



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  $\geq 3.8$  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

# Nutritional Clinical Significance Of

**Lewis A. Barness, Yank D.  
Coble, Donald Ian MacDonald, George  
Christakis**

## **Nutritional Clinical Significance Of:**

*Importance of body composition analysis in clinical nutrition* Clelia Madeddu, Lidia Santarpia, Maria Letizia Petroni, Alberto Bazzocchi, 2023-02-15      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 thorough 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      **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      New Aspects of Clinical Nutrition G. Kleinberger, E. Deutsch, 1983-02-03      **Nutrition Education--1972[-1973]. Hearings, Ninety-second Congress, Second Session[--Ninety-third Congress, First Session].** United States. Congress. Senate. Select Committee on Nutrition and Human Needs, 1973      **Clinical nutrition and oncologic outcomes - Volume 1** Paula Ravasco, Antti Mäkitie, Faith Ottery, Kalliopi-Anna Poulia, Lucio Lara Santos, 2023-05-25      *Clinical Nutrition and Oncologic Outcomes, Volume II* Antti Mäkitie, 2023-11-07      **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      **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.

*Toxicological Risk Assessment and Multi-System Health Impacts from Exposure* Aristidis M. Tsatsakis, 2021-08-01. This book 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.

**The Importance of Vitamins to Human Health** J.A. Taylor, 2012-12-06. The Kellogg Company ranks among the world's leading food manufacturers and it follows therefore that our corporate policies are important to human health. Indeed food manufacturers as a combined industrial force must bear a major responsibility for the health of mankind because commercially processed foods are increasingly an indispensable part of the mosaic of human nutrition. This is particularly true in advanced industrialised societies. Here in Great Britain 40% of the people live in major conurbations and 41 % of the food they eat is either pre cooked or preserved, compounded or frozen, dehydrated or concentrated or modified in some other way to satisfy a consumer need or preference. These preferences are communicated to the manufacturer through the competitive forces of the market and are then translated into products in their most attractive and saleable form. However it is questionable how far consumer choice, depending largely on sight and taste, can be relied upon to ensure a correctly balanced and nutritionally adequate diet. The probable answer is that if we all relied solely on our senses and our appetites many of us would be suffering from some form of nutritional imbalance. A serious nutritional responsibility.

therefore rests with the modern food manufacturer We at Kellogg s are conscious of the need not only to make the foods we produce attractive to the purse and palate but to ensure that they make a sound contribution in nutritional terms **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 Education--1972[-1973].** United States. Congress. Senate. Select Committee on Nutrition and Human Needs,1973 *Nutrition Education, 1972* United States. Congress. Senate. Select Committee on Nutrition and Human Needs,1973 **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 **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 formulating 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 (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) 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) are intakes below the UL that 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.

Nutritional Status Assessment and its Links with Chronic Disease Prognosis and Surgical Outcomes

Gabriela Villação 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

**Nutrition for the Hospitalized Patient** Torosian,1995-01-25 This work offers detailed coverage of the biochemical and metabolic framework that forms the basis for the current theory of nutrition support It presents analyses of the practical aspects of providing nutrition to hospitalized patients and examines nutrition support in critical care and sepsis cancer gastrointestinal disease cardiac and pulmonary disease burns renal failure newborns and children pregnancy AIDS neurological impairment and perioperative patients *Nutritional Value of Amaranth* Viduranga Yashasvi

Waisundara,2020-03-18 Pseudocereals belonging to the genus *Amaranthus* have been cultivated for their grains for 8 000 years or more The grain was a staple food of the Aztecs and was also considered an integral part of Aztec religious ceremonies The book primarily focuses on the nutrient properties of amaranth and expresses its viewpoint in considering this crop as a remedy for many nutrient deficiencies and curbing food insecurity The functional properties of the grain are immense and it is clear that the crop would be a valuable agricultural product around the world Daily and Nocturnal

Hemodialysis Robert M. Lindsay,2004-01-01 As the frequency of hemodialysis sessions has always been a concern it is not astonishing that interest in quotidian daily hemodialysis appears to be growing worldwide The main reasons for more frequent dialysis are to maximize well being and minimize both intra and interdialytic symptoms as well as to improve the treatment of patients with severe underlying medical problems particularly cardiovascular disease Moreover studies also indicate overall potential cost savings as compared with current conventional hemodialysis There are two options available namely short daily and long nightly treatments The main difference centers on the ability of the nightly regimen to remove greater amounts of phosphate and beta 2 microglobulin Even so there is no doubt that both treatments are highly preferable to conventional three times weekly dialysis Further issues which are discussed include the requirements necessary to run dialysis programs vascular access requirements and the management of complications and risks such as calcium and phosphorus control This is the first publication devoted solely to daily hemodialysis therapies Concentrating on clinical and technical issues it is an important contribution to the practical development of daily hemodialysis and is highly recommended to nephrologists nurses managers of renal programs and others involved in renal care

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