Fig. S1

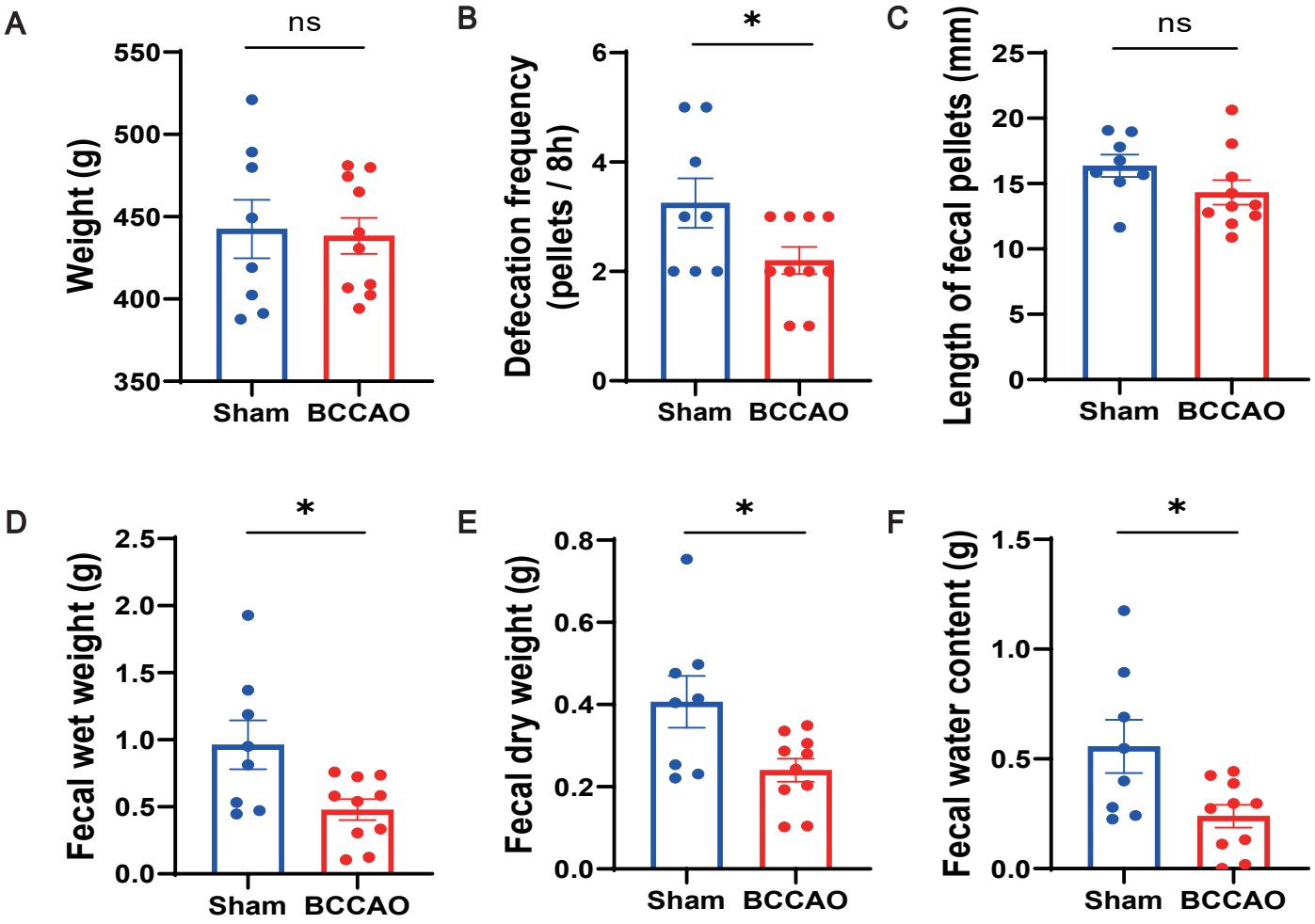

Fig. S1 Effects of BCCAO on body weight (**A**), defecation frequency (**B**), length of fecal pellets (**C**), fecal wet weight (**D**), fecal dry weight (**E**), and fecal water content (**F**) in rats (n = 8 Sham, n = 10 BCCAO). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. * $p < 0.05$ compared to the sham group.

