ORIGINAL RESEARCH

Self-Reported Interview-Assisted Diet Records Underreport Energy Intake in Maintenance Hemodialysis Patients

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Objectives: Studies suggest that maintenance hemodialysis (MHD) patients report dietary energy intakes (EIs) that are lower than what is actually ingested. Data supporting this conclusion have several important limitations. The present study introduces a novel approach of assessing underreporting of EI in MHD patients.

Design: Comparisons of EI of free-living MHD patients determined from food records to their measured energy needs.

Setting: Metabolic research ward.

Subjects: Thirteen clinically stable MHD patients with unchanging weights whose EI was assessed by dietitian interview-assisted 3-day food records.

Intervention: EI was compared with (1) patients' resting energy expenditure (REE), measured by indirect calorimetry, and estimated total energy expenditure (TEE) and (2) patients' dietary energy requirements (DER) measured while patients underwent nitrogen balance studies and consumed a constant energy diet in a research ward for a mean duration of 89.5 days. DER was calculated as the actual EI during the research study corrected for changes in body fat and lean body mass measured by Dual X-Ray Absorptiometry.

Main Outcome Measure: Underreporting of EI was determined by an EI:REE ratio <1.27 and an EI:TEE ratio or EI:DEE ratio <1.0.

Results: Seven of the 13 MHD patients studied were male. Patient's ages were 47.7 ± standard deviation 9.7 years; body mass index averaged 25.4 ± 2.8 kg/m^2, and dialysis vintage was 53.3 ± 37.1 months. The EI:REE ratio (1.03 ± 0.23) was significantly less than the cutoff value for underreporting of 1.27 ($P = .001$); 12 of 13 patients had EI:REE ratios <1.27. The mean EI:TEE ratio was significantly less than the cutoff value of 1.0 (0.73 ± 0.17, $P < .0001$), and 12 MHD patients had EI:TEE ratios <1.0. The EI:DER ratio was also <1.0 (0.83 ± 0.25, $P = .012$), and 10 MHD had EI:DER ratios <1.0.

Conclusions: Dietitian interview-assisted diet records by MHD patients substantially underestimate the patient's dietary EI.

Introduction

PROTEIN-ENERGY WASTING (PEW) is a highly prevalent complication of maintenance hemodialysis (MHD) patients[1–4] and is associated with much higher mortality.[5,6] Because reduced energy intake (EI) may contribute to PEW, it is important to assess dietary EI in MHD patients in their normal outpatient environment. A question arises as to the degree of accuracy of dietary food records or dietetic interviews for assessing EI in MHD patients. To the authors' knowledge, 4 previous studies have addressed this question. One older study demonstrated that in MHD patients whose reported calorie intakes were lower (below 30 kcal/kg/day) than the intakes routinely provided for hospitalized individuals, little change in their body weight was observed over a period of several months.[7] Three subsequent studies have more directly assessed the question of underreporting of EI in MHD patients.[8–10] All 3 of these studies were limited by comparing reported EI to previously published estimates of energy expenditure based on the patients' body weights. Moreover, only one of these reports established that patients were weight stable at or during the time of study.[8] This is an essential component of a study assessing accuracy of reported dietary EIs because a low reported EI is also consistent with an accurate report of EI with weight loss.

The present study presents a novel approach to investigate the accuracy of reported EI in MHD patients. Reported EI, determined by dietitian interview-assisted 3-day food records, was assessed in 13 clinically stable MHD patients who had stable postdialysis body weights

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before, and during, the period of study. Two techniques were used to assess underreporting:

(1) Comparing the patients' reported EI to their resting energy expenditure (REE) measured by indirect calorimetry and to a validated estimate of total energy expenditure (TEE) and (2) comparing the patients' reported EI to their actual dietary energy requirements (DERs) for weight stability, measured under the strict protocol of a long-term (mean, 89.5 days) classical nitrogen balance study in which constant energy diets were meticulously prepared and fed to MHD patients for relatively long periods of time. DER was ascertained using the patients' actual EI during the study corrected for changes in the patients' body fat and lean mass as measured by DEXA. Underreporting was determined by an EI:REE ratio <1.27 or by an EI:TEE ratio or EI:DER ratio <1.0.

