

Supplementary material

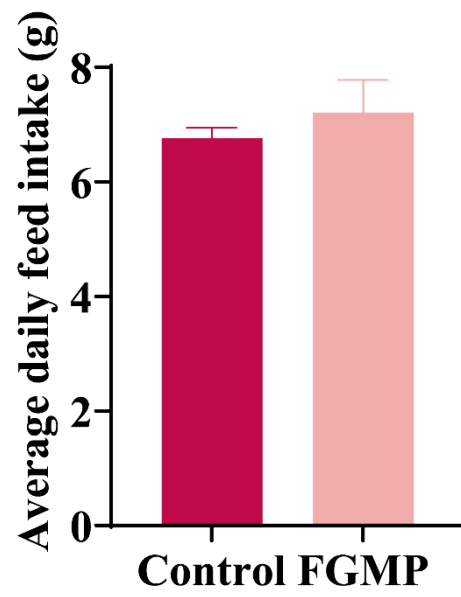
Supplementary Table 1 Nutritional composition and physicochemical index of fermented goat milk powder.

Nutrients	Content	Physicochemical indicators	Content
lactose, %	43.2	reconstituted milk pH value	6.0-6.5
Crude fat, %	≥ 26	Restored lactic acidity (° T)	≤ 10.0-15.0
Crude protein, %	≥ 24	Moisture, %	≤ 4
Coarse ash content, %	≤ 7.5	Insolubility index, mL	≤ 1.0
Taurine mg / 100 g	45.2	Chlorine mg / 100g	≤ 1800
Calcium mg / 100 g	790	bacteria live count (CFU/g)	1×10 ⁷ CFU / g
Zinc mg / 100 g	1.92		
Iron mg / 100 g	0.17		
Selenium mg / 100 g	4.2		

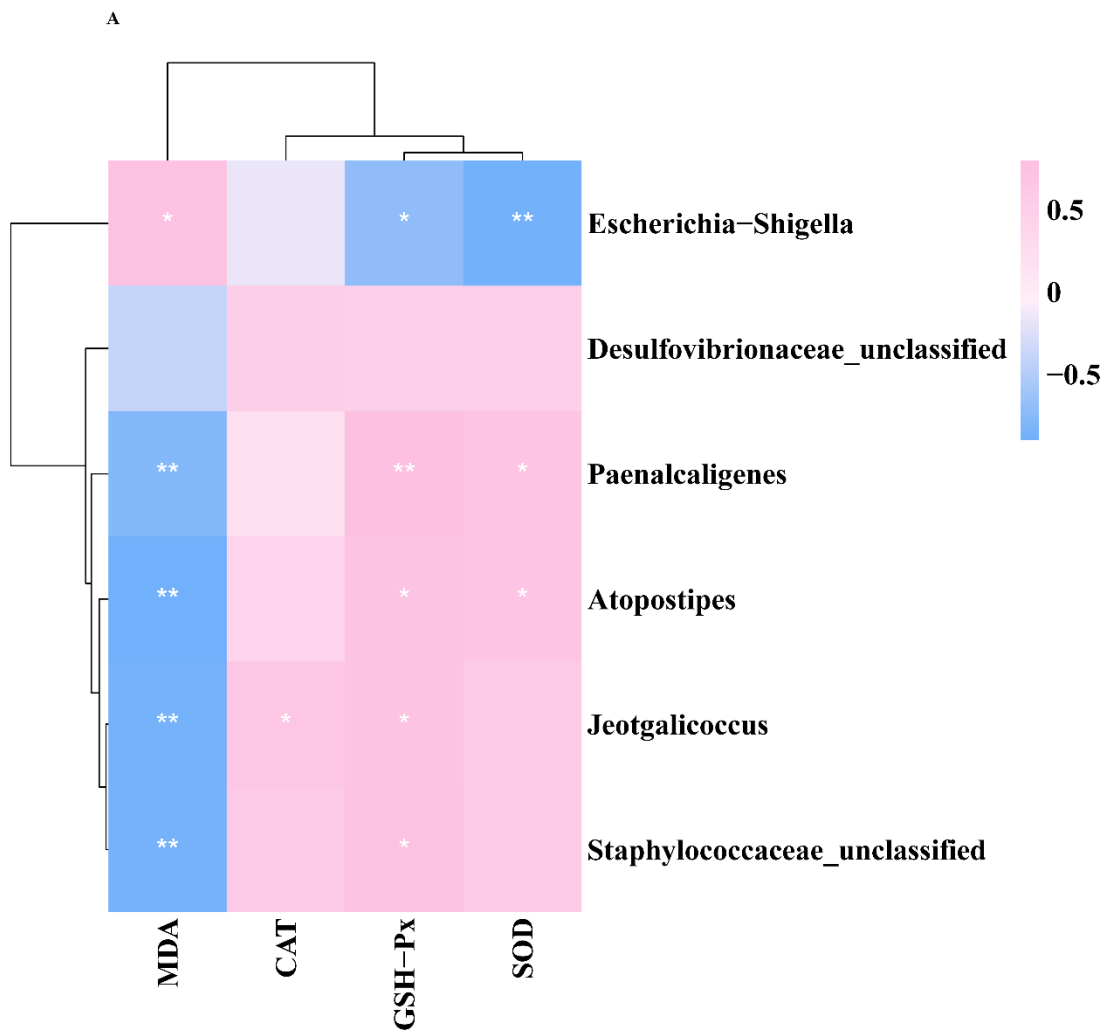
Supplementary Table 2 Primer pairs for RT-qPCR analysis.