Fig. S2

A

B

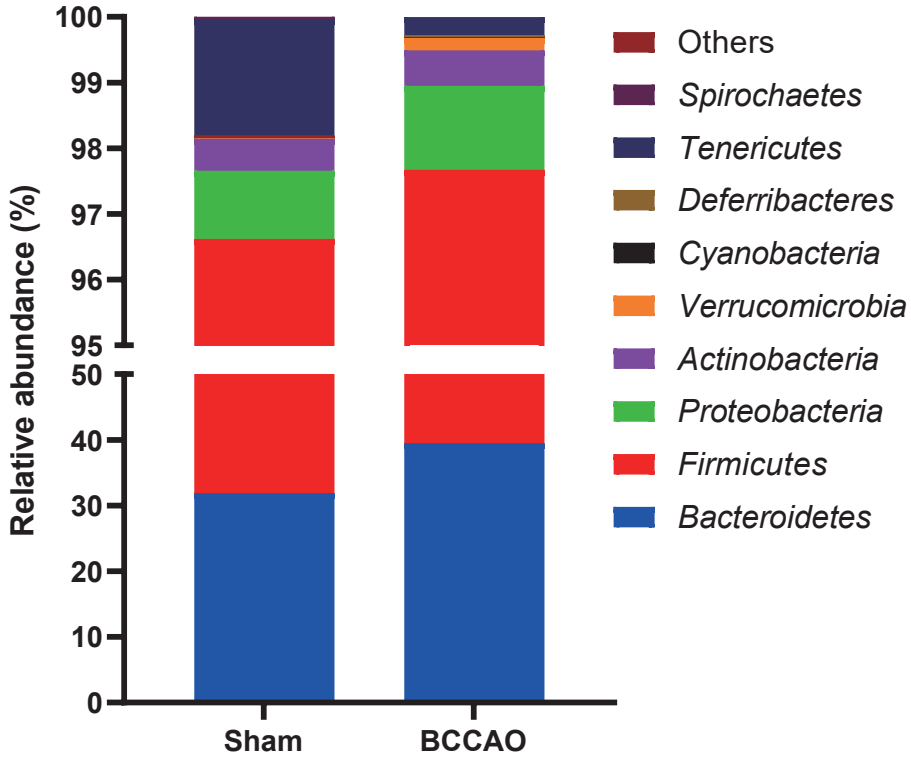

Fig. S2 Effects of BCCAO on gut function and microbial ecology. **A** One of the BCCAO rats was excluded from the intestinal motility test due to intestinal obstruction. **B** The structure of the gut microbiota at the phylum level (n = 15/group).

