



Article

Clinical Significance of Nutritional Status, Inflammation, and Body Composition in Elderly Hemodialysis Patients—A Case–Control Study

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Abstract: Nutritional and inflammatory disorders are factors that increase the risk of adverse clinical outcomes and mortality in elderly hemodialysis (HD) patients. This study aimed to examine nutritional and inflammation status as well as body composition in older adults on HD compared to matched controls. A case–control study was conducted on 168 older participants (84 HD patients (cases) and 84 controls) age- and sex-matched. Demographic, clinical, anthropometric, and laboratory parameters were collected from medical records. The primary outcome was nutritional status assessment using a combination of nutritional and inflammatory markers along with the geriatric nutritional risk index (GNRI). Sarcopenic obesity (SO) was studied by the combined application of anthropometric measures. Body composition and hydration status were assessed by bioelectrical impedance analysis (BIA). Univariate and multivariate regression analyses were performed to identify nutritional and inflammatory independent risk indicators in elderly HD patients and controls. A significantly high prevalence of nutritional risk measured by the GNRI was found in HD patients (32.1%) compared to controls (6.0%) ($p < 0.001$). Elderly HD patients were overweight and had lower percent arm muscle circumference, phase angle (PA), serum albumin (s-albumin), as well as higher percent extracellular body water (ECW%) and serum C-reactive protein (s-CRP) than controls (all at least, $p < 0.01$). SO was higher in HD patients (15.50%) than in controls (14.30%). By multi-regression analyses, age < 75 years (OR: 0.119; 95%CI: 0.006 to 0.388), ECW% (OR: 1.162; 95%CI: 1.061 to 1.273), PA (OR: 0.099; 95%CI: 0.036 to 0.271), as well as BMI, s-albumin ≥ 3.8 g/dL, and lower s-CRP were independently related between cases and controls (all at least, $p < 0.05$). Elderly HD patients had increased nutritional risk, SO, inflammation, overhydration, and metabolic derangements compared to controls. This study highlights the importance of identifying nutritional risk along with inflammation profile and associated body composition disorders in the nutritional care of elderly HD patients. Further studies are needed to prevent nutritional disorders in elderly HD patients.

Keywords: aging; bioimpedance analysis; body composition; case–control study; elderly; geriatric nutritional risk; hemodialysis; inflammation; obesity; older adults; phase angle; sarcopenic obesity; s-albumin



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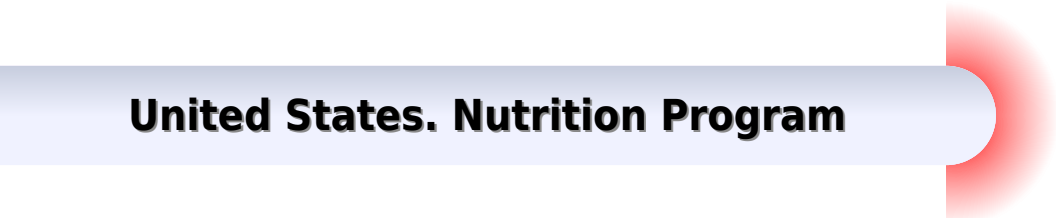
1. Introduction

The global aging of the population, with special attention to the elderly, favors the development of chronic non-communicable diseases and nutritional disorders. By the mid-century, the world's population over the age of 65 is expected to increase from 10% in 2022 to 16% in 2050 [1].

Chronic kidney disease (CKD) represents a growing public health problem in the world's aging population. The number of people receiving renal replacement therapy (RRT) is expected to reach 5439 million dialysis patients by 2030 [2]. The most common

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Importance of body composition analysis in clinical nutrition Clelia Madeddu,Lidia Santarpia,Maria Letizia Petroni,Alberto Bazzocchi,2023-02-15 Clinical nutrition and oncologic outcomes - Volume 1 Paula Ravasco,Antti Mäkitie,Faith Ottery,Kalliopi-Anna Poulia,Lucio Lara Santos,2023-05-25 **New Aspects of Clinical Nutrition** G. Kleinberger,E. Deutsch,1983-02-03 *Nutritional Status Assessment and its Links with Chronic Disease Prognosis and Surgical Outcomes* Gabriela Villaça Chaves,Barbara Perez Vogt,Geórgia das Graças Pena ,Rodolfo Espinoza,2024-11-06

