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Feature Article

Nutritional profile of older adults with chronic venous leg ulcers: A pilot study

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ABSTRACT

The purpose of this cross-sectional descriptive pilot study was to describe daily intake of select nutrients important for efficient wound healing and general health in a sample of older adults (64.25 ± 9.49 years of age) with chronic venous leg ulcers (CVLUs; $N = 12$), compared to recommended dietary allowances (RDA). Anthropometric data were also collected. Compared to RDA, participants on average consumed lower vitamin C (60.03 ± 49.73 mg/d) and higher sodium (3197.07 ± 1455.04 mg/d), sugar (181.21 ± 115.45 g/d), and saturated fat (33.75 ± 1.06 g/d). They also demonstrated a relatively high plasma n-6/n-3 polyunsaturated fatty acid ratio, a biomarker of inflammation (11.25 ± 1.99). The mean body mass index indicated extreme obesity (41.48 ± 11.47). A multidisciplinary treatment approach that includes routine dietary assessments followed by tailored dietary interventions may improve wound healing and long-term health outcomes in this population.

Introduction

Chronic venous leg ulcers (CVLUs) are significant clinical problems affecting approximately 600,000 Americans annually,[1] including ~3.6% of people over 65 years of age.[2] Moreover, the global incidence of CVLUs is predicted to escalate dramatically, in tandem with the rising numbers of older adults because CVLUs are associated with aging.[1] Currently, annual CVLU treatment-related costs to the U.S. health care system are >$3.5 billion, directly related to protracted healing times.[1] Only an estimated 50–65% of CVLUs heal within six months of diagnosis, 20% remain unhealed after two years, and 8% remain unhealed after five years.[1] Further, the recurrence rate is nearly 50%.[3] Thus, cost-effective adjunct treatment strategies are needed to help prevent or facilitate healing of these problematic wounds.

The pathobiology of CVLUs involves sustained venous hypertension leading to leaky vessels and high levels of activated pro-inflammatory cytokines and proteases in wound microenvironments that contribute to chronic inflammation.[1] Although inflammation is the essential initial stage of healing, chronic inflammation prevents or delays subsequent healing stages.[4] Treatment regimens for CVLUs include compression therapy (gold standard) and various types of wound dressings targeting excessive drainage and/or bacterial overgrowth.[5] Additionally, it is important that adequate levels of oxygen and key nutrients such as vitamin C and zinc reach the site of tissue damage to facilitate reparative processes.[6] Patients with chronic wounds may require higher than recommended dietary allowances (RDA) of certain nutrients to expedite healing because of a heightened metabolism triggered by chronic inflammation and increased cellular activity at wound sites.[6] Thus, individuals' overall cardiovascular health and nutritional status affect healing outcomes.[6] Unfortunately, the nutritional status of older adults is often suboptimal because of comorbidities, physical limitations, damaged teeth, chewing and swallowing difficulties, multiple medication usage, or limited access to healthy foods due to a lack of social support, transportation, and income.[6,7] Malnutrition among older adults has been described as a growing, but still unaddressed, epidemic.[8] This could have profound effects on the incidence of chronic wounds and wound healing in the aging population.

Low intake of vitamin C, zinc, and protein has been associated with healing delays in older adults with pressure ulcers.[9–12] However, few studies have evaluated the nutritional status of older adults with CVLUs, and the findings have been inconsistent.[1,13] Moreover, there are limited data regarding weights of CVLU patients and how obesity may affect wound healing. Thus, the primary purpose of this cross-sectional pilot study was to describe the nutritional profile of a sample of older adults with CVLUs by comparing their average daily intake levels of nutrients known to affect wound healing, inflammation status, and general health to

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recommendations by public health organizations such as the Institute of Medicine (IOM) dietary reference intake (DRI) and USDA RDA (both called RDA herein). Secondary aims were to describe the group's anthropometric measures, comorbidities, and dietary supplement use. The main hypothesis was that most participants would not meet national guidelines for daily intake levels of key nutrients important for optimal health and would have high levels of systemic inflammation that collectively could contribute to wound healing delays and other chronic diseases. This pilot study was a preliminary step to generate evidence for future studies to determine if dietary assessments should be a component of standard care for this population and whether dietary interventions in this population could promote healing.

Materials and methods

Design

This pilot study used a descriptive, cross-sectional design to assess the dietary intake levels of nutrients important for wound healing and general health in a sample of older adults with CVLUs during one study visit wherein they self-reported nutritional data. Sociodemographic data, anthropometric data, plasma polyunsaturated fatty acid (PUFA) data and opinions about dietary supplement use were also collected. Individuals received $100 for participating in the one-visit study.

