

Table S1 Environmental variables

No.	Environmental variables	No.	Environmental variables
1	Altitude	36	Monthly Maximum Temperature October
2	Annual Mean Temperature	37	Monthly Maximum Temperature November
3	Mean Temperature of Warmest Quarter	38	Monthly Maximum Temperature December
4	Mean Temperature of Coldest Quarter	39	Monthly Maximum Temperature February
5	Annual Precipitation	40	Monthly Maximum Temperature March
6	Precipitation of Wettest Month	41	Monthly Maximum Temperature April
7	Precipitation of Driest Month	42	Monthly Maximum Temperature May
8	Precipitation Seasonality	43	Monthly Maximum Temperature June
9	Precipitation of Wettest Quarter	44	Monthly Maximum Temperature July
10	Precipitation of Driest Quarter	45	Monthly Maximum Temperature August
11	Precipitation of Warmest Quarter	46	Monthly Maximum Temperature September
12	Precipitation of Coldest Quarter	47	Monthly Mean Temperature January
13	Mean Diurnal Range	48	Monthly Mean Temperature October
14	Isothermality	49	Monthly Mean Temperature November
15	Temperature Seasonality	50	Monthly Mean Temperature December
16	Max Temperature of Warmest Month	51	Monthly Mean Temperature February
17	Min Temperature of Coldest Month	52	Monthly Mean Temperature March
18	Temperature Annual Range	53	Monthly Mean Temperature April
19	Mean Temperature of Wettest Quarter	54	Monthly Mean Temperature May
20	Mean Temperature of Driest Quarter	55	Monthly Mean Temperature June
21	Human Footprint Index	56	Monthly Mean Temperature July
22	Normalized Difference Vegetation Index	57	Monthly Mean Temperature August
23	Monthly Precipitation January	58	Monthly Mean Temperature September
24	Monthly Precipitation October	59	Monthly Minimum Temperature January
25	Monthly Precipitation November	60	Monthly Minimum Temperature October
26	Monthly Precipitation December	61	Monthly Minimum Temperature November
27	Monthly Precipitation February	62	Monthly Minimum Temperature December
28	Monthly Precipitation March	63	Monthly Minimum Temperature February
29	Monthly Precipitation April	64	Monthly Minimum Temperature March
30	Monthly Precipitation May	65	Monthly Minimum Temperature April
31	Monthly Precipitation June	66	Monthly Minimum Temperature May
32	Monthly Precipitation July	67	Monthly Minimum Temperature June
33	Monthly Precipitation August	68	Monthly Minimum Temperature July
34	Monthly Precipitation September	69	Monthly Minimum Temperature August
35	Monthly Maximum Temperature January	70	Monthly Minimum Temperature September

Table S2 Raw metagenomic sequencing data

Samples	Raw base (bp)	Samples	Raw base (bp)
P221201H	15,108,536,700	P224811H	15,257,735,400
P221202H	15,224,411,100	P224812H	12,780,220,800
P221203H	14,726,972,100	P224813H	14,653,399,800
P221204H	16,978,700,400	P224814H	17,433,577,200
P221205H	16,564,106,400	P224815H	14,428,551,900
P221206H	18,110,906,100	P237802H	18,373,895,100
P221207H	23,031,775,800	P237803H	12,930,478,500
P221208H	14,172,586,800	P237804H	15,629,781,900
P221209H	17,028,789,900	P237805H	13,559,562,300
P221210H	15,503,055,000	P237806H	17,564,923,200
P221211H	12,405,063,000	P237807H	16,363,808,400
P221212H	15,880,760,100	P237808H	18,068,080,200
P221213H	13,338,437,100	P237809H	13,784,881,800
P221214H	14,506,537,200	P237810H	15,897,507,600
P221215H	15,242,891,700	P237811H	18,612,980,700
P224801H	12,133,176,900	P237812H	18,025,850,400
P224802H	13,220,573,700	P237813H	13,871,075,100
P224803H	12,367,908,300	P237814H	12,543,897,900
P224804H	13,887,737,400	P237816H	15,257,296,500
P224805H	13,360,851,300	P237817H	13,574,050,800
P224806H	12,943,606,500	P237818H	15,060,510,600
P224807H	16,240,995,300	P237819H	17,298,724,200
P224808H	15,575,277,900	P237820H	14,298,492,900
P224809H	14,814,801,600	P237821H	14,605,167,000
P224810H	19,680,904,200		