Nutritional disorders are related to poor health outcomes including longer hospital stays postoperative complications cancer treatment toxicity shorter survival and reduced quality of life The use of nutritional assessment tools for both diagnostic and outcome measure purposes has been widely explored However understanding of their responsiveness to nutritional interventions is still in its incipient stages There has been increasing awareness of the importance of nutritional screening and assessment especially the integration of skeletal muscle mass evaluation into clinical practice In this context a standardized definition of low muscle mass myosteatosis and muscle strength is still under debate Since there is no clear definition of proper cut off points for each assessment tool the understanding and synthesis of the literature results are hindered Moreover the interplay among nutritional disorders has been under explored in literature research Efforts should be made to assess the association between comprehensive nutritional diagnosis and the prognosis of chronic diseases and surgical outcomes as most studies provide information on one feature of nutritional status and do not explore standardized nutritional assessment widely *Nutritional Aspects Of Aging* Linda H. Chen,2018-01-18 The first section in Volume 1 describes the fundamentals of nutrition and aging which include research strategies for the study of nutrition and aging The nutritional modulation of the aging process which has provided a major breakthrough in the field of nutrition and longevity is also discussed These include biomedical influences and social and psychological aspects Section 3 includes dietary characteristics of the elderly population and methods for the assessment of nutritional status The nutritional status of the elderly with respect to individual nutrients as determined by dietary survey and by biochemical methods is described in Section 4 Section 4 also includes discussion on nutrient metabolism requirements nutritional imbalances and deficiencies of nutrients Energy metabolism and obesity as a factor in pathogenesis of diseases are also discussed **Clinical Nutrition for Surgical Patients** Mary Marian,Scott A. Shikora,Mary Russell,2008 Clinical Nutrition for Surgical Patients Third Edition is the most comprehensive resource available for practitioners who offer interdisciplinary nutrition care to surgical patients This reference begins with a through review of the basics of medical nutrition therapy for surgical patients including nutritional assessment the role of surgical diets and the indications and contraindications for specialized nutrition support Subsequent chapters written by experts in the field address specific medical and surgical conditions and disease states that present specific challenges with provision of nutrition support All recommendations are evidence based and can be applied to

clinical practice The latest nutrition support techniques are described and their roles in managing many types of surgical patients are outlined Any clinician caring for surgical patients will benefit from the wealth of current information provided in this text **Clinical Nutrition and Oncologic Outcomes, Volume II** Antti Mäkitie,2023-11-07 **Toxicological Risk**

Assessment and Multi-System Health Impacts from Exposure Aristidis M. Tsatsakis,2021-08-01 **Toxicological Risk** Assessment and Multisystem Health Impacts From Exposure highlights the emerging problems of human and environmental health attributable to cumulative and multiple sources of long term exposure to environmental toxicants The book describes the cellular biological immunological endocrinologic genetic and epigenetic effects of long term exposure It examines how the combined exposure to nanomaterials metals pharmaceuticals multifrequency radiation dietary mycotoxins and pesticides accelerates ecotoxicity in humans animals plants and the larger environment The book goes on to also offer insights into mixture risk assessments protocols for evaluating the risks and how this information can serve the regulatory agencies in setting safer exposure limits The book is a go to resource for scientists and professionals in the field tackling the current and emerging trends in modern toxicology and risk assessment Bridges basic research with clinical epidemiological regulatory and translational research conveying both an introductory understanding and the latest developments in the field Evaluates real life human health risk assessment for long term exposures to xenobiotic mixtures and the role they play in contributing to chronic disease Discusses advances in predictive in silico toxicology tools and the benefits of using omics technologies in toxicology research Clinical Nutrition in Gastrointestinal Disease Alan Buchman,2006 Provides a practical guide that

examines and explains the necessary elements and principles of nutrition With more than 100 images and 180 tables this unique and comprehensive text provides essential information to optimally and successfully manage patients Some topics covered include Nutritional assessment Nutrition in critical care Nutritional support Management of intestinal failure and Obesity Some gastrointestinal diseases covered include Inflammatory bowel disease Irritable bowel syndrome Colon cancer Pancreatitis Hepatic failure and Celiac sprue **Handbook of cheese in health: production, nutrition and medical sciences** Victor R. Preedy,Ronald Ross Watson,Vinood B. Patel,2023-08-07 Cheeses are one of the most diverse food commodities known They have a wide range of regional and geographical differences in manufacture taste texture colour and contribution to the diet Because cheese is an important source of macro and micro nutrients it can be seen as a valuable product in human nutrition However some consider that traditionally manufactured cheeses may not contribute to optimal health For this reason there is a drive to produce types with reduced or modified fat or salt contents Another aspect that affects human health is that cheese may also harbour harmful pathogens in some circumstances To gain a holistic understanding of cheese in health nutritionists and dieticians have a fundamental need to grasp the process of cheese manufacture while cheese manufacturers benefit by understanding the health related aspects of cheese This handbook bridges the intellectual and trans disciplinary divide and provides a balanced overview of cheese in relation to health Experts

