

The 8th China-Belgium Science and Technology Exchange Symposium

Reflections & Prospects: 55 Years of Partnership, Shaping the Future Through Science and Innovation

第八届中比科技交流研讨会

Garlic Polysaccharide–Casein Complex-Stabilized Curcumin Emulsion Alleviates Experimental Colitis by Restoring Intestinal Barrier and Microbial Homeostasis

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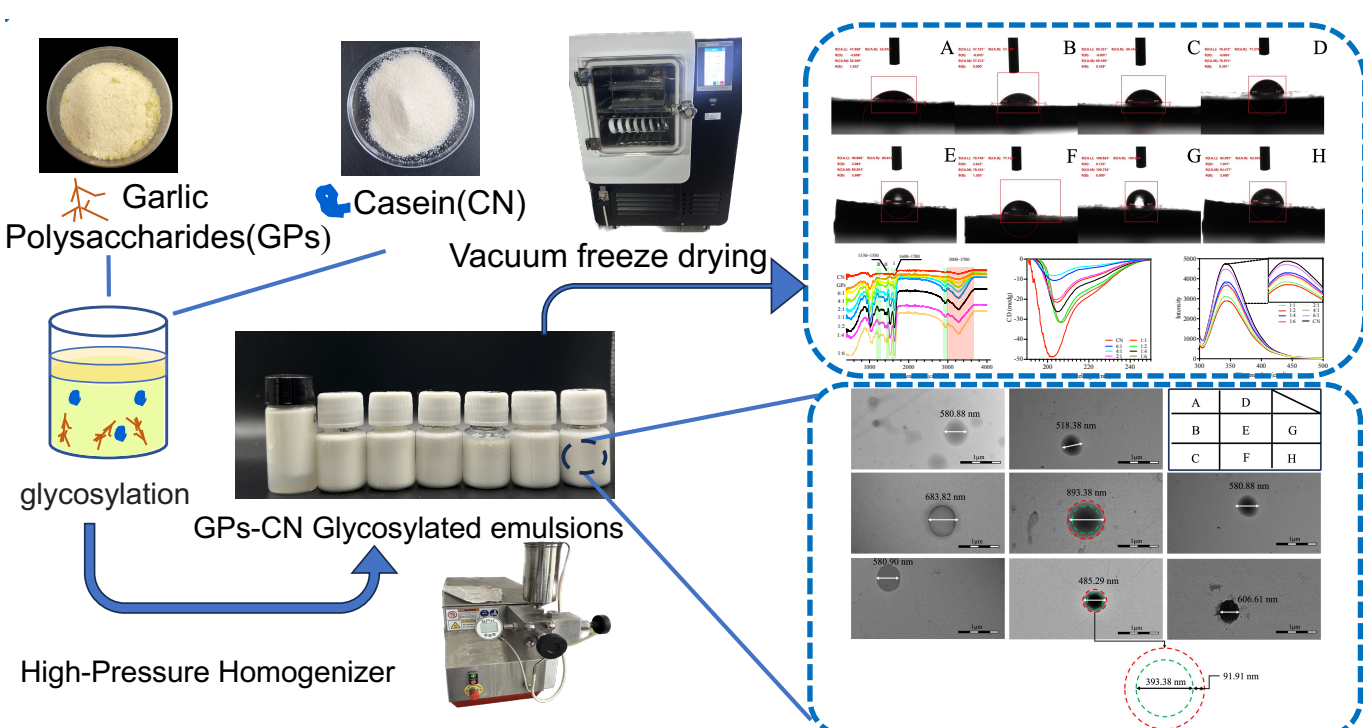
BACKGROUND

Curcumin has strong anti-inflammatory potential but poor aqueous solubility, instability and low oral bioavailability. Natural polysaccharide–protein emulsifiers may protect curcumin during digestion and improve intestinal delivery.

