

Supplementary Table 1. Metabolites measured in CRIC case-control analysis

Metabolite	OR per SD	p-value
uric acid	9.72	2.9E-03
glucuronate	1.84	6.5E-03
threonine	0.35	1.0E-02
4-hydroxymandelate	5.00	1.1E-02
3-methyladipate/pimelate	1.95	1.3E-02
methionine	0.35	3.5E-02
cytosine	1.61	3.7E-02
phenylalanine	0.23	4.3E-02
homogentisate	3.32	4.4E-02
arginine	0.46	4.5E-02
cotinine	1.11	5.2E-02
inositol	2.11	5.3E-02
cAMP	1.53	5.6E-02
taurine	1.94	5.7E-02
3-hydroxyanthranilic acid	0.60	5.9E-02
sebacate	2.71	6.8E-02
histamine	0.71	7.8E-02
alpha-glycerophosphocholine	1.54	8.0E-02
lactose	1.33	8.0E-02
pentose monophosphate	1.54	9.3E-02
symmetric dimethylarginine	1.87	9.4E-02
betaine	2.79	9.8E-02
isocitrate	1.78	1.1E-01
creatine	0.72	1.1E-01
C4-methylmalonylcarnitine_B	1.56	1.1E-01
suberate	1.47	1.2E-01
1-methylnicotinamide	0.79	1.2E-01
hexose monophosphate	1.51	1.2E-01
tryptophan	0.50	1.2E-01
thymine	2.17	1.2E-01
fumarate/maleate	1.82	1.3E-01
lysine	0.44	1.3E-01
2-hydroxyglutarate	1.48	1.3E-01
hypoxanthine	1.30	1.4E-01
C3 malonylcarnitine	1.34	1.4E-01
salicylurate	0.92	1.4E-01
GMP	1.20	1.4E-01
anthranilic acid	0.68	1.4E-01
hexose diphosphate	1.51	1.5E-01
C18:2-linoleylcarnitine	1.57	1.5E-01
C5 glutarylcarnitine_A	1.41	1.5E-01
xanthurenate	0.66	1.7E-01

acetylcholine/butyrobetaine	0.59	1.8E-01
AMP	1.21	1.9E-01
3-hydroxykynurenate	1.31	1.9E-01
GDP	1.17	2.0E-01
N-carbomoyl-beta-alanine	1.47	2.1E-01
uracil	1.60	2.1E-01
erythrose-4-phosphate	1.46	2.2E-01
glutamate	1.42	2.2E-01
2-aminoadipate	0.74	2.3E-01
cytidine	1.28	2.4E-01
dimethylglycine	1.44	2.4E-01
C12 lauroylcarnitine	1.28	2.5E-01
glycocholate	1.15	2.6E-01
C9 nonanoylcarnitine	1.30	2.7E-01
pantothenate	0.83	2.7E-01
isoleucine	0.58	2.8E-01
inosine	1.21	2.8E-01
4-pyridoxate	0.91	2.9E-01
ADP	1.14	2.9E-01
C7 heptanoylcarnitine	1.37	2.9E-01
2-phosphoglycerate	0.84	3.0E-01
C14 myristoylcarnitine	1.33	3.2E-01
beta-alanine	0.69	3.3E-01
phosphocreatine	0.75	3.3E-01
sucrose	1.15	3.3E-01
malondialdehyde	1.30	3.3E-01
leucine	0.59	3.3E-01
hydroxyphenylacetate	1.26	3.6E-01
C16 palmitoylcarnitine	1.48	3.6E-01
lithocholate	1.21	3.7E-01
uridine	1.37	3.7E-01
aspartate	1.56	3.8E-01
thiamine	0.89	3.9E-01
C2 acetylcarnitine	1.53	3.9E-01
phosphocholine	0.57	3.9E-01
xanthine	1.13	3.9E-01
C18:1 oleoylcarnitine	1.33	3.9E-01
5'-adenosylhomocysteine	1.34	4.0E-01
chenodeoxycholate/deoxycholate	0.90	4.1E-01
anserine	0.91	4.2E-01
cystathionine	1.18	4.2E-01
valine	0.63	4.4E-01
C26 hexacosanoylcarnitine	1.17	4.5E-01
niacinamide	0.87	4.6E-01
C4 butyrylcarnitines	0.83	4.7E-01