Fig. S3

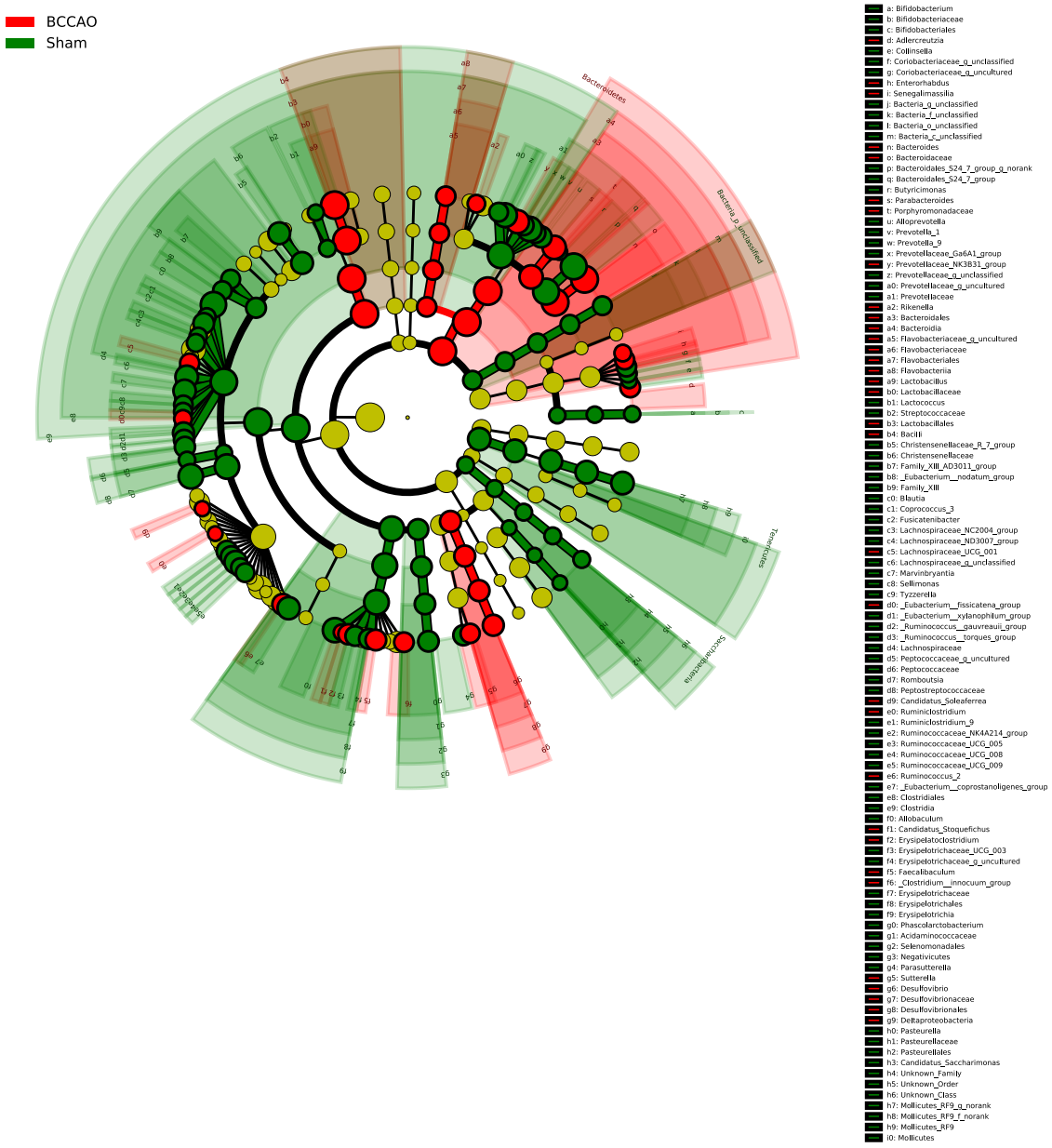

Fig. S3 Overall representation of bacterial profiles in the sham and BCCAO rats by linear discriminant effect size (LEfSe) analysis (n = 15/group).

Fig.S4

Fig. S4 A heatmap demonstrating the gut microbiota profile at the family level between the sham and BCCAO groups (n = 15/ group).

