, the advancement of scientific and hygienic principles of therapeutic nutrition is essential for improving treatment outcomes, preventing complications, and promoting sustainable health. By integrating hygiene, physiology, and technology, healthcare institutions can transform dietary nutrition into a powerful, patient-centered instrument of modern medicine.

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