lactate	1.23	4.7E-01
gentisate	0.91	4.7E-01
1-methylhistamine	0.84	4.8E-01
C6 hexanoylcarnitine	1.18	4.9E-01
C5 glutarylcarnitine_B	0.81	4.9E-01
hippurate	1.09	4.9E-01
UDP	1.10	5.0E-01
thyroxine	0.80	5.0E-01
tyrosine	0.73	5.0E-01
glycerol	1.16	5.0E-01
alpha-hydroxybutyrate	0.84	5.1E-01
aconitate	1.26	5.3E-01
histidine	0.77	5.4E-01
cystamine	0.90	5.5E-01
ornithine	0.81	5.5E-01
5-hydroxyindoleacetic acid	0.86	5.6E-01
malate	1.19	5.6E-01
glycodeoxycholate/glycochenodeoxycholate	1.07	5.6E-01
indoxyl sulfate	0.91	5.6E-01
C5 valerylcarnitine	0.84	5.7E-01
guanosine	0.84	5.8E-01
cholate	0.96	5.9E-01
taurocholate	1.05	6.0E-01
indole-3-propionate	0.94	6.0E-01
beta-hydroxybutyrate	1.06	6.0E-01
5-hydroxytryptophan	0.95	6.0E-01
pyruvate	0.90	6.1E-01
kynurenic acid	0.90	6.3E-01
glutamine	0.73	6.6E-01
taurodeoxycholate/taurochenodeoxycholate	1.04	6.9E-01
glycine	1.16	7.0E-01
sarcosine	0.86	7.1E-01
citicholine	1.05	7.1E-01
xanthosine	1.08	7.2E-01
methionine sulfoxide	0.90	7.2E-01
citrate	0.87	7.2E-01
phosphoethanolamine	0.96	7.3E-01
adipate	0.90	7.4E-01
pipecolic acid	0.95	7.4E-01
serotonin	0.97	7.4E-01
cysteamine	0.94	7.5E-01
serine	1.17	7.5E-01
carnitine	0.82	7.5E-01
IMP	1.03	7.9E-01
C3 propionylcarnitine	0.92	8.0E-01

sorbitol	1.04	8.1E-01
C10 decanoylcarnitine	1.05	8.1E-01
quinolinate	0.94	8.5E-01
C8 octanoylcarnitine	1.03	8.6E-01
C18:0 stearoylcarnitine	0.94	8.6E-01
kynurenine	0.93	8.6E-01
allantoin	1.04	8.6E-01
glucose	1.06	8.7E-01
C4 methylmalonylcarnitine_A	1.07	8.7E-01
alanine	1.08	8.7E-01
cis/trans hydroxyproline	0.96	8.8E-01
citrulline	1.06	8.8E-01
asparagine	1.07	8.9E-01
methylmalonate	1.05	8.9E-01
oxalate	0.97	9.0E-01
alpha-glycerophosphate	0.98	9.0E-01
UDP-galactose/UDP-glucose	0.99	9.1E-01
succinate	1.04	9.1E-01
propionate	0.98	9.1E-01
adenosine	1.02	9.2E-01
5-aminolevulinic acid	0.98	9.3E-01
aminoisobutyric acid	0.99	9.3E-01
fructose/glucose/galactose	1.07	9.3E-01
creatinine	0.94	9.4E-01
asymmetric dimethylarginine	0.97	9.4E-01
proline	1.03	9.6E-01
trimethylamine-N-oxide	1.01	9.6E-01
choline	1.00	1.0E+00

Supplementary Table 2. Clinical characteristics of individuals undergoing renal arteriovenous plasma sampling

Characteristic	Total n=23
Age (years)	69.5 ± 12.7
Sex	16 male/7 female
Race/ethnicity	22 Caucasian/1 Hispanic
Hypertension (%)	87
Diabetes (%)	30
Coronary artery disease (%)	65
Indication for procedure	valve disease (n=9) preoperative (n=6) dyspnea (n=5) heart transplant monitoring (n=2) other (n=1)
Serum creatinine (mg/dL)	1.06 ± 0.30
eGFR (mL/min/1.73m ²)	68.1 ± 19.2

The two individuals with ESRD who were enrolled in the protocol are not shown

Supplementary Table 3. Mean metabolite V/A ratios in arteriovenous sampling

Metabolite	Mean V/A	p-value
creatinine	0.81	2.4E-14
choline	0.46	3.8E-12
C5 carnitine	0.72	5.3E-12
suberate	0.74	2.8E-11
C9 carnitine	0.33	4.1E-11
malate	0.39	7.8E-11
aconitate	0.72	8.4E-11
putrescine	0.31	9.5E-11
fumarate/maleate	0.49	1.0E-10
C10:2 carnitine	0.43	2.6E-10
homovanillate	0.60	5.3E-10
hypoxanthine	0.88	7.3E-10
succinate	0.49	1.2E-09
2-hydroxyglutarate	0.48	1.6E-09
arginine	1.16	2.2E-09
C7 carnitine	0.34	2.6E-09
3-methyladipate/pimelate	0.60	2.8E-09
C6 carnitine	0.57	3.0E-09
serine	1.54	3.2E-09
dimethylglycine	0.85	7.3E-09
C12:1 carnitine	0.59	7.5E-09
citrulline	0.62	8.8E-09
C12 carnitine	0.70	9.9E-09
N-carbamoyl-beta-alanine	0.82	4.6E-08
glucuronate	0.85	5.9E-08
C5:1 carnitine	0.81	6.1E-08
inositol	0.84	6.9E-08
C2 carnitine	0.87	7.5E-08
1-methylnicotinamide	0.35	9.0E-08
quinolinate	0.83	2.2E-07
alanine	1.15	5.3E-07
pentose monophosphate	0.67	5.3E-07
aminoisobutyric acid	0.54	5.4E-07
asymmetric dimethylarginine	0.85	5.5E-07
C14:1 carnitine	0.80	5.6E-07
C4 carnitine	0.79	5.9E-07
4-pyridoxate	0.47	6.4E-07
cytosine	0.80	7.1E-07
methylmalonate	0.85	7.1E-07
homogentisate	0.37	8.1E-07
4-hydroxymandelate	0.37	8.8E-07

