Electronic Supplementary Material (ESI) for Food & Function.

Supplementary Table

Table S1. The characteristics of three test loads.

	GL Load	**WR Load**	**HB Load**
Energy each load			
Kal	307.5	307.5	307.5
KJ	1286	1286	1286
Total mass (g/test load)	75	89.7	100.2
Macronutrient composition			
Protein (g)	-	7.4	10.0
Fat (g)	-	0.8	1.0
Carbohydrate (g)	75	76.5	64.5
β-glucan(g)	-	0.75	6.42
Insoluble dietary fiber (g)	-	0.7	8.7
Glycemic index	100	83 ± 5	35 ± 4

Table S2. The insulin resistance index and sensitivity index of IFG participants in the study 2.

	HB	WR	GL
HOMR-IR	2.88±1.89	2.8±1.54	2.23±1.35
ISI	54.2±8.43**††	41.5±4.37*	36.9±5.43

Note. Data are mean ± SD. HOMR-IR: Homeostasis model assessment of insulin resistance; ISI: insulin sensitivity index. HB: Highland barley; WR: White rice; GL: Glucose. * $p < 0.05$, ** $p < 0.001$, HB or WR vs. GL loads. †† $p < 0.001$, HB vs. WR loads.

Table S3. Concentrations of serum lipids in the fasting state and 2h after ingestion of three test loads in the IFG group.

	HDL-C(mmol/L)		LDL-C(mmol/L)		TG(mmol/L)		TC(mmol/L)	
	0 min	120 min	0 min	120 min	0 min	120 min	0 min	120 min
HB	1.12±0.33	1.12±0.35	4.03±0.7	3.35±0.54*	2.07±1.29	1.49±1.33	5.33±0.66	3.88±1.78*
WR	1.21±0.33	1.48±0.46	4.42±0.82	3.94±0.47	2.29±1.42	1.67±0.85	5.98±0.99	4.97±0.7
GL	1.11±0.32	1.01±0.29	4.06±0.64	3.57±0.52	3.12±2.5	2.62±1.73	5.67±0.91	5.67±0.91

Note. Data are mean ± SD. TG: Triglycerides; TC: Total cholesterol; HDL-C: High density lipoprotein cholesterol; LDL-C: Low density lipoprotein cholesterol. HB: Highland barley; WR: White rice; GL: Glucose.* $p < 0.05$, 2h after ingestion of three test loads compared with fasting state in the IFG group.

Supplementary Method

Materials, reagents and chemicals

Organic acid standards : α-hydroxybutyrate, β-hydroxybutyrate, 2-hydroxyisocaproic acid, cis-Aconitic acid, citrate, fumarate, glutaric acid, glycolic acid, lactate, malate, malonic acid, ethylmalonic acid, oxalic acid, oxaloacetate, pimelic acid, pyroglutamic acid, pyruvate, sebacic acid, suberic acid, succinate, α-ketoglutarate acid, caprylic acid, capric acid, orotic acid, isocitrate, phosphoenol pyruvate and D4-succinate, methoxylaminehydrochloride, pyridine, N-methyl-N-(trimethylsilyl)trifluoroacetamide (MSTFA) were purchased from Sigma (St Louis, MO, USA, ≥99% purity). Acetone, acetonitrile and methanol (chromatographic grade) were purchased from Thermo Fisher Scientific Company (Waltham, MA, USA). Deionized water (18 MΩ cm) from aMillipore Milli-Q water purification system was used to prepare the solutions. Stock solutions of the 24 organic acids including D4-succinate were prepared at 1mg/mL in methanol. Stock solutions of 3 organic acids (isocitrate, orotic acid, phosphoenol pyruvate) were prepared at 1mg/mL in deionized water.