OBJECTIVE

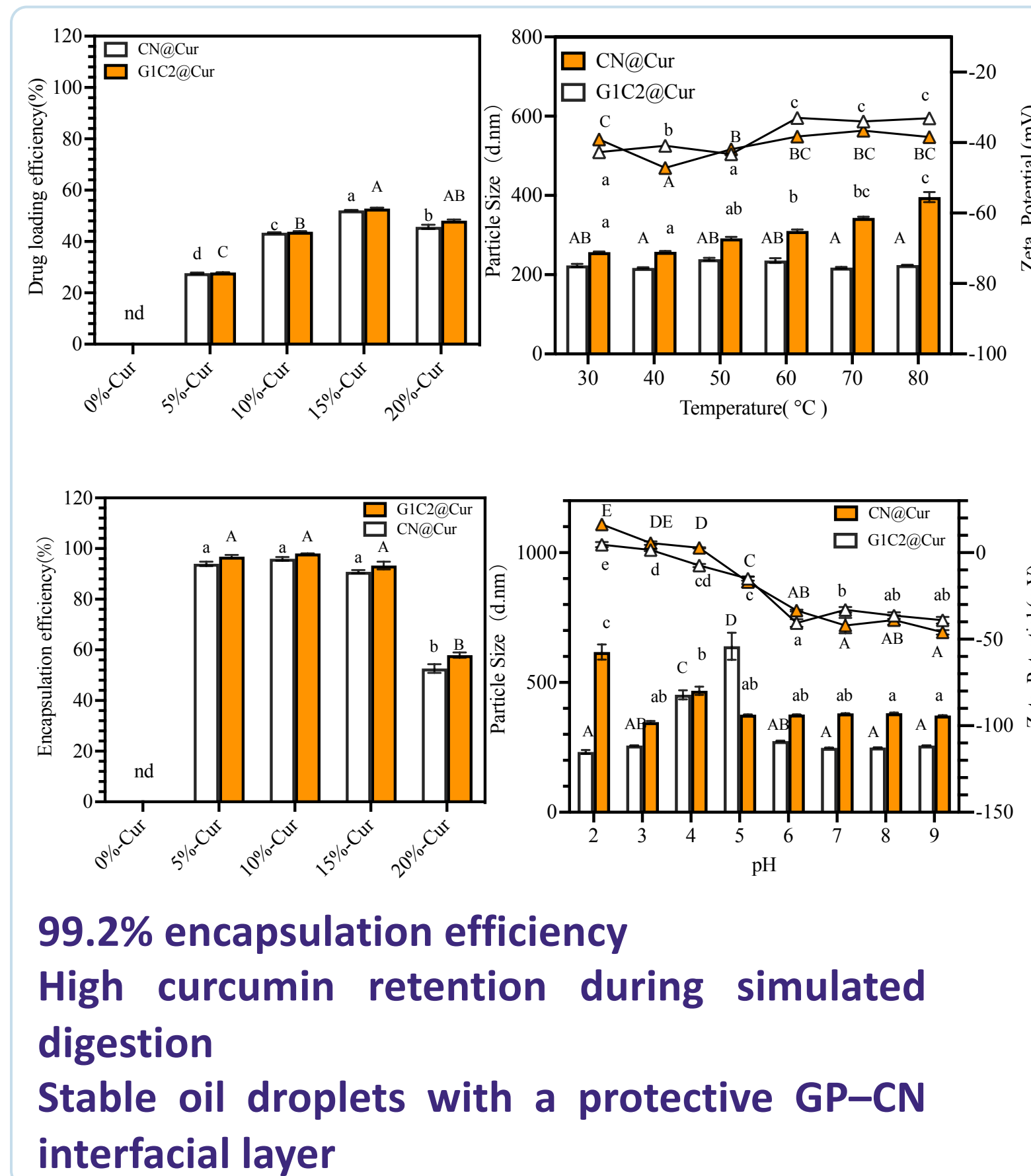
Develop a garlic polysaccharide–casein (GP–CN) complex-stabilized curcumin emulsion and determine whether it alleviates DSS-induced colitis by restoring barrier, microbial and metabolic homeostasis.

