Name	Total contents of each	,			<b>1</b> \		Proportion (%)		
	component	Mannose	D-Glucosamine	Rhamnose	Glucuronic	Galactose	D-Galactosamine	Glucose	Galactose
	(µg/mg)		hydrochloride		Acid		HCl		
FUC	594.807	5.021	0.002	3.972	7.186	0	0	2.720	7.324
LA	4.731	0	0	0	35.147	0	26.558	38.295	0

**TableS 1.** The monosaccharides components of FUC and LA. The chromatographic column: ZORBAX EclipseXDB-C18; Acetonitrile was used as the mobile phase  $(30^{\circ}C/250 \text{ nm}/10\mu\text{L})$ .

**Table S2.** The average weight of mice in the control check and model control groups were shown in this table. (Mean  $\pm$  SD) The food intake of each mouse= 24-hour food intake per cage/ number of mice in the cage. There was no significant difference in body weight and food intake between the two groups before and after loperamide intervention.

	Body weight(g)	Body weight(g)	Food intake(g)	Food intake(g)	
	(day 1)	(day 7)	(day 1)	(day 7)	
Control check group	$19.68 \pm 0.25$	$21.74 \pm 0.93$	4.52	4.00	
Model control group	$19.76 \pm 0.16$	$21.60\pm0.80$	4.17	3.88	



**FigS. 1** Representative H&E-stained duodenum (left) and stomach (right)sections were observed at  $100 \times$ . After observation, the gastrointestinal structure of mice in MC group did not change significantly compared with that in CK group.







FigS. 3 According to the results of muti-group comparison and two-group comparison at phylum(A, B) and genus levels (C, D), the species composition differences were showed above. At thephylum level, the intervention of FUC significantly increased the levels of *Bacteroidota* and*Deferribacterota*, and the intervention of LA remarkably upregulated the level of *Deferribacterota*.At the genus level, FUC and LA intervention increased the levels of many probiotics and decreasedtheproportionofsomeharmfulbacteria.