Association of self-reported and objective measures of physical exercise with leg muscle mitochondrial oxidative capacity in CKD

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Background

•Chronic kidney disease (CKD) is associated with skeletal muscle dysfunction leading to decreased physical functioning.

•Reduced kidney function leads to impaired muscle mitochondrial oxidative capacity underlying poor physical performance.

•The link between muscle mitochondrial oxidative capacity and patient-reported vs. objective measures of physical activity (PA) remains unclear.

•Objective: Determine the association between in-vivo leg muscle mitochondrial capacity and self-reported PA and objective PA

Methods

•We performed a cross-sectional study of participants from the Chronic Kidney Mitochondrial Energetics and Dysfunction (CKD-MEND) study.

•Muscle mitochondrial oxidative capacity (ATPmax) in the tibialis anterior muscle was measured using in vivo ^{31}Phosphorus Magnetic Resonance Spectroscopy.

•We assessed patient-reported PA with the Human Activity Profile (HAP) questionnaire and objective PA with log-transformed accelerometry counts from an Actigraph accelerometer worn over a 14-day period.

•Multivariable linear regression was used to test associations between CKD status with ATPmax in nested models separately adjusting for HAP scores or objective PA.

Results

Table 1: Participant characteristics

	CKD (N=40)	Control (N=19)
Age (years), mean (SD)	62 (14)	60 (8)
Female, No (%)	22 (55)	6 (32)
Black, No (%)	5 (13)	2 (11)
Diabetes, No (%)	12 (30)	6 (32)
BMI (kg/m^2), mean (SD)	28.7 (6)	27.2 (5)
Systolic BP (mmHg), mean (SD)	127 (18)	129 (12)
eGFRcr-cysc (ml/min per 1.73m^2) (SD)	38 (19)	98 (14)
Hemoglobin (gm/dL), mean (SD)	13 (2)	14.3 (2)
Bicarbonate (mmol/L) , mean (SD)	21.9 (3)	22.8 (1.7)

Figure 1. Linear regression models of the association of CKD with ATPmax

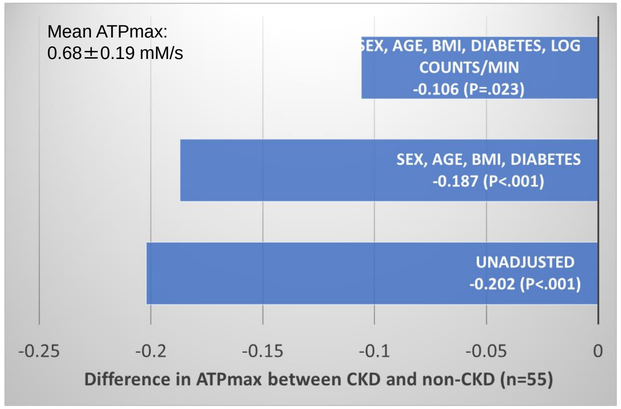


Figure 2. Association of ATPmax with objective PA

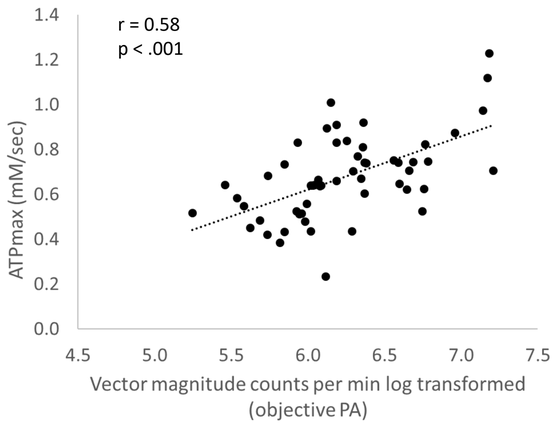
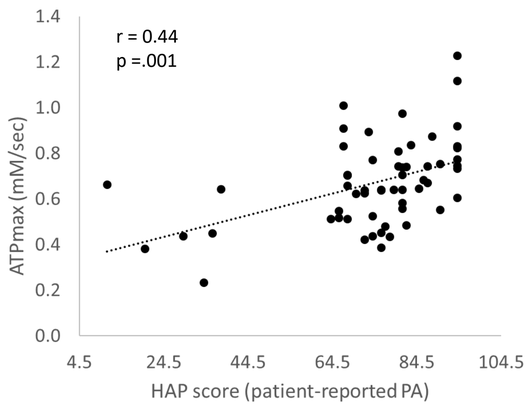


Figure 3. Association of ATPmax with self-reported PA



Results

•ATPmax was more strongly associated with accelerometry counts (objective PA) than HAP scores (self-reported PA).

•Accelerometry counts explained 43% of the difference in leg muscle ATPmax between CKD and controls (-0.106 mM/s, p=0.02) while HAP scores accounted for 15% of the ATPmax differences (-0.158 mM/s, p<0.01) after adjusting for sex, age, BMI, and diabetes.

•Diabetes and CKD were independently associated with lower ATPmax (-0.118 mM/s, p<0.01 and -0.186 mM/s, p<0.01, respectively).

Conclusions

•Objective PA measure of accelerometry counts is more strongly associated with ATPmax and explains more of the differences in ATPmax between CKD and controls than self-reported PA.

•Objective physical activity better captures the influence of habitual physical activity on muscle mitochondrial capacity.

•Further studies are needed to demonstrate if increased structured PA can improve mitochondrial oxidative capacity.

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