Supplementary Figure

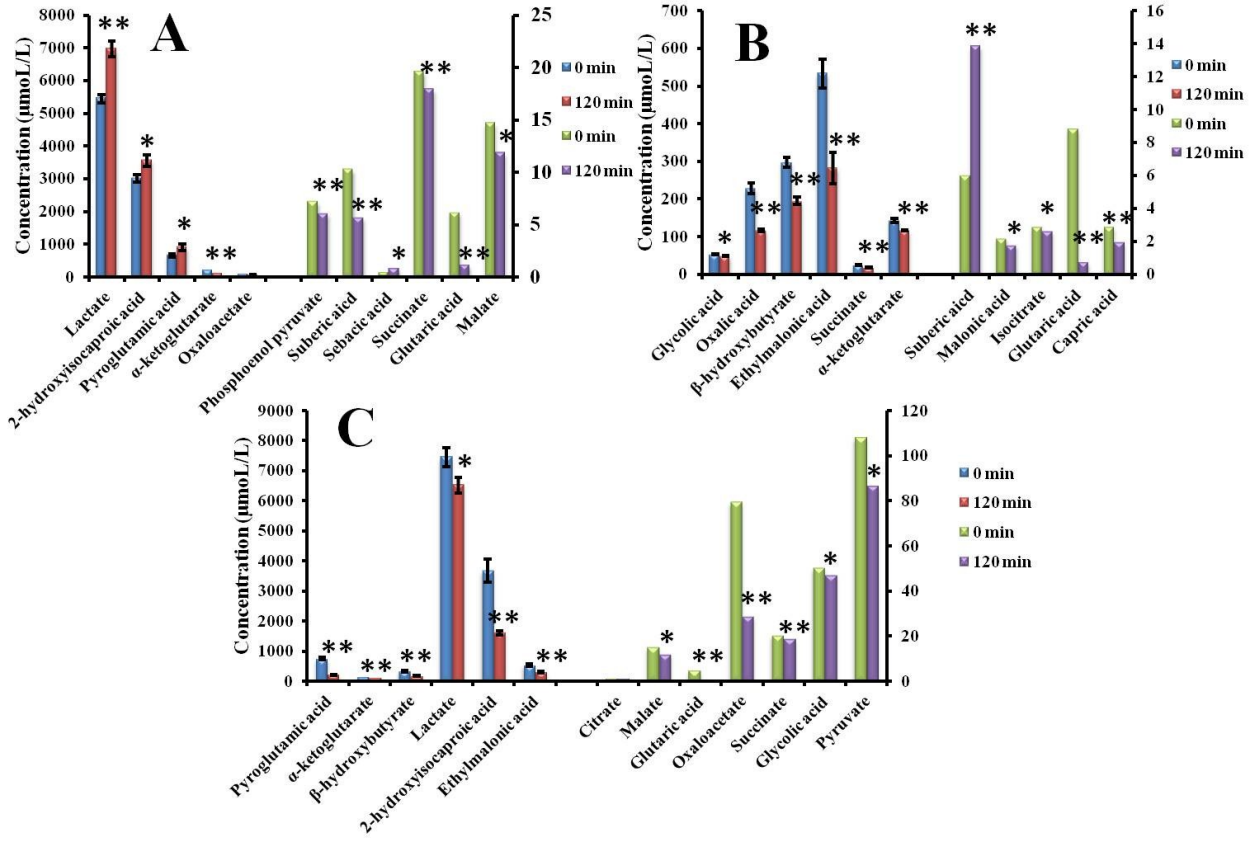

Figure S1. The concentration of significant metabolites from fasting to 2-h postprandial during the HB (A), WR (B) and GL (C) loads in the IFG group. Data are mean ± SEM. * $p < 0.05$, ** $p < 0.001$, 2h after glucose loading compared with fasting state