MATERIALS & METHODS



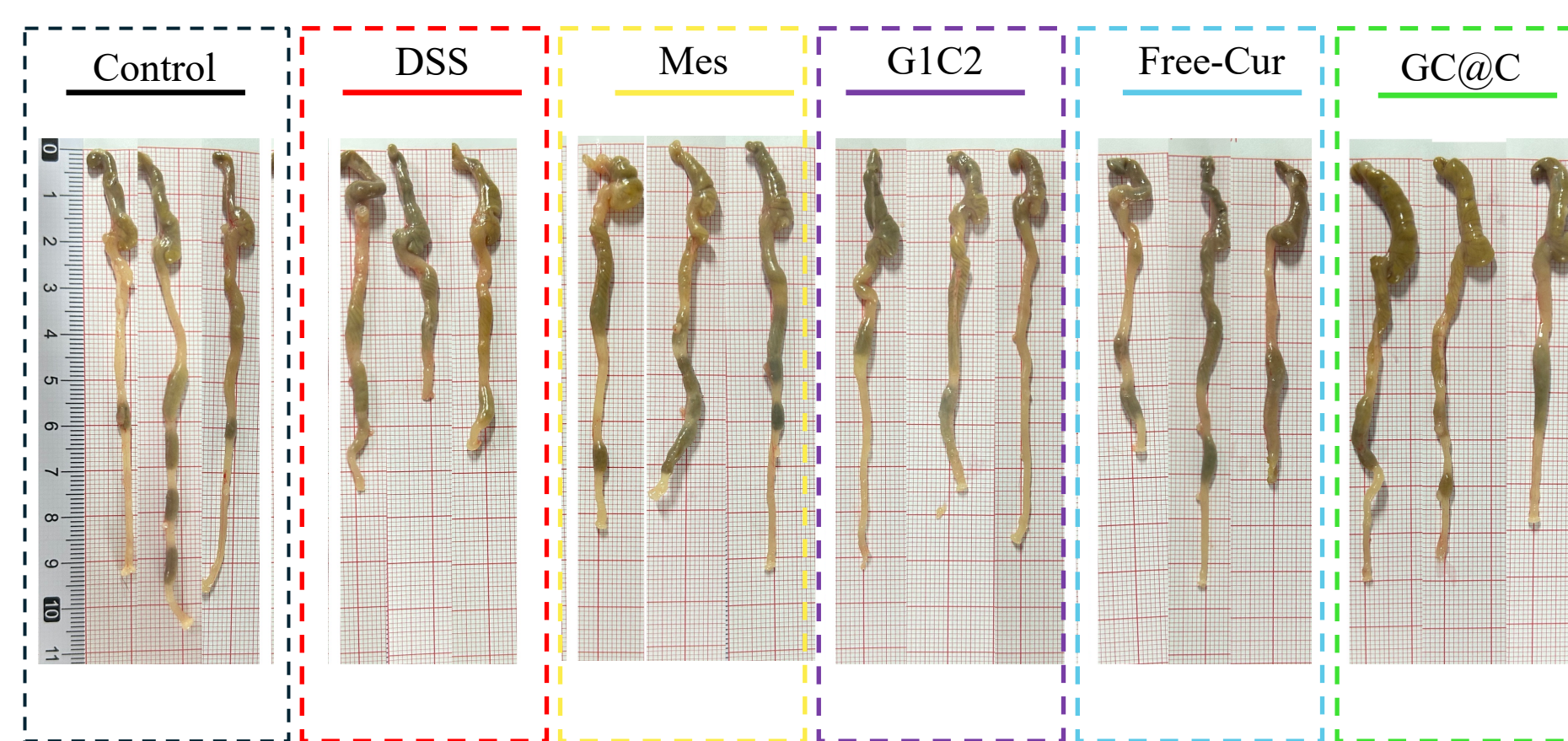
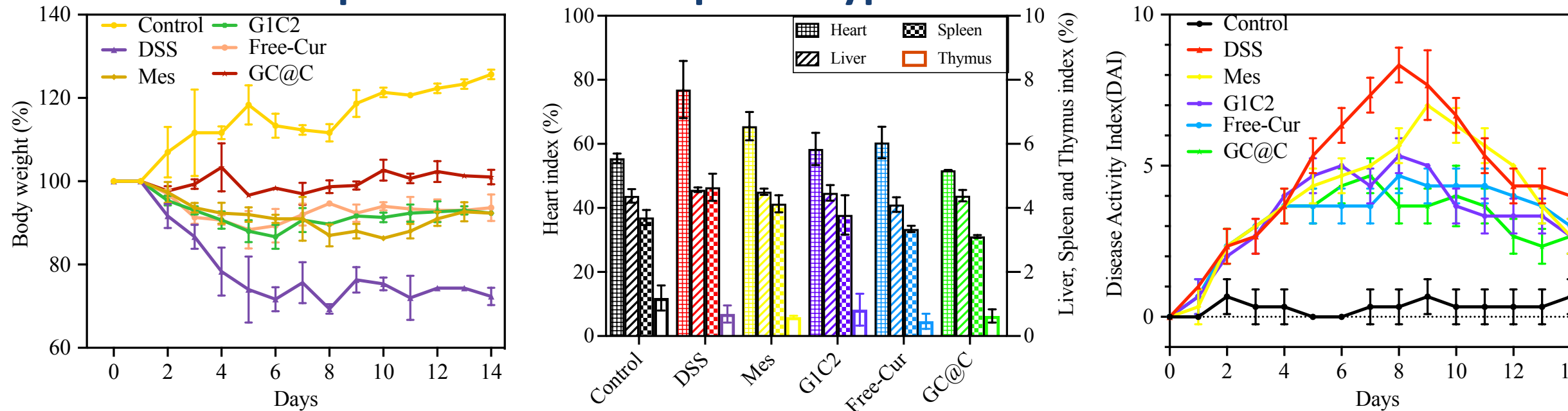
- GP–CN conjugates prepared by a Maillard-type reaction
- Curcumin-loaded oil-in-water emulsion optimized for size, ζ -potential, encapsulation and stability
- Simulated gastrointestinal digestion and mucus penetration
- DSS-colitis mouse model: clinical signs, histology, inflammation, oxidative stress and barrier proteins
- Gut microbiota, short-chain fatty acids and intestinal metabolomics