provide a comprehensive coverage of subjects in relation to cheese production nutrition and medical sciences such as composition and health benefits toxicology metabolic and nutritional effects and microbiology *Handbook of Dairy Foods and Nutrition* Gregory D. Miller, Judith K. Jarvis, Lois D. McBean, 2006-12-15 *Handbook of Dairy Foods and Nutrition* Third Edition examines the role of dairy products in diet and health covering such areas as cardiovascular health hypertension cancer bone and oral health This edition features a new chapter on dairy foods and weight management Other chapters address lactose digestion and the contribution of dairy foods to health throughout the lifecycle All chapters contain updated or new data content and references With peer reviewed chapters by nutrition and medical experts this book remains the most subsidized reference on dairy and nutrition currently available *Dietary Patterns in Cancer Prevention and Survival* Raul Zamora-Ros, Esther Molina-Montes, 2024-09-13 Cancer is a leading cause of death worldwide accounting for nearly 10 million deaths in 2020 or nearly one in six deaths Although some individuals are at higher risk due to non modifiable risk factors between 30 40% of all cancer cases are estimated to be preventable through healthy lifestyles including healthy diets In 2018 a report from the World Cancer Research Fund and the American Institute for Cancer Research promoted ten cancer prevention recommendations on diet and nutrition But characterizing a healthy diet is not easy since foods and nutrients are not consumed alone Over the past decade dietary pattern analysis has emerged as an alternative and complementary approach to evaluating the relationship between diet and cancer risk Instead of looking at individual nutrients or foods dietary pattern analysis examines the effects of the overall diet Conceptually dietary patterns represent a broader picture of food and nutrient consumption and may thus be more predictive of disease risk than individual foods or nutrients Research on the effects of diet nutrition and physical activity on the risk of cancer in cancer survivors is growing but it is much more limited than that on risk Therefore the current lifestyle recommendations for cancer survivors should be similar to those for cancer prevention until we do not have specific recommendations *Nutrition and Medical Practice* Lewis A. Barnes, Yank D. Coble, Donald Ian MacDonald, George Christakis, 2012-12-06 All forms of life require food materials in certain minimum amounts to insure an active life and successful reproduction Nutrition is concerned with what these materials are how they function what effects they have when absent and what happens to them when ingested During the past two centuries such nutritional disorders as scurvy beriberi rickets and pellagra have been discovered successfully treated and eradicated by physicians in developed countries In this century such noted researchers as Rose Meyerhof and Krebs have contributed enormously to the field of nutrition Currently research is evolving new concepts and facts so rapidly that the average practitioner can hardly keep current even in his own field of medicine Bona fide research by universities and governmental agencies has produced voluminous information much of which seems contradictory and therefore tends to confuse the general public particularly in the area of potential carcinogens This confusion has prompted consumer groups politicians and social welfarists to bring pressures and demands on medical schools and practitioners of medicine to increase their

knowledge and concern in the field of nutrition Taking advantage of and adding to this confusion are the health food faddists and cultists some only for monetary gain and others with a real religious zeal Nutrition and Physical Activity in Inflammatory Diseases Manohar L. Garg, Lisa G. Wood, 2013 Certain nutrients and physical activity can significantly alter immune function and inflammation Targeted interventions may be an effective and inexpensive means to improve the inflammation and immune dysfunction associated with chronic diseases This book defines the relevant underlying biological mechanisms and strengthens our understanding of how nutrients and physical activity impact inflammatory diseases A useful reference for researchers and students of nutrition physiology and sports science it explores the unique aspects of inflammation induced by nutritional deficiencies or activity levels and their interrelationship **Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline** Institute of Medicine, Food and Nutrition Board, Subcommittee on Upper Reference Levels of Nutrients, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes and its Panel on Folate, Other B Vitamins, and Choline, 2000-06-15 Since 1941 Recommended Dietary Allowances RDAs has been recognized as the most authoritative source of information on nutrient levels for healthy people Since publication of the 10th edition in 1989 there has been rising awareness of the impact of nutrition on chronic disease In light of new research findings and a growing public focus on nutrition and health the expert panel responsible for formulation RDAs reviewed and expanded its approach the result Dietary Reference Intakes This new series of references greatly extends the scope and application of previous nutrient guidelines For each nutrient the book presents what is known about how the nutrient functions in the human body what the best method is to determine its requirements which factors caffeine or exercise for example may affect how it works and how the nutrient may be related to chronic disease This volume of the series presents information about thiamin riboflavin niacin vitamin B6 folate vitamin B12 pantothenic acid biotin and choline Based on analysis of nutrient metabolism in humans and data on intakes in the U S population the committee recommends intakes for each age group from the first days of life through childhood sexual maturity midlife and the later years Recommendations for pregnancy and lactation also are made and the book identifies when intake of a nutrient may be too much Representing a new paradigm for the nutrition community Dietary Reference Intakes encompasses Estimated Average Requirements EARs These are used to set Recommended Dietary Allowances Recommended Dietary Allowances RDAs Intakes that meet the RDA are likely to meet the nutrient requirement of nearly all individuals in a life stage and gender group Adequate Intakes AIs These are used instead of RDAs when an EAR cannot be calculated Both the RDA and the AI may be used as goals for individual intake Tolerable Upper Intake Levels ULs Intakes below the UL are unlikely to pose risks of adverse health effects in healthy people This new framework encompasses both essential nutrients and other food components thought to play a role in health such as dietary fiber It incorporates functional endpoints and examines the relationship between dose and response in determining adequacy and the hazards of excess

