Introduction and Aims: Kidneys play an important role in energy metabolism and whole body protein turnover. The relationship between whole body protein turnover and resting energy expenditure in chronic kidney disease (CKD) has not been explored. The aim of this study was to examine the alterations in protein turnover in advanced chronic kidney disease and to calculate the energetic cost of protein turnover in this patient population.

Methods: We recruited 6 pre-dialysis CKD (eGFR < 20 ml/min) and 6 haemodialysis (HD) patients who were age and sex matched. Participants prospectively completed a food diary for 3 days prior to the study for estimation of protein intake. Demographic and anthropometric data was collected from medical records and direct measurements. Resting energy expenditure was measured using indirect calorimetry with a ventilated hood system. Whole body protein turnover was measured using a continuous intravenous infusion of 13C-leucine stable isotope over 3 hours after an overnight fast. Blood and breath samples were collected at specified intervals for measurement of isotopic enrichment of α-ketocisacaproate and Carbon dioxide which enabled calculation of whole body protein turnover.

Results: There were 6 females and 5 males included in the analyses. One pre-dialysis CKD patient was excluded due to elevated C-reactive protein titres on the study day. The mean age of the cohort was 65.3 (± 8.2) years. Mean body weight was 73.8 (± 8.9) kg. Mean protein intake was 0.94 (± 0.21) g/kg/day. There was no difference in age, body size parameters and protein intake between pre-dialysis and HD groups. Mean resting energy expenditure was 1317 ± 225 kcal/day. Protein synthesis rate was significantly higher in HD patients compared to pre-dialysis patients (89.9 ± 6.6 vs. 75.3 ± 10.1 µmol/kg/hr, p = 0.02). Protein breakdown rate was also significantly higher in HD patients (98.2 ± 5.2 vs. 85.3 ± 12.7 µmol/kg/hr, p = 0.04). The net balance of protein turnover, which is the difference between synthesis and breakdown rates, was -8.3 (±4.5) µmol/kg/hr in HD and -9.9 (±2.8) µmol/kg/hr in pre-dialysis patients (p = 0.51). The mean energy expenditure associated with whole body protein turnover was 705 (± 85) kcal/day. This equates to a mean energetic cost of 55% of the resting energy expenditure per day for whole body protein turnover.

Conclusions: Our study shows that both pre-dialysis CKD and haemodialysis patients are in negative protein balance. Haemodialysis patients have a significantly higher protein turnover compared to pre-dialysis patients. With similar protein intake between the groups, this higher protein turnover increases the risk of malnutrition in haemodialysis patients. The energetic cost of protein turnover is comparable to those reported in healthy general population.