Table S3 Relative abundance of plant families consumed by Przewalski's gazelle across three geographically distinct populations

Family	WH	RQH	SD
Rosaceae	55.27 ± 14.99 %	56.49 ± 32.03 %	7.02 ± 12.46 %
Others	24.49 ± 17.82 %	2.48 ± 2.60 %	16.20 ± 20.67 %
Asteraceae	9.69 ± 14.58 %	13.95 ± 13.47 %	17.53 ± 9.39 %
Poaceae	7.32 ± 7.54 %	4.65 ± 4.30 %	14.06 ± 9.91 %
Fabaceae	1.25 ± 1.97 %	0.57 ± 1.07 %	15.37 ± 15.79 %
Bryaceae	0.65 ± 1.23 %	0.02 ± 0.07 %	0.01 ± 0.03 %
Plantaginaceae	0.60 ± 0.69 %	0.08 ± 0.15 %	0.07 ± 0.25 %
Brassicaceae	0.36 ± 1.00 %	0.19 ± 0.24 %	0.19 ± 0.65 %
Cyperaceae	0.14 ± 0.21 %	0.26 ± 0.37 %	0.26 ± 0.55 %
Chenopodiaceae	0.09 ± 0.15 %	0.16 ± 0.43 %	0.26 ± 0.26 %
Polygonaceae	0.05 ± 0.18 %	0.00 ± 0.00 %	0.00 ± 0.00 %
Amaryllidaceae	0.04 ± 0.10 %	0.01 ± 0.03 %	0.00 ± 0.01 %
Anacardiaceae	0.02 ± 0.08 %	0.00 ± 0.00 %	0.22 ± 0.76 %
Tamaricaceae	0.01 ± 0.02 %	0.35 ± 0.48 %	0.00 ± 0.00 %
Elaeagnaceae	0.00 ± 0.01 %	8.51 ± 11.46 %	13.63 ± 7.70 %
Salicaceae	0.00 ± 0.01 %	11.66 ± 13.98 %	0.44 ± 0.43 %
Asparagaceae	0.00 ± 0.00 %	0.00 ± 0.00 %	0.10 ± 0.26 %
Crassulaceae	0.00 ± 0.00 %	0.09 ± 0.19 %	0.05 ± 0.09 %
Ephedraceae	0.00 ± 0.00 %	0.01 ± 0.01 %	0.09 ± 0.22 %
Gentianaceae	0.00 ± 0.00 %	0.46 ± 0.59 %	0.01 ± 0.04 %
Iridaceae	0.00 ± 0.00 %	0.00 ± 0.00 %	4.66 ± 4.16 %
Malvaceae	0.00 ± 0.00 %	0.00 ± 0.00 %	0.00 ± 0.00 %
Orobanchaceae	0.00 ± 0.00 %	0.04 ± 0.11 %	0.18 ± 0.27 %
Pinaceae	0.00 ± 0.00 %	0.00 ± 0.00 %	0.00 ± 0.00 %
Primulaceae	0.00 ± 0.00 %	0.00 ± 0.00 %	9.56 ± 7.73 %
Ranunculaceae	0.00 ± 0.00 %	0.00 ± 0.00 %	0.06 ± 0.13 %

Notes: WH represents the Wahe population, RQH represents the Ranquehu population, and SD represents the Shadao population. Data are presented as mean ± standard deviation.

Table S4 KEGG Level 1 functional categories

KEGG pathway Level1	Mean	Standard deviation
Metabolism	49.97%	0.28%
Genetic Information Processing	17.55%	0.17%
Environmental Information Processing	13.29%	0.22%
Cellular Processes	8.94%	0.12%
Human Diseases	7.02%	0.07%
Organismal Systems	3.22%	0.07%

Table S5 KEGG Level 2 functional categories (abundance>1%)