intake for each nutrient Herb, Nutrient, and Drug Interactions Mitchell Bebel Stargrove, Jonathan Treasure, Dwight L. McKee, 2007-12-06 Presenting detailed evidence based coverage of the most commonly encountered therapeutic agents in modern clinical practice this resource is designed to help you safely and effectively integrate herbal nutrient and drug therapy for your patients or clients Combining pharmaceuticals with herbs or supplements may complement or interfere with a drug s therapeutic action or may increase adverse effects Additionally drug induced depletion of nutrients can occur Comprehensive clinical data quick reference features and the insight and expertise of trusted authorities help you gain a confident understanding of how herbal remedies and nutritional supplements interact with pharmaceuticals and develop safe individualized treatment strategies for your patients More than 60 comprehensive monographs of herb drug and nutrient drug interactions cover the most commonly used herbs and nutrients in health related practice and help you coordinate safe reliable therapy Each herb and nutrient monograph features summary tables and concise practical suggestions that provide quick and easy reference and complement the systematic review and in depth analysis References included on the bound in CD provide high quality evidence based support Unique icons throughout the text differentiate interactions evidence and clinical significance Up to date information keeps you current with the latest developments in pharmacology nutrition phytotherapy biochemistry genomics oncology hematology naturopathic medicine Chinese medicine and other fields A diverse team of authoritative experts lends valuable trans disciplinary insight *Nutrition Survey: pt. 1] East Pakistan, by the Ministry of Health, Govt. of Pakistan ... and the Nutrition Section Office of International Research, National Institutes of Health* United States. Nutrition Program, 1956 Nutritional Management of Diabetes Mellitus Gary Frost, Anne Dornhorst, Robert Moses, 2003-08-29 Diabetes mellitus is a common disorder where the body is no longer able to regulate blood glucose levels correctly owing to defects in insulin secretion or action While some people require treatment with insulin many are able to control their diabetes through management of diet e g by decreasing the fat intake and increasing the amount of fibre This book provides an up to date review of the dietary management of diabetes looking at general topics such as the metabolic principles of nutrition as well as more specific topics such as nutritional management of diabetic children pregnant women and the elderly A specialist text on the nutritional management of diabetes A practical book useful in clinical practice Written by well respected clinicians within the field Nutrition in the Prevention and Treatment of Disease Ann M. Coulston, Carol J. Boushey, Mario Ferruzzi, Linda Delahanty, 2017-04-28 Nutrition in the Prevention and Treatment of Disease Fourth Edition is a compilation of current knowledge in clinical nutrition and an overview of the rationale and science base of its application to practice in the prevention and treatment of disease In its fourth edition this text continues the tradition of incorporating new discoveries and methods related to this important area of research Generating and analyzing data that summarize dietary intake and its association with disease are valuable tasks in treating disease and developing disease prevention strategies Well founded medical nutrition therapies can minimize disease

development and related complications Providing scientifically sound creative and effective nutrition interventions is both challenging and rewarding Two new chapters on metabolomics and translational research which have come to be used in nutrition research in recent years The new areas of study are discussed with the perspective that the application of the scientific method is by definition an evolutionary process A new chapter on Genetics and Diabetes which reviews the latest research on causal genetic variants and biological mechanisms responsible for the disease and explores potential interactions with environmental factors such as diet and lifestyle Includes all major omics the exposome metabolomics genomics and the gut microbiome Expands the microbiota portions to reflect complexity of diet on gut microbial ecology metabolism and health

Nutrition and Patients Royal College of Physicians of London, 2002 This report looks at how under and over nutrition is closely linked to illness and disease affecting both the response to medical treatments and eventual recovery

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