Subjects and Methods

Study Overview and Subjects

This study was a component of an investigation of dietary protein needs in 13 clinically stable MHD patients who lived in the metabolic research ward (Clinical and Translational Science Institute, CTSI) at Harbor-UCLA Medical Center for an average of 89.5 days. Patients recruited for the metabolic study were selected from a pool of approximately 1,040 eligible MHD patients undergoing dialysis treatment in 12 chronic hemodialysis centers in the South Bay area of Los Angeles. Patients were assigned, in random order, to receive diets providing about 0.6, 0.8, 1.0, 1.15, and 1.30 g protein/kg/day. Except for one protein intake fed to 1 patient for 11 days, each diet was fed for 16 to 22 days. All dialysate, feces, and urine, if any, were collected continuously and about 4 to 5 additional 24-hour dietary intakes were prepared. These specimens were each analyzed for nitrogen. Patients were hemodialysis with Fresenius F60 or F80® polysulphone hemodialyzers (Fresenius Medical Care, Bad Homburg, Germany). Blood flows were 400 mL/minute; dialysate flows were 800 mL/minute, and glucose in dialysate concentrations were 200 mg/dL (182 mg anhydrous glucose/dL).

Patients were recruited from DaVita Dialysis Centers in Los Angeles, California, and were selected for the study on the basis of the following criteria. Inclusion criteria: (1) ages 25 to 65 years, (2) men and women of all racial and ethnic groups, (3) MHD treatment 3-times weekly for $\geq$6 months (at the time that the nitrogen balance studies commenced), (4) serum albumin $\geq$3.6 g/dL, (5) serum hemoglobin $\geq$11 g/dL, and (6) relative body weight of 90% to 115% of NHANES II median body weights. Exclusion criteria: (1) moderate-or-severe PEW, (2) existing cancer other than basal cell carcinoma, (3) severe heart, lung, or liver disease, (4) poorly controlled hypertension or asthma, chronic systemic infection, active vasculitis, or any systemic inflammatory process, symptomatic musculoskeletal disease or neuropathy, or amputations of the lower extremities, (5) insulin-dependent or insulin-independent diabetes mellitus, (6) pregnancy, (7) history of alcohol or drug abuse, (8) treatment with L-carnitine or anabolic hormones within the previous 6 months, (9) psychosis or inability to give informed consent or to follow the protocol.

This study was approved by the Institutional Review Board of the Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center (US Gov. Trials No. NCT02194114).

Free-Living EI

The patients' EI while living at home was assessed from an interview-assisted food record. Subjects were carefully instructed by a trained dietitian to record their total food intake for 3 consecutive days including at least 1 dialysis treatment day, at least 1 weekday and at least one weekend day. Patients were instructed to record the quantity of all food and beverages consumed in household measures or by weight and to record methods of food preparation, brand names and ingredients of foods, and recipes of mixed dishes when possible. A dietitian reviewed the completed food record with each patient for clarification of food details and amounts. The dietary records and interviews and the metabolic studies of the patients were conducted during every season of the year. The 3-day food record was analyzed using Nutrition Data System for Research software (v4.06/34; Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN). Postdialysis body weights in the 13 MHD patients were recorded over a 2-month period that ended at the time these outpatient diaries and interviews measurements were conducted.

Resting Energy Expenditure

Assessments of REE were generally performed within 24 to 96 hours of completing the interview-assisted food records. Energy needs were measured under standard basal metabolic rate conditions by indirect calorimetry using an open-circuit, ventilated, computerized metabolic system (Vmax Spectra series model V29n, Sensor Medics Corporation/VIASYS health care, Yorba Linda, CA). Patients were admitted the night before the measurement and were fasted from 9:00 PM. until after the test the following morning between 7:00 AM and 8:00 AM. Patients rested for 30 minutes before and during the measurement in the supine position in a quiet thermoneutral room with the lights semidarkened. A transparent plastic hood was placed over the patients' head with the vinyl skirt covering the torso and airflow. O_2 consumption and CO_2 production were measured continuously for 30 to 40 minutes. Five minutes of data were allowed to expire before initiating formal data collection to allow for acclimation to the apparatus. Data points were collected every 30 seconds and steady state was defined as 10 minutes during which the volume of oxygen consumed, expired ventilation, and respiratory quotient did not vary $>$7%. REE was calculated using the following equation: