

Fig. S1 Rarefaction curves of intestinal bacteria of semi-free-range and captive red-crowned cranes.

Note: SY, Red-crowned cranes in semi-free-range, JY, Red-crowned cranes in captivity.

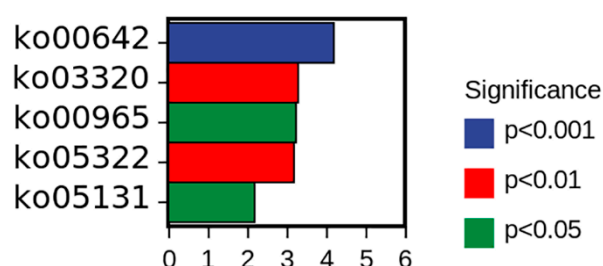


Fig. S2 Analysis of metabolic pathway differences between semi-free-range and captive red-crowned cranes based on the third KEGG classification level.

Note: The positive value of $\log_{FC}(\log_2(\text{fold change}))$ on the horizontal axis represents up-regulation in the upregulated group compared with the control group, while the negative value represents down-regulation. The vertical coordinates are different Pathway tags; Show the degree of significance in different colors. Upregulation group: SY, semi free-range red-crowned cranes, control group: JY, captive red-crowned cranes.

Table S1. Relative abundances of the dominant bacteria at the phylum level in semi-free-range and captive red-crowned cranes.

Phylum	Semi-free-range	Captive
Proteobacteria	63.51%	80.51%
Firmicutes	36.09%	19.28%
Actinobacteria	0.16%	0.09%
Bacteroidetes	0.02%	0.02%
Cyanobacteria	0.00%	0.01%
Fusobacteria	0.00%	0.01%
Chloroflexi	0.00%	0.00%

Tenericutes	0.00%	0.00%
Verrucomicrobia	0.00%	0.00%
Gemmatimonadetes	0.00%	0.00%
Others	0.21%	0.08%

Table S2. Relative abundances of the dominant bacteria at the genus level in semi-free-range and captive red-crowned cranes.

Genus	Semi-free-range	Captive
Psychrobacter	45.61%	19.08%
Pseudomonadaceae_Pseudomonas	7.70%	22.09%
Lactobacillus	0.46%	14.76%
Sporosarcina	10.99%	0.01%
Acinetobacter	4.42%	5.60%
Brochothrix	8.12%	0.71%
Carnobacterium	2.47%	0.76%
Lactococcus	3.05%	0.08%
Pantoea	0.00%	2.79%
Hafnia	0.00%	1.50%
Others	17.18%	32.62%

Table S1 One-way ANOVA of the relative abundance of metabolic pathways based on the second KEGG classification level in semi-free-range and captive red-crowned cranes intestinal bacteria.

	Feeding patterns (mean \pm standard deviation)		<i>F</i>	<i>p</i>
	captive (<i>n</i> =8)	semi-free-range (<i>n</i> =8)		
Cell growth and death	476.19 \pm 44.16	425.57 \pm 82.12	2.358	0.147
Cell motility	665.14 \pm 339.80	923.26 \pm 413.24	1.862	0.194
Cellular community - eukaryotes	0.00 \pm 0.00	0.00 \pm 0.00	null	null
Cellular community - prokaryotes	66.23 \pm 26.48	113.99 \pm 21.79	15.520	0.001**
Transport and catabolism	154.27 \pm 30.87	117.91 \pm 29.06	5.886	0.029*
Membrane transport	882.71 \pm 131.50	911.05 \pm 74.92	0.280	0.605
Signal transduction	207.73 \pm 38.37	238.58 \pm 58.56	1.553	0.233
Signaling molecules and interaction	0.00 \pm 0.00	0.07 \pm 0.13	2.196	0.161
Folding, sorting and degradation	1261.35 \pm 141.29	1091.58 \pm 145.67	5.598	0.033*
Replication and repair	1917.30 \pm 219.06	1672.84 \pm 440.10	1.978	0.181
Transcription	245.34 \pm 42.31	219.30 \pm 29.04	2.059	0.173
Translation	1065.18 \pm 174.77	887.29 \pm 319.00	1.914	0.188
Metabolism of terpenoids and polyketides	2552.34 \pm 299.13	2702.97 \pm 108.20	1.794	0.202
Nucleotide metabolism	643.98 \pm 86.19	576.45 \pm 167.54	1.027	0.328

Xenobiotics biodegradation and metabolism	2118.51±592.62	2523.95±256.20	3.155	0.097
Digestive system	0.01±0.01	0.08±0.11	2.750	0.119
Endocrine system	30.32±35.53	87.43±47.37	7.442	0.016*
Environmental adaptation	68.09±6.39	64.64±5.24	1.400	0.256
Immune system	4.60±8.83	2.25±6.35	0.376	0.550
Cancers	1.55±4.39	0.00±0.00	1.000	0.334
Cardiovascular diseases	0.01±0.01	0.20±0.17	10.397	0.006**
Immune diseases	0.00±0.00	0.03±0.05	2.644	0.126
Infectious diseases	78.19±31.01	87.83±23.40	0.493	0.494
Neurodegenerative diseases	2.93±8.28	4.49±12.69	0.085	0.775
Amino acid metabolism	5074.07±240.78	4381.37±506.46	12.207	0.004**
Biosynthesis of other secondary metabolites	475.17±69.46	597.57±57.07	14.830	0.002**
Carbohydrate metabolism	4816.11±487.83	4339.79±407.82	4.490	0.052
Energy metabolism	1808.56±194.49	1745.41±116.09	0.622	0.444
Glycan biosynthesis and metabolism	946.33±140.65	943.99±76.20	0.002	0.968
Lipid metabolism	3021.38±253.91	2729.95±429.37	2.731	0.121
Metabolism of cofactors and vitamins	4666.45±437.09	4201.01±483.23	4.082	0.063
Metabolism of other amino acids	3029.60±201.67	2719.14±347.08	4.785	0.046*
* $p < 0.05$ ** $p < 0.01$				