KEGG pathway Level2	Mean	Standard deviation
Global and overview maps	26.79%	0.13%
Carbohydrate metabolism	10.12%	0.12%
Amino acid metabolism	6.05%	0.08%
Glycan biosynthesis and metabolism	4.83%	0.10%
Metabolism of cofactors and vitamins	4.57%	0.07%
Membrane transport	4.49%	0.21%
Energy metabolism	4.35%	0.10%
Translation	4.16%	0.13%
Nucleotide metabolism	3.36%	0.03%
Replication and repair	3.30%	0.09%
Signal transduction	3.30%	0.08%
Cellular community - prokaryotes	3.05%	0.08%
Lipid metabolism	2.71%	0.08%
Folding, sorting and degradation	2.11%	0.03%
Biosynthesis of other secondary metabolites	2.05%	0.04%
Metabolism of other amino acids	1.85%	0.03%
Drug resistance: antimicrobial	1.83%	0.04%
Cell growth and death	1.44%	0.03%
Xenobiotics biodegradation and metabolism	1.08%	0.04%
Infectious disease: bacterial	1.04%	0.02%
Metabolism of terpenoids and polyketides	1.04%	0.02%

Table S6 Expression levels of 20 metabolites

Metabolite	Formula	WH	RQH	SD
(24R)-5b,8b-Epidioxysterosta-6,22E-dien-3b-ol 3-glucoside	C ₃₄ H ₅₄ O ₈	4.86 ± 0.38	0.78 ± 0.40	1.14 ± 1.16
10-Formyltetrahydrofolate	C ₂₀ H ₂₃ N ₇ O ₇	5.82 ± 0.21	1.20 ± 1.66	1.33 ± 1.69
6"-p-Coumaroylprunin	C ₃₀ H ₂₈ O ₁₂	5.42 ± 0.19	0.92 ± 1.21	0.61 ± 1.05
8-Acetoxy-4'-methoxypinoresinol 4-glucoside	C ₂₉ H ₃₆ O ₁₃	5.37 ± 0.19	1.86 ± 0.79	1.76 ± 0.64
Angiotensin III	C ₄₆ H ₆₆ N ₁₂ O ₉	5.65 ± 0.27	1.26 ± 1.49	1.23 ± 1.48
Arctignan C	C ₃₀ H ₃₂ O ₁₀	5.50 ± 1.47	2.01 ± 1.84	0.52 ± 0.80
Cinnassiol A 19-glucoside	C ₂₆ H ₄₀ O ₁₂	5.83 ± 0.47	0.51 ± 1.15	0.01 ± 0.00
PA(PGD2/i-16:0)	C ₃₉ H ₆₉ O ₁₁ P	4.92 ± 0.34	0.66 ± 1.05	0.40 ± 0.58
PG(PGD2/i-17:0)	C ₄₃ H ₇₇ O ₁₃ P	5.24 ± 0.30	1.35 ± 1.50	1.92 ± 1.55
5,10-Methylene-Thf	C ₂₀ H ₂₃ N ₇ O ₆	6.19 ± 0.18	2.17 ± 1.25	1.84 ± 0.99
Physagulin F	C ₃₀ H ₄₀ O ₉	4.52 ± 0.59	0.52 ± 1.33	2.59 ± 2.09
AMMB-DPA-DHIPC-6-COOH	C ₂₉ H ₂₈ N ₄ O ₃	3.91 ± 1.14	0.09 ± 0.01	0.08 ± 0.01
4-(4-sulfohenyl)octanoic acid	C ₁₄ H ₂₀ O ₅ S	4.43 ± 0.25	0.75 ± 1.12	1.02 ± 1.11
5-Deoxykievitol	C ₂₀ H ₂₀ O ₆	2.02 ± 0.04	5.49 ± 1.80	1.95 ± 0.03
Aurantio-Obtusin	C ₁₇ H ₁₄ O ₇	5.93 ± 0.31	2.64 ± 2.23	0.19 ± 0.81
Hex2Cer(24:0_2O)	C ₃₆ H ₆₉ NO ₁₃	6.30 ± 0.24	1.57 ± 1.54	1.40 ± 1.17
Lnaps(25:0/n-3:0)	C ₃₄ H ₆₆ NO ₁₀ P	5.91 ± 0.28	1.14 ± 1.49	1.36 ± 1.41
Pa(pgd1/p-16:0)	C ₃₉ H ₇₁ O ₁₀ P	4.28 ± 0.30	0.67 ± 1.13	1.21 ± 1.44
Smgdg(o-24:6/23:0)	C ₅₆ H ₉₈ O ₁₂ S	5.54 ± 0.18	1.27 ± 1.77	0.87 ± 1.16
Surfactin A	C ₅₁ H ₈₉ N ₇ O ₁₃	5.51 ± 0.20	1.92 ± 1.32	1.72 ± 1.11

Notes: WH represents the Wahe population, RQH represents the Ranquehu population, and SD represents the Shadao population. Data are presented as mean ± standard deviation.