Fig.S5

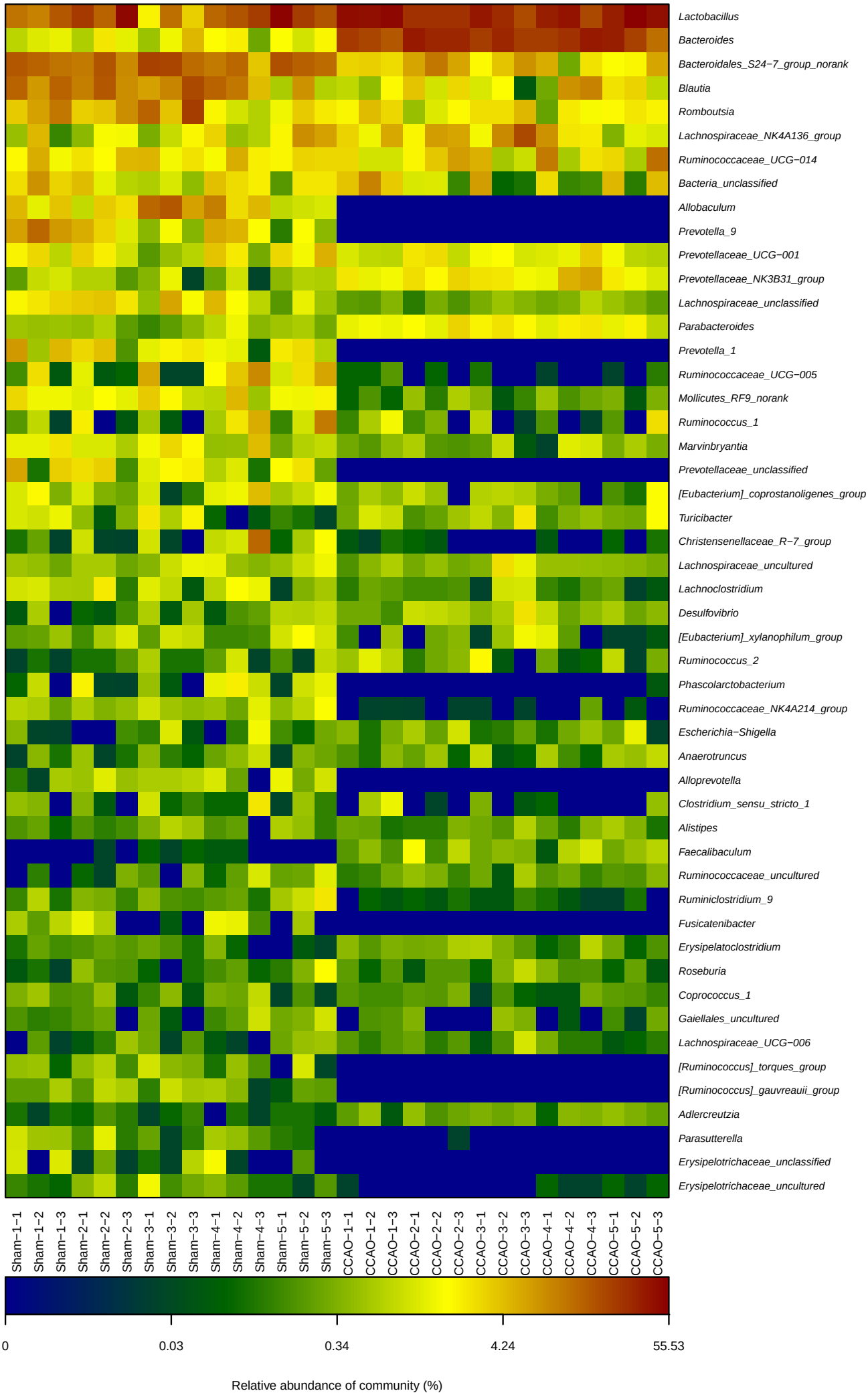

Fig. S5 A heatmap demonstrating the gut microbiota profile at the genus level between the sham and BCCAO groups (n = 15/group).