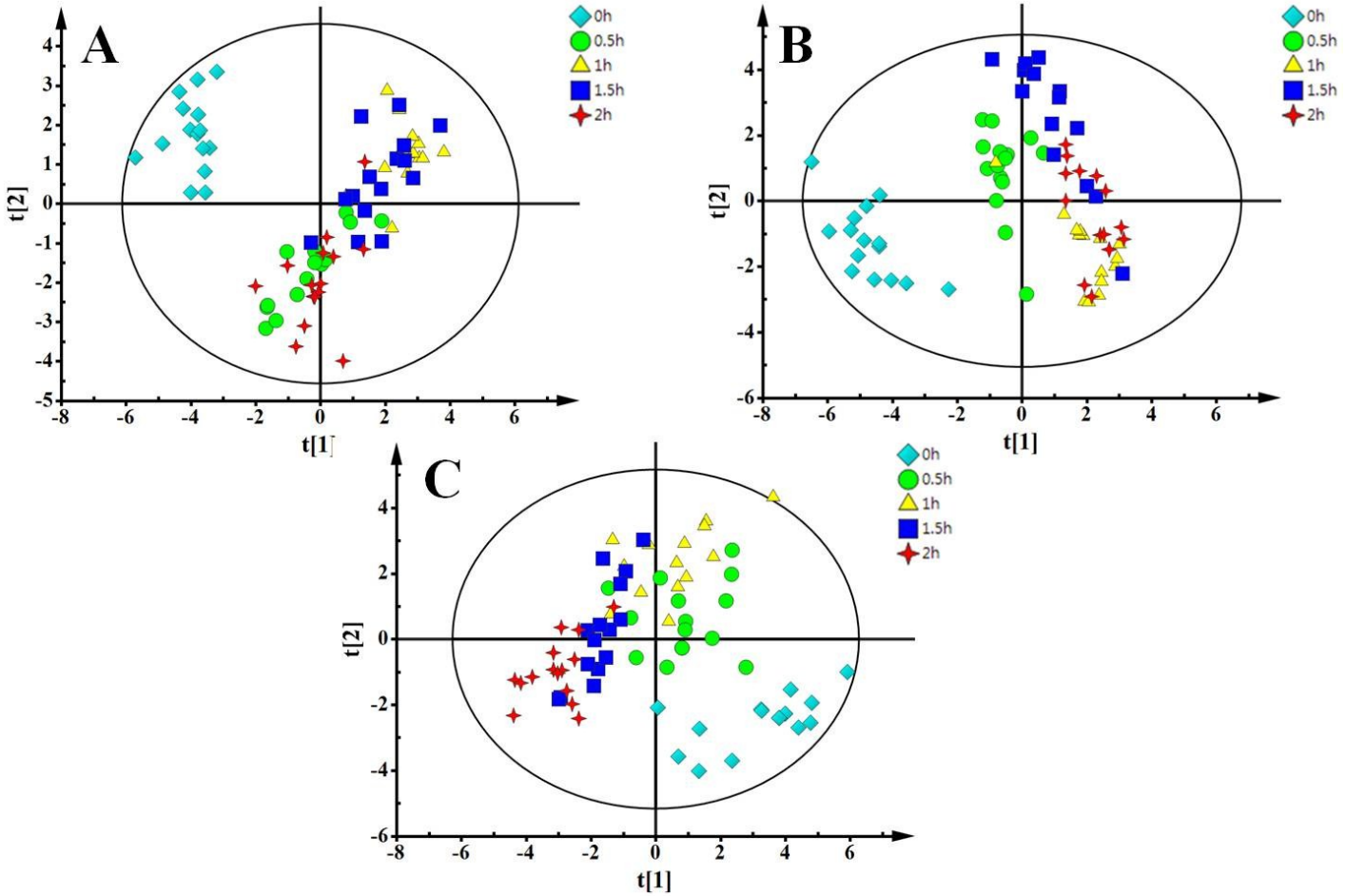

Figure S2. Scores plots from PCA model classifying the time points after the intake of HB (A), WR (B) and GL (C) loads in the IFG group. (A, R2X = 0.354, Q2 = 0.176; B, R2X = 0.434, Q2 = 0.281; C, R2X = 0.496, Q2 = 0.247).

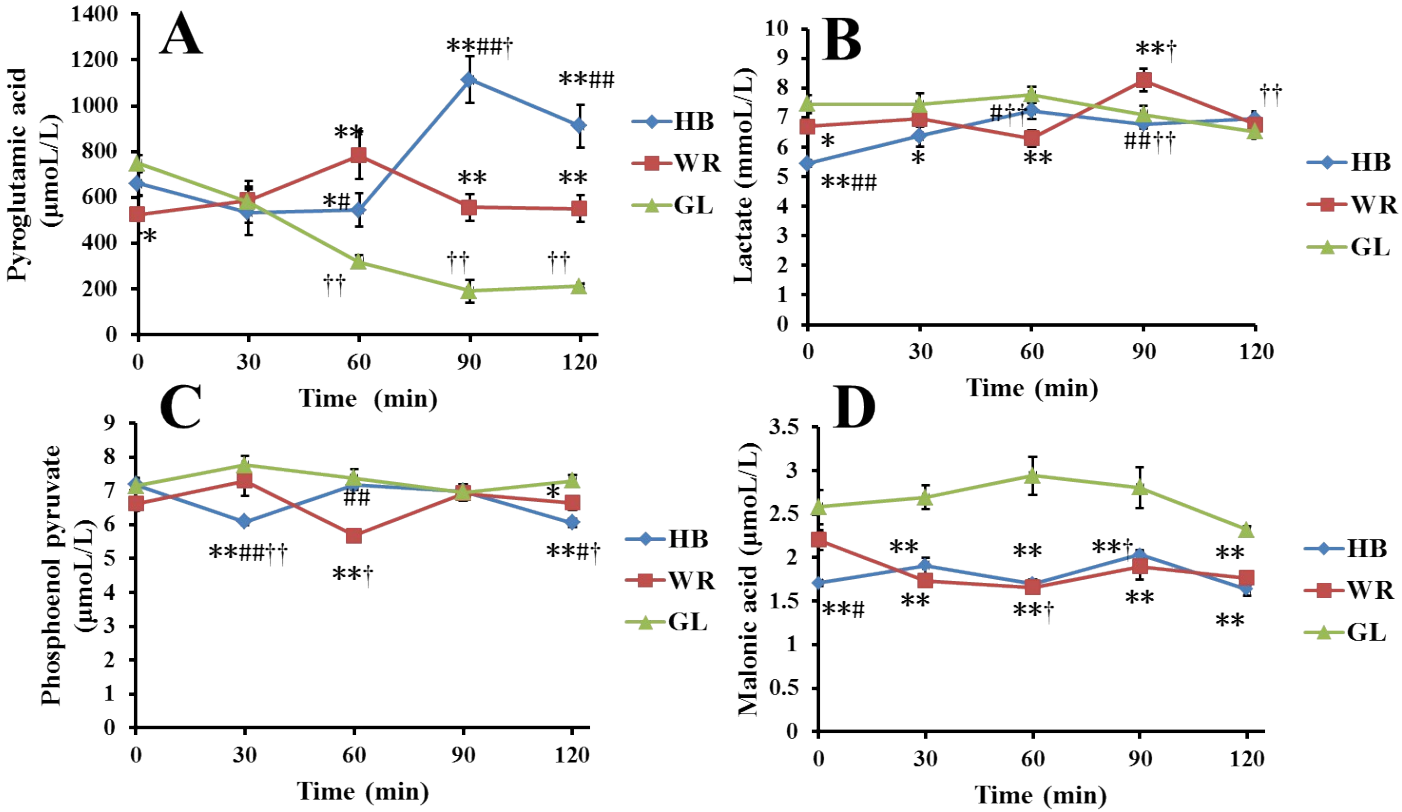

Figure S3. The changes in serum pyroglutamic acid (A), lactate (B), phosphoenol pyruvate (C) and malonic acid (D) during three test loads. GL: glucose load; WR, white rice; HB, highland barley. * $p < 0.05$, ** $p < 0.01$, HB or WR vs. GL at the same time point using repeated measures ANOVA analysis with a LSD post hoc test. # $p < 0.05$, ## $p < 0.01$, HB vs. WR at the same time point using repeated measures ANOVA analysis with LSD post hoc test. † $p < 0.05$, †† $p < 0.01$, compared with the baseline in the same treated group using multiple comparisons analysis with LSD post hoc test. Data are mean ± SEM.

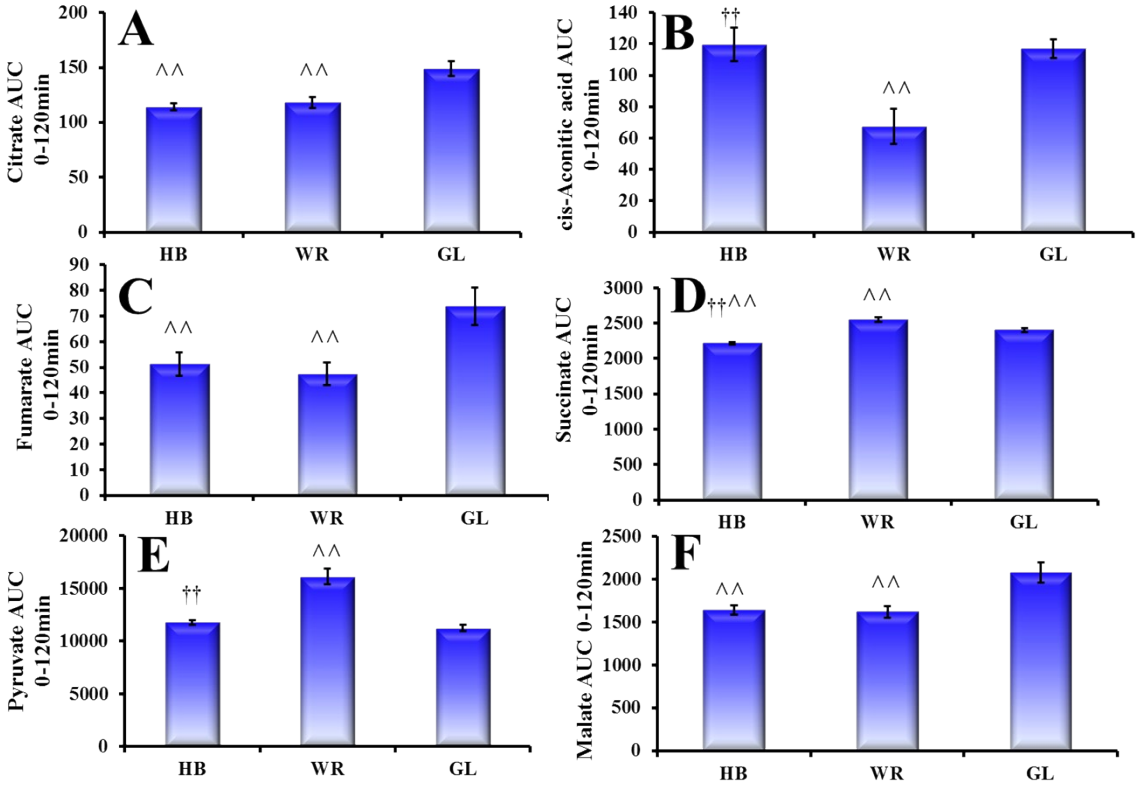

Figure S4. The AUC of serum citrate (A), cis-Aconitic acid (B), fumarate (C), succinate (D), pyruvate (E) and malate (F) between 0 and 120 min of different test loads. GL: glucose load; WR, white rice; HB, highland barley. ^ $p < 0.05$, ^^ $p < 0.01$, HB or WR compared with GL using one-way ANOVA analysis with LSD post hoc test. † $p < 0.05$, †† $p < 0.01$, HB compared with WR using one-way ANOVA analysis with LSD post hoc test. Data are mean ± SEM.