Gene	Sequence (5' to 3')
β-actin	F: CGTGC GTGACATTAAGGAGAAG
	R: GCTCGTAGCTCTTCTCCAAGTCC
GPX4	F: GCCGTCTGAGCCGCTTACTT
	R: GATGCACACGAAACCCCTGT
ACSL4	F: GAAAGCAA ACTGAAGGCGGC
	R: AATGGCCATGTCTGAAGGGG
ALOX15	F: ATGCAGCTTTCTGACCACC
	R: CAGATGAAGTTTTCTCCCTTTGAA
LPCAT3	F: CTCCATCTTCCTGGGCTACC
	R: CACCGGTGGCTGTGTAGTAA
NOX1	F: CACCAATGCC CAGGATCGAG
	R: TGGAAGCAAAGGGAGTGACC
PTGS2	F: TGAGTACCGCAAACGCTTCT
	R: CAGCCATTCCTTCTCTCCTGT

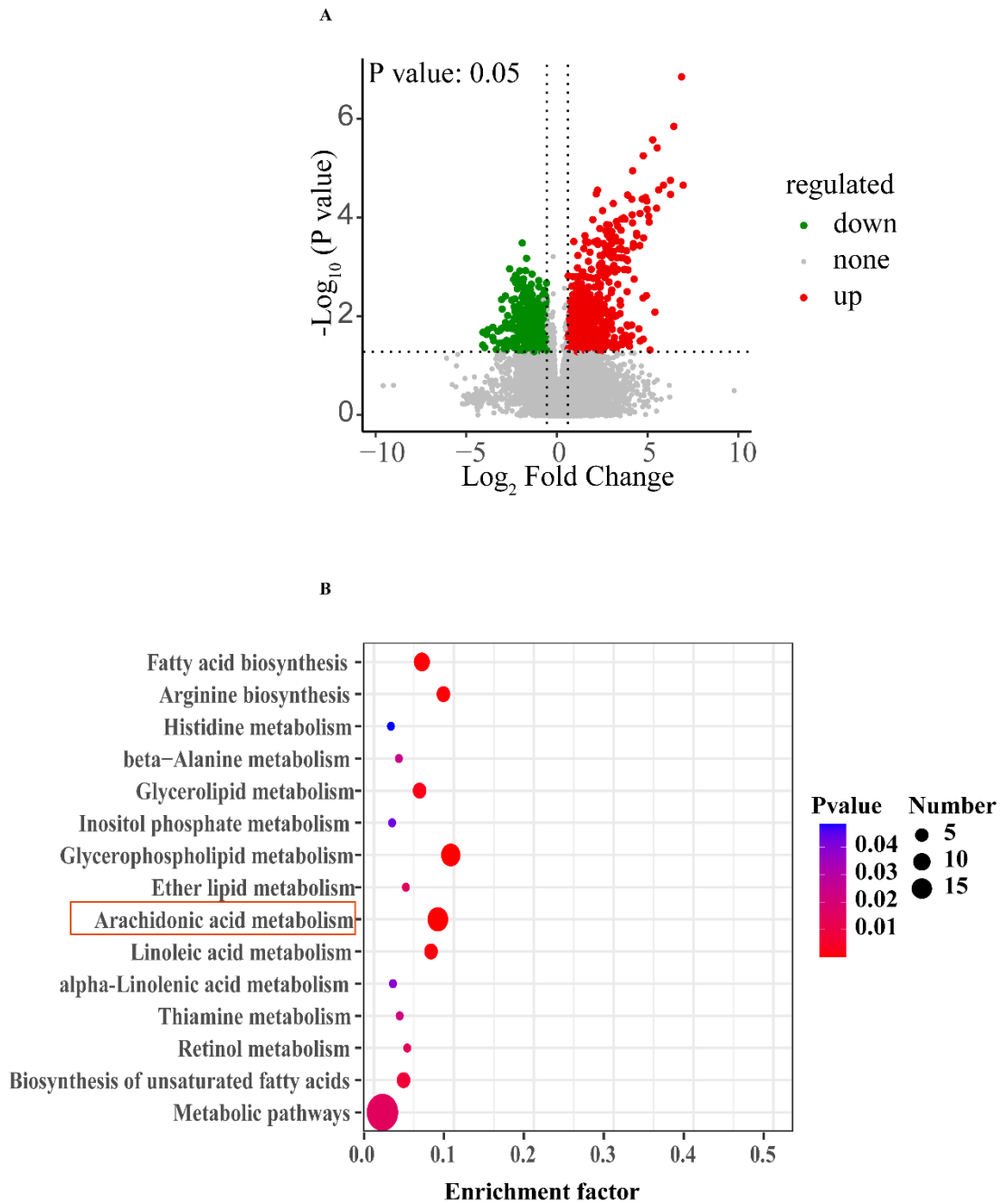
A



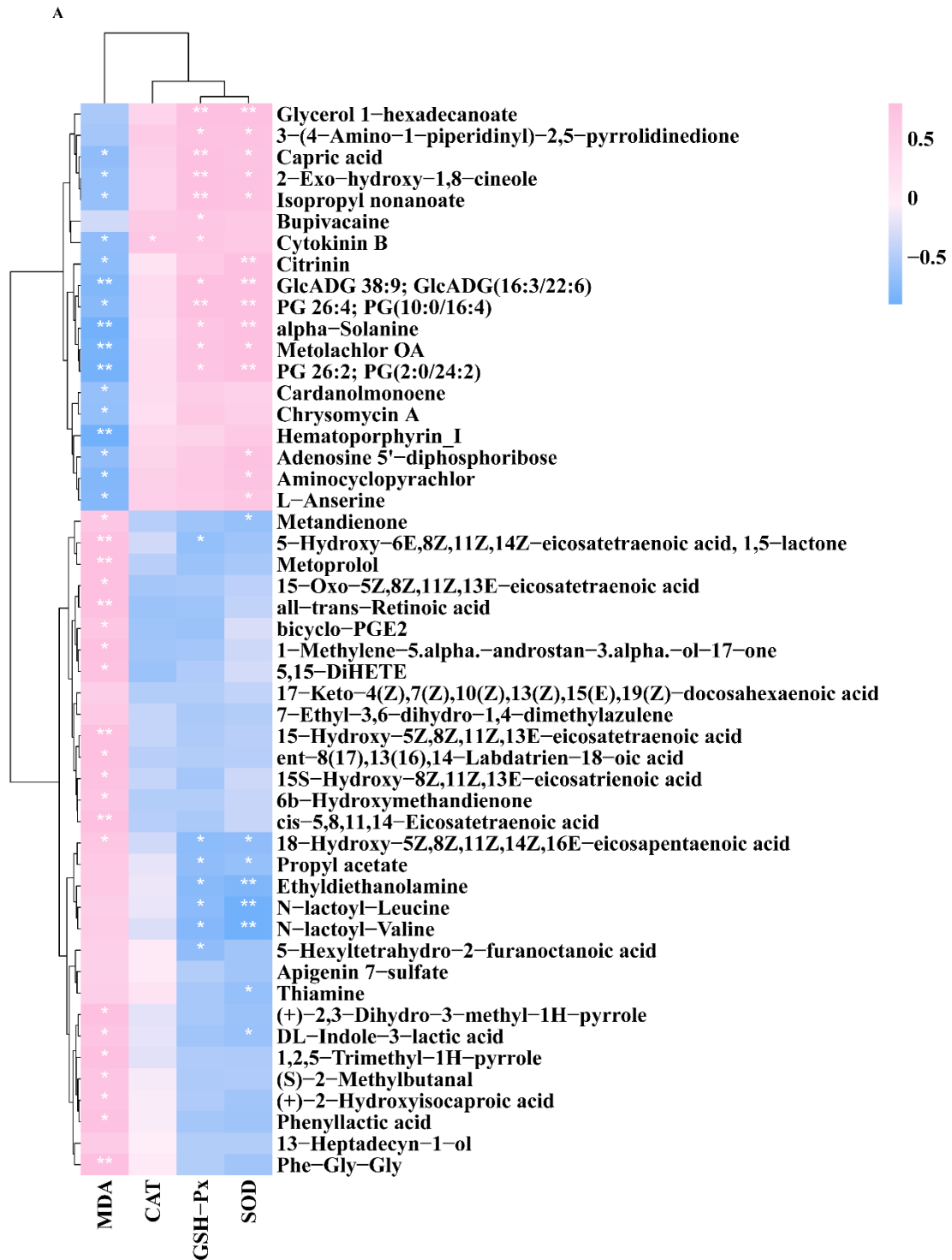
Supplementary Fig. 1 Average daily food intake of mice. (A) Average daily food intake in Control and FGMP-fed mice during the 35-day experimental period.



Supplementary Fig.2 Correlation analysis between significantly altered gut bacterial genera and systemic antioxidant indices in mice fed fermented goat milk powder (FGMP).



Supplementary Fig.3 Metabolomic analysis of mice intestinal contents. (A) Volcano plot of differentially abundant metabolites. (B) KEGG pathway enrichment analysis, revealing significant enrichment in metabolic pathways including fatty acid and arachidonic acid metabolism.



Supplementary Fig.4 Correlation analysis between differential intestinal metabolites and serum antioxidant markers.