KEY FORMULATION PERFORMANCE



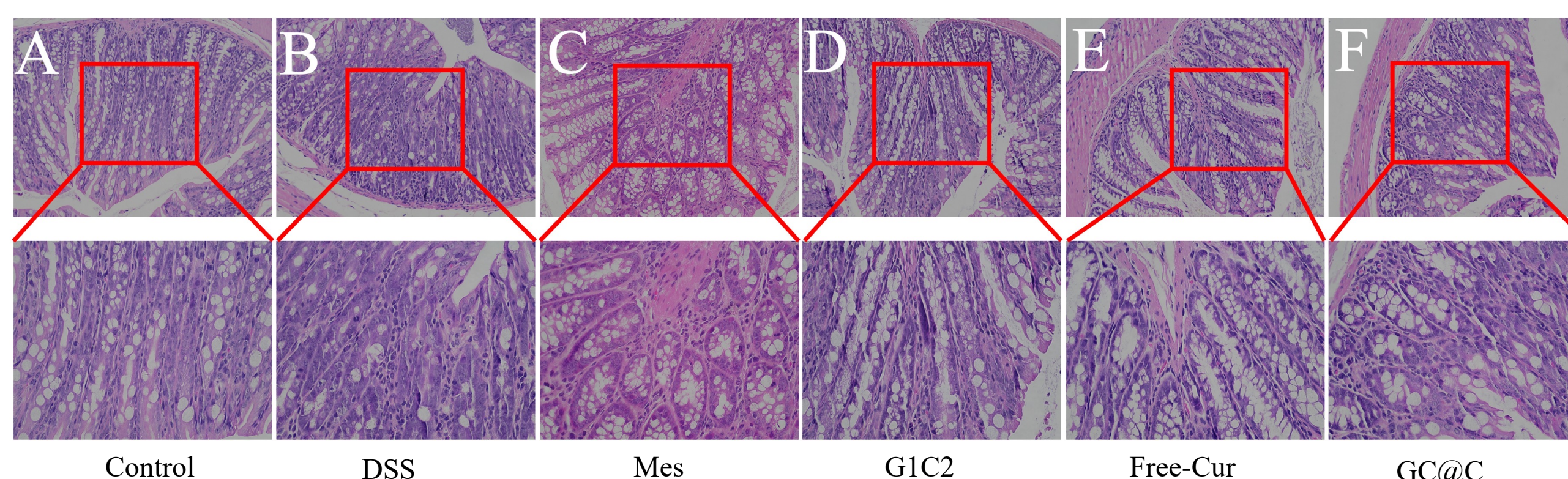
RESULTS

1. Oral emulsion improves the colitis phenotype