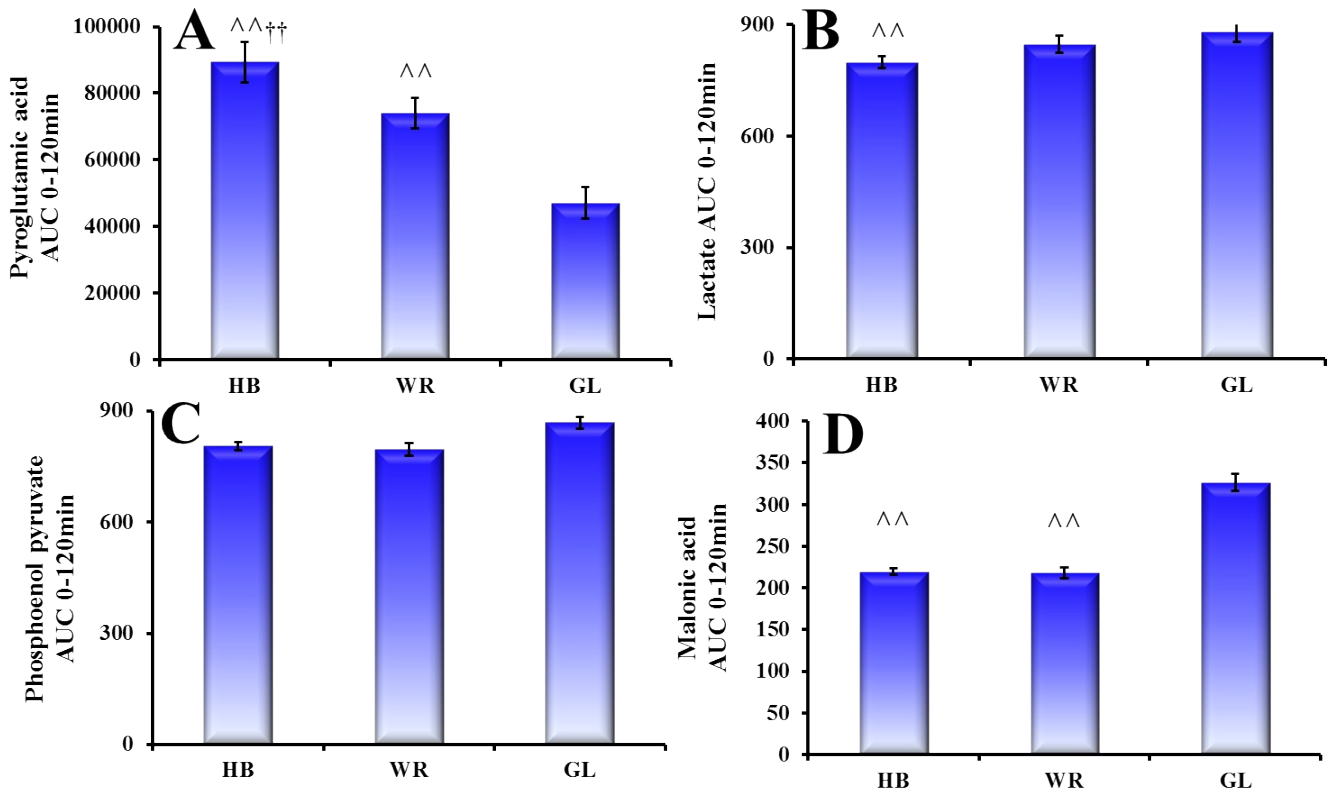

Figure S5. The AUC of serum pyroglutamic acid (A), lactate (B), phosphoenol pyruvate (C), malonic acid (D) between 0 and 120 min of different test loads. GL: glucose load; WR, white rice; HB, highland barley. ^ $p < 0.05$, ^^ $p < 0.01$, HB or WR compared with GL using one-way ANOVA analysis with LSD post hoc test. † $p < 0.05$, †† $p < 0.01$, HB compared with WR using one-way ANOVA analysis with LSD post hoc test. Data are mean ± SEM.