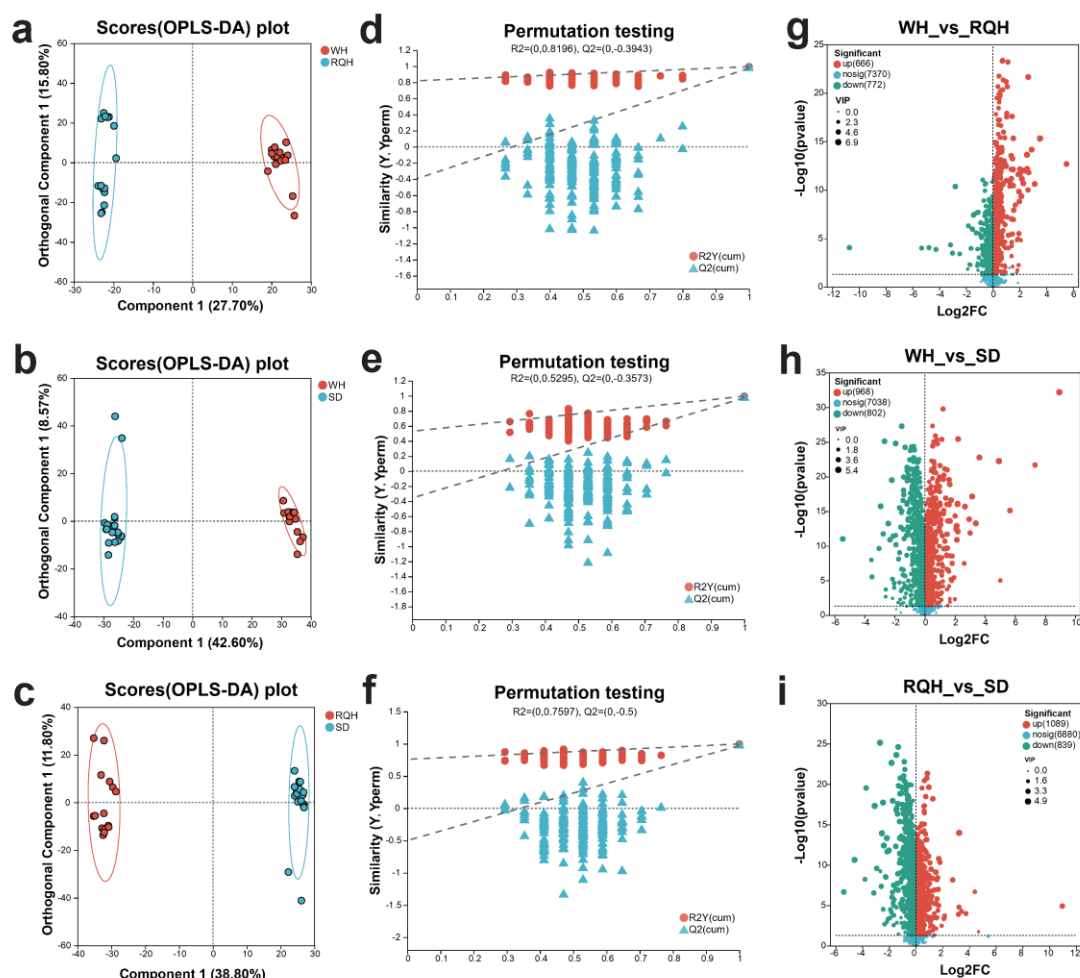


Fig. S1 Non-targeted metabolomic differences among three geographically distinct populations of Przewalski's gazelle, where WH represents the Wahe population, RQH represents the Ranquehu population, and SD represents the Shadao population. (a–c) OPLS-DA score plots. Component 1 indicates the first predictive principal component, and orthogonal Component 1 indicates the first orthogonal component. (d–f) Validation of the OPLS-DA models. The x-axis represents the permutation retention, and the y-axis shows the values of R^2 (red circles) and Q^2 (blue triangles) from permutation tests; the dashed lines indicate the regression lines for R^2 and Q^2 . (g–i) Volcano plots of differentially abundant metabolites. The x-axis shows the log2 fold change (log2FC) between groups, and the y-axis shows the $-\log_{10}(p \text{ value})$, with higher values indicating greater statistical significance.