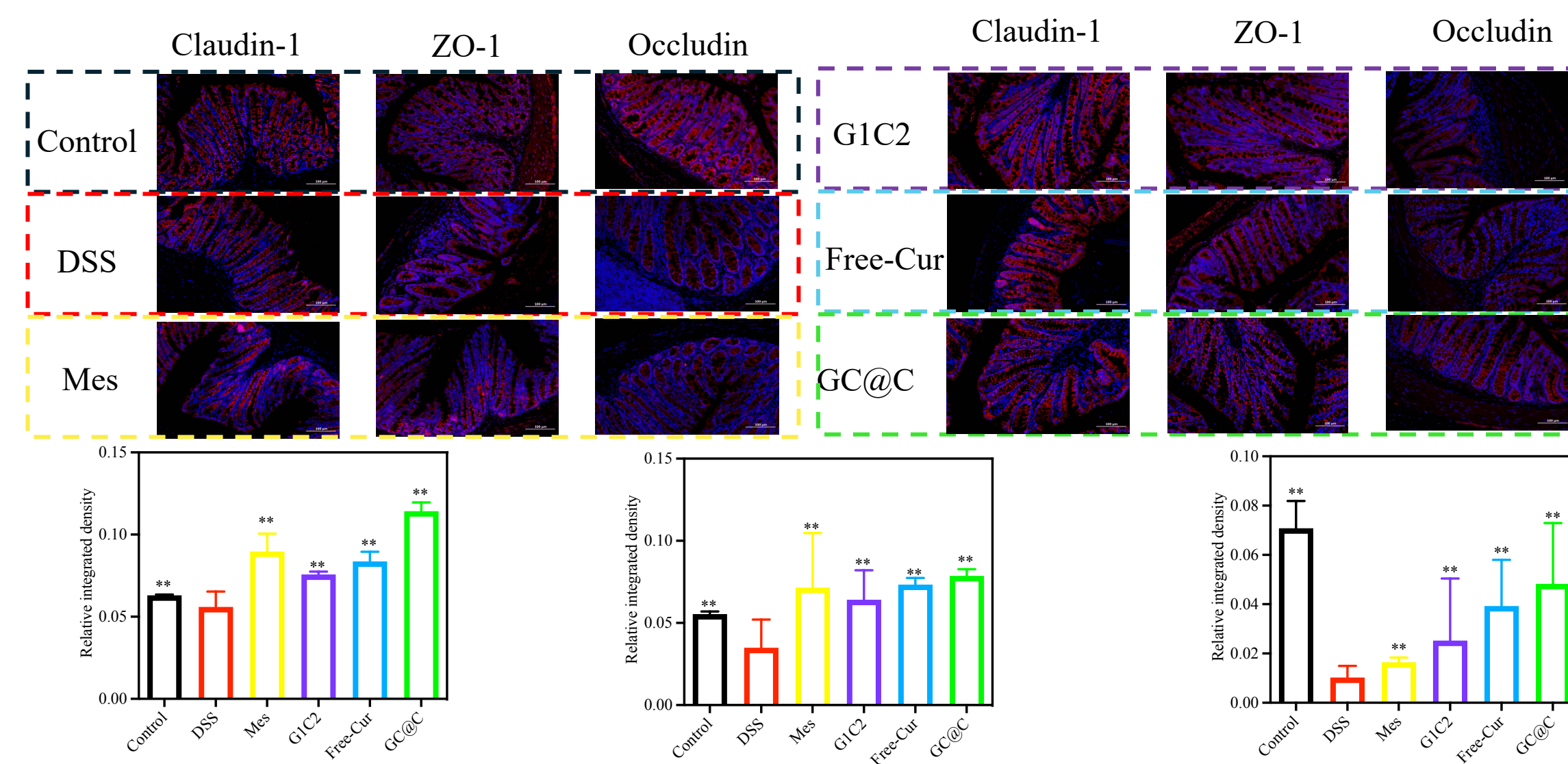
Reduced body-weight loss and disease activity; prevented colon shortening.