Potential participants were identified from University Wound Clinic records and approached about the study if they had an existing wound (CVLU) for at least three months, were English-speaking, and were able to sign their own consent. Exclusion criteria included taking fish oil (n-3 PUFAs) supplements or already in a study related to CVLUs. The Institutional Review Board (IRB) approved the study, which was conducted in compliance with ethical rules for human experimentation as stated in the 1975 Declaration of Helsinki.

Setting

The study was conducted in the Clinical Research Center (CRC) of a large university in the Midwest United States. The CRC provided a high-quality, ethical, safe, efficient, and cost-effective environment in which to complete the study protocol.

Participants

Data collected from 12 individuals (64.25 ± 9.49 years of age) who were diagnosed with at least one CVLU were used for analysis. Eighteen patients were approached about the study; 18 met eligibility criteria; 12 were interested in participation; 12 were consented.

Data collection

After potential participants expressed interest in the study, a confidential screening interview was performed to confirm eligibility. Participants were instructed to consume only clear fluids during the 8 h prior to their one-time study appointment to fulfill plasma PUFA assay requirements. Study details were reviewed again when individuals arrived at the CRC, and time was allowed for questions before a consent form was presented for signature. Sociodemographic, anthropometric, and nutritional supplement data were collected; body mass index (BMI) was calculated; and a blood sample was collected to quantify plasma PUFA levels. Then study participants received instructions on completing the electronic food frequency questionnaire (FFQ) that collected data about nutrient intake from foods.

Sociodemographic and nutritional supplement measures

Participants completed an electronic health and lifestyle questionnaire wherein they self-reported gender, age, income level, years of education, race/ethnicity, nutritional supplement use, and opinions about taking nutritional supplements to improve wound healing.

Nutrient measures

Food Frequency Questionnaire

An electronic form of the FFQ validated by the Women's Health Initiative, the VioFFQ (VIOCARE, Inc., Princeton, NJ), was used to collect nutrient data.[14] It is a web-based system that allows participants to self-administer the questionnaire using a tablet via internet connection. Participants watched a 9-min instructional video about portion size and received instruction on VioFFQ completion. The VioFFQ asks questions about type, frequency, and quantity of foods and beverages consumed in the previous 90 days. Bias and precision of the FFQ used in the current study have been assessed by comparing the intake of 30 nutrients estimated from the FFQ with means from four 24-h dietary recalls and a 4-day food record. For most nutrients, means estimated by the FFQ were within 10% of the records or recalls. Precision, defined as the correlation between the FFQ and the records and recalls, was similar to other FFQs. Energy adjusted correlation coefficients ranged from 0.2 (vitamin B12) to 0.7 (magnesium), with a mean of 0.5. Thus, this FFQ generated nutrient estimates that were similar to those obtained from short-term dietary recall and recording methods.[14] CRC Registered Dietitian Nutritionists were available to answer participants' questions and assist as needed. Data generated included a nutrient analysis of reported diet on a per-day basis. Nutrient databases used include the Nutrition Data System for Research (NDSR), which includes all United States Department of Agriculture (USDA) databases and corresponding consumer, manufacturer, and science review board updates.

Plasma PUFA data

Plasma PUFAs were analyzed by the well-established gas chromatography/mass spectrometry (GC/MS) method. Lipids were extracted from plasma samples with 2:1 (v/v) chloroform:methanol and 0.24 ml 0.88% KCL.[15–17] Fatty acid methyl esters were prepared using tetramethylguanidine at 100 °C.[16,17] Fatty acid methyl esters were analyzed by gas chromatography using a 30-m Omegawax™ 320 (Sigma–Aldrich, St. Louis, MO) capillary column. Oven temperature was started at 175 °C and increased at a rate of 3 °C/min until reaching 220 °C. Flow rate of the carrier gas helium was 30 mL/min. Retention times were compared to standards for fatty acid methyl esters (Sigma–Aldrich, St. Louis, MO, and Matreya, LLC, Pleasant Gap, PA). The resultant values were expressed as % composition. This is routinely done to express fatty acid values and widely accepted in the field.[15–17]

Anthropometric measures

Height and weight were measured, and BMI was calculated by CRC research nurses. Height was measured using the Harpenden Stadiometer (Holtain Limited, Crymych, Dyfed, UK) to the nearest 0.1 cm. Measurement of stature can be performed accurately and quickly using the Harpenden stadiometer, which delivers results reproducible within ±0.29 cm.[18] Body weight was measured using the Seca 644 digital multifunctional handrail scale, model number 6441321108, made in Hamburg, Germany, to the nearest 0.1 kg. The