Fig. S6

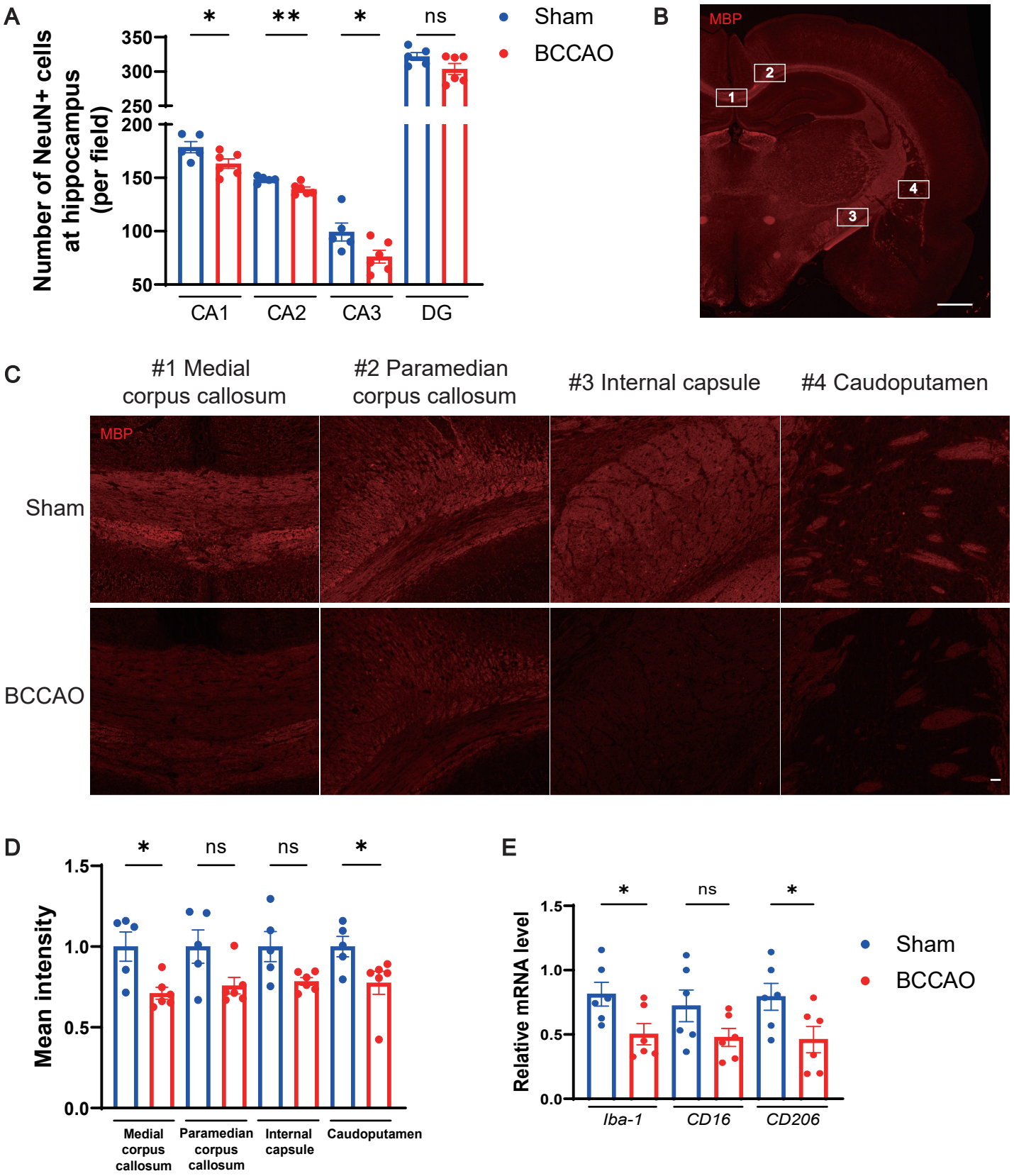

Fig. S6 Effects of BCCAO on hippocampal neuron, white matter injury and microglial activation. **A** Bar plots showing the number of NeuN+ cells in different areas of the hippocampus, namaly cornu ammonis (CA) 1, CA2, CA3, and dentate gyrus (DG) (n = 5 Sham, n = 6 BCCAO). **B** Immunofluorescence staining of myelin basic protein (MBP). Scale bar, 1 mm. **C** Representative images of the medial corpus callosum (CC), paramedian CC, internal capsule (IC), and caudoputamen regions and **D** bar plots showing the mean fluorescence intensity (n = 5 Sham, n = 6 BCCAO). Scale bar, 50 μm. **E** mRNA levels of Iba-1, microglial pro-inflammatory marker (*CD16*), and anti-inflammatory marker (*CD206*) in the hippocampus at day 36 post BCCAO (n = 6/group). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. * $p < 0.05$, ** $p < 0.01$ compared to the sham group.