2. Histology confirms mucosal protection



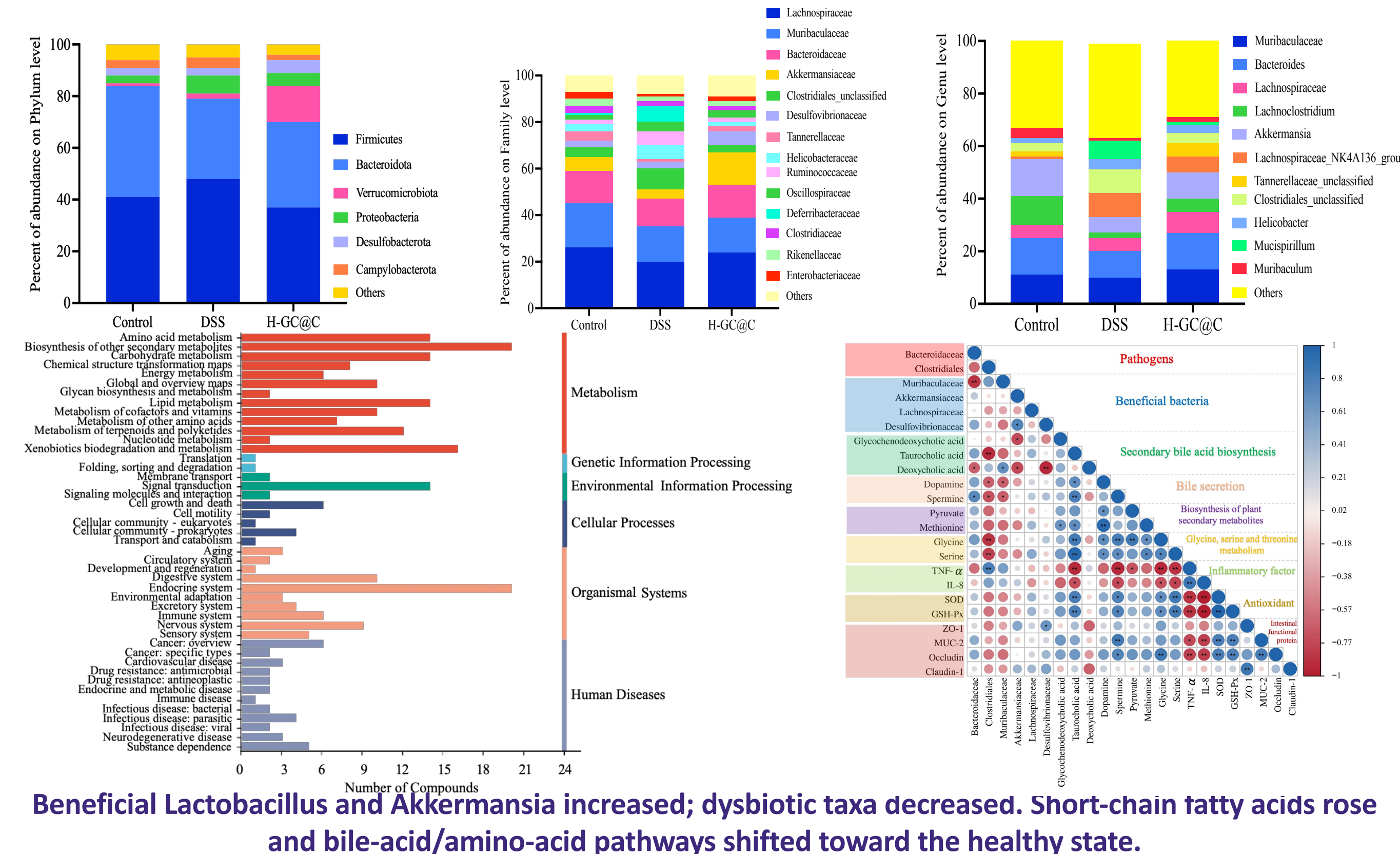
Treatment decreased inflammatory infiltration and crypt injury and preserved goblet-cell-rich mucosal architecture.

3. The intestinal barrier is rebuilt



MUC2, ZO-1, occludin and claudin-1 increased, consistent with improved mucus and tight-junction integrity.