alpha-ketoglutarate	0.78	1.2E-06
C14:2 carnitine	0.69	1.3E-06
C5-DC carnitine	0.86	1.5E-06
2-aminoadipate	0.80	1.5E-06
sebacate	0.87	1.6E-06
C10 carnitine	0.48	1.8E-06
1-methylhistamine	0.38	2.7E-06
allantoin	0.83	3.4E-06
C4-OH carnitine	0.84	3.5E-06
kynurenic acid	0.54	4.0E-06
tyrosine	1.13	5.4E-06
thymine	0.72	8.3E-06
kynurenine	0.51	8.9E-06
adipate	0.75	9.7E-06
isocitrate	0.77	1.0E-05
beta-alanine	0.73	1.1E-05
C14 carnitine	0.87	1.5E-05
C3-DC-CH3 carnitine	0.83	1.5E-05
symmetric dimethylarginine	0.89	1.9E-05
methionine	1.10	2.1E-05
orotate	0.61	2.8E-05
uridine	0.70	4.0E-05
C8 carnitine	0.40	4.7E-05
uracil	0.75	6.2E-05
betaine	1.09	7.6E-05
alpha-glycerophosphocholine	1.30	1.0E-04
gentisate	0.85	1.1E-04
indolelactate	0.92	1.9E-04
trimethylamine-N-oxide	0.84	2.0E-04
salicylurate	0.52	2.5E-04
threonine	1.07	4.4E-04
hippurate	0.34	4.6E-04
C3-DC carnitine	0.70	5.4E-04
acetylglycine	0.53	8.1E-04
pantothenate	0.88	1.4E-03
leucine	1.05	2.4E-03
asparagine	1.08	2.8E-03
proline	0.95	3.5E-03
tryptophan	1.04	5.7E-03
C26 carnitine	0.92	6.1E-03
xanthosine	0.86	7.0E-03
adenosine	0.87	1.3E-02
niacinamide	1.25	1.5E-02
uric acid	0.98	1.6E-02
C16 carnitine	0.96	2.2E-02

sorbitol	0.79	2.2E-02
C18:1 carnitine	0.95	2.7E-02
sucrose	0.80	3.2E-02
lactose	0.80	3.2E-02
glycine	0.96	3.5E-02
cotinine	0.62	4.2E-02
fructose/glucose/galactose	0.96	4.2E-02
serotonin	0.62	4.3E-02
C20 carnitine	0.85	4.6E-02
lysine	1.05	4.7E-02
xanthurenate	0.43	5.7E-02
GABA	1.06	6.2E-02
C18 carnitine	1.17	6.5E-02
chenodeoxycholate/deoxycholate	1.12	6.7E-02
NG-monomethyl-L-arginine	0.97	7.8E-02
AMP	3.48	7.9E-02
indole-3-propionate	0.96	8.9E-02
sarcosine	1.04	1.3E-01
valine	1.02	1.4E-01
glutamate	0.99	1.5E-01
hydroxyproline	0.84	1.9E-01
histamine	1.68	1.9E-01
methionine sulfoxide	0.96	1.9E-01
2/3-phosphoglycerate	1.24	1.9E-01
creatine	1.03	2.0E-01
carnitine	1.02	2.1E-01
xanthine	1.02	2.1E-01
ADP	3.97	2.5E-01
C18:2 carnitine	1.00	2.6E-01
C16-OH carnitine	1.71	2.8E-01
thiamine	0.73	2.9E-01
hydroxyphenylacetate	0.91	3.0E-01
pipecolic acid	0.99	3.2E-01
histidine	1.03	3.3E-01
3-hydroxyanthranilic acid	1.33	3.4E-01
taurine	1.02	3.6E-01
C18:1-OH carnitine	0.94	3.9E-01
pyroglutamic acid	0.97	3.9E-01
isoleucine	1.01	4.4E-01
glutamine	0.97	4.7E-01
taurodeoxycholate/taurochenodeoxycholate	1.45	5.3E-01
alpha-glycerophosphate	1.07	5.8E-01
anserine	0.91	5.9E-01
mevalonic acid	0.97	6.2E-01
glycocholate	1.05	7.4E-01

inosine	1.57	7.4E-01
cAMP	1.22	7.4E-01
C3 carnitine	1.00	7.4E-01
ornithine	1.02	9.0E-01
phenylalanine	1.00	9.2E-01
glycodeoxycholate/glycochenodeoxycholate	1.01	9.6E-01
thyroxine	1.18	9.8E-01