Fig. S7

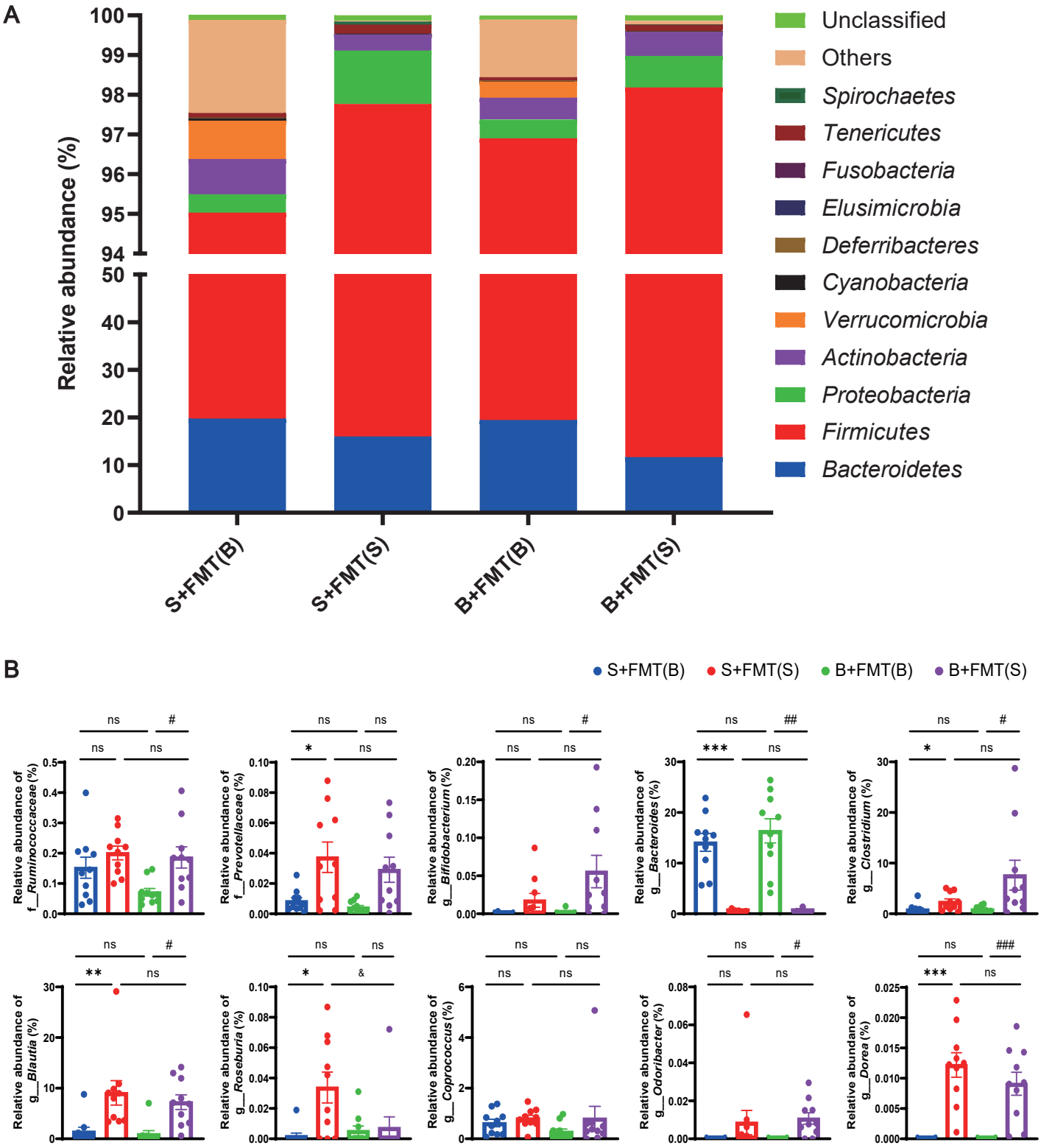

Fig. S7 Fecal microbiota transplantation successfully rebuilds distinct gut microbiota composition. **A** The structure of gut microbiota at the phylum level successfully reestablished by FMT (n = 10/group). **B** Bar plots showing the relative abundance of f_*Ruminococcaceae* and f_*Prevotellaceae* at the family level and g_*Bifidobacterium*, g_*Bacteroides*, g_*Clostridium*, g_*Blautia*, g_*Roseburia*, g_*Coprococcus*, and g_*Dorea* at the genus level (n = 10/group). S+FMT(B), sham rats received BCCAO-rat-derived fecal microbiota transplantation. S+FMT(S), sham rats received sham-rat-derived fecal microbiota transplantation. B+FMT(B), BCCAO rats received BCCAO-rat-derived fecal microbiota transplantation. B+FMT(S), BCCAO rats received sham-rat-derived fecal microbiota transplantation. The data represent the mean ± SEM. $p < 0.05$ was set as the threshold for significance. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ compared to the S+FMT(B) group. & $p < 0.05$ compared to the S+FMT(S) group. # $p < 0.05$, ## $p < 0.01$ compared to the B+FMT(B) group.