4. Microbial and metabolic homeostasis partially returns



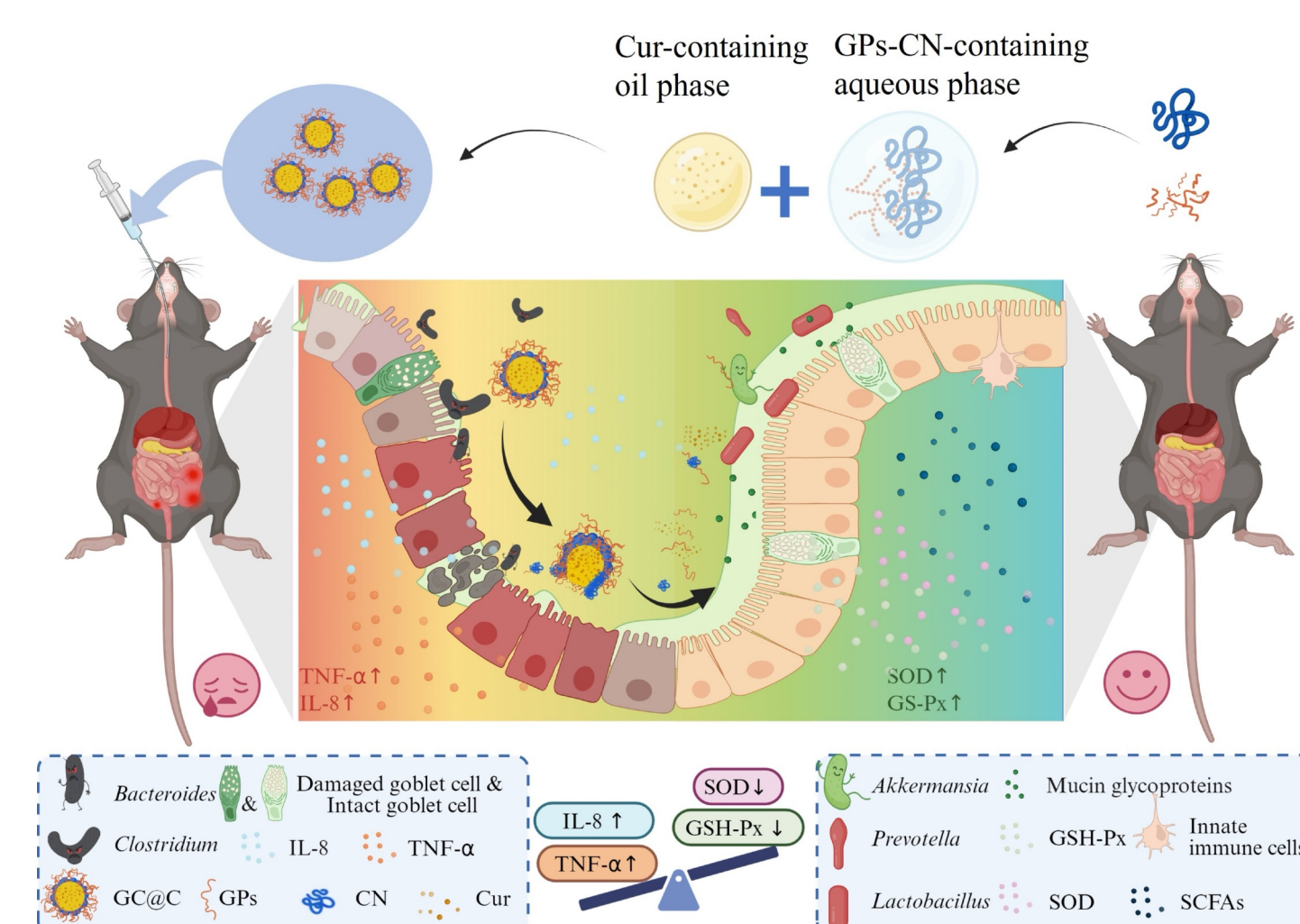
SUMMARY

A natural GP–CN interfacial complex enabled highly efficient curcumin encapsulation and gastrointestinal delivery.

In DSS-colitis mice, the emulsion improved clinical symptoms, colon morphology, inflammatory and oxidative status, mucus production and tight-junction integrity.

Microbiota and intestinal metabolite profiles moved toward homeostasis.

INTEGRATED MECHANISM



Improved delivery → lower inflammation and oxidative stress → barrier repair → microbiota/SCFA recovery → metabolic rebalancing

CONCLUSION

The GP–CN complex-stabilized curcumin emulsion alleviates experimental colitis through coordinated anti-inflammatory activity, intestinal barrier repair, and microbial–metabolic regulation.

It is a promising food-grade oral delivery strategy for dietary intervention in inflammatory bowel disease.

REFERENCES & CONTACT

Sources
• Conference abstract: “Garlic Polysaccharide–Casein Complex-Stabilized Curcumin Emulsion...”
• Xinyan Bai, Thesis Committee Report, 2026

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