Fig. S8

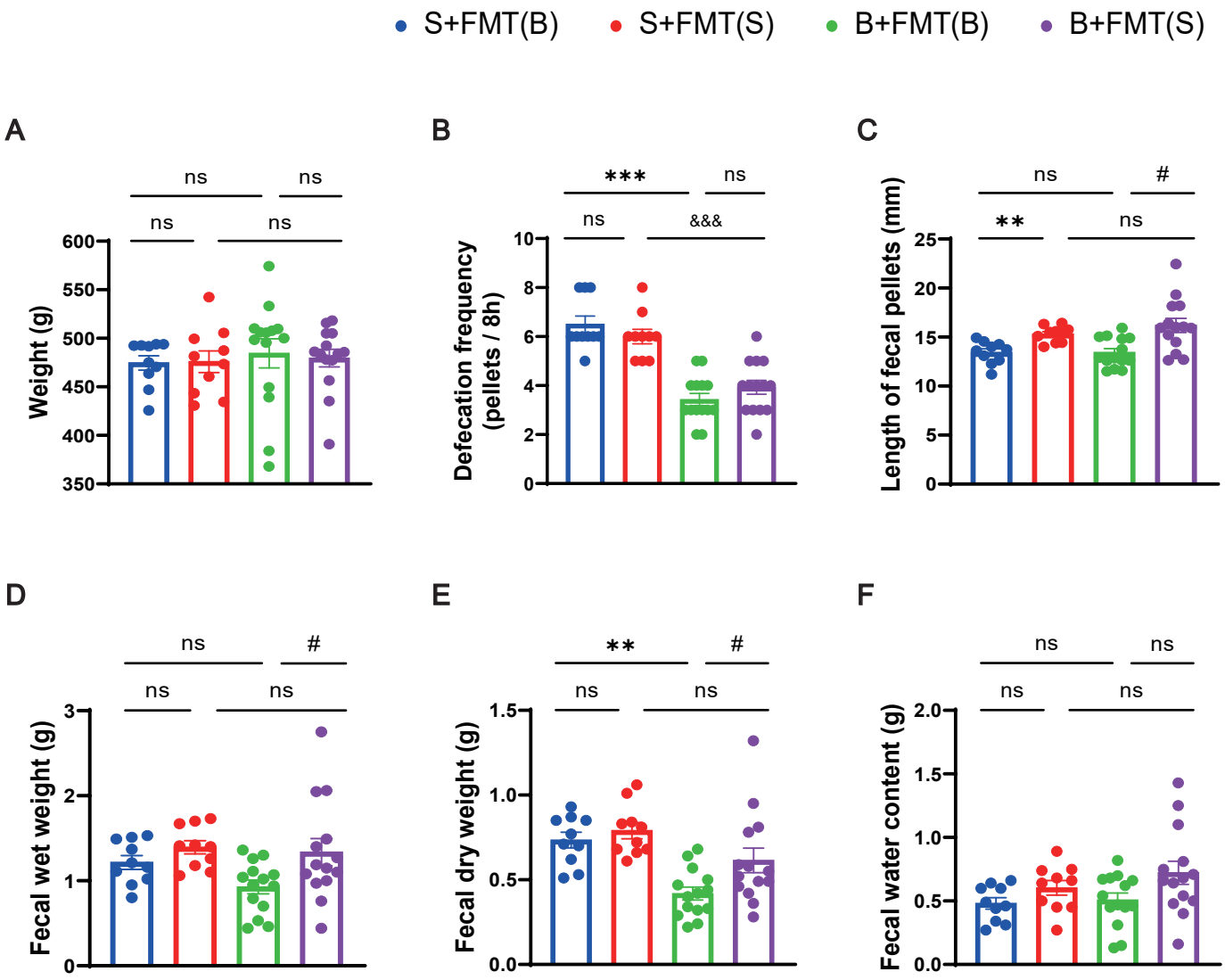

Fig. S8 Effects of FMT on body weight (**A**), defecation frequency (**B**), length of fecal pellets (**C**), fecal wet weight (**D**), fecal dry weight (**E**), and fecal water content (**F**) in recipient rats (n = 10 S+FMT(B) and S+FMT(S), n = 14 B+FMT(B) and B+FMT(S)). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. ** $p < 0.01$, *** $p < 0.001$ compared to the S+FMT(B) group. &&& $p < 0.001$ compared to the S+FMT(S) group. # $p < 0.05$ compared to the B+FMT(B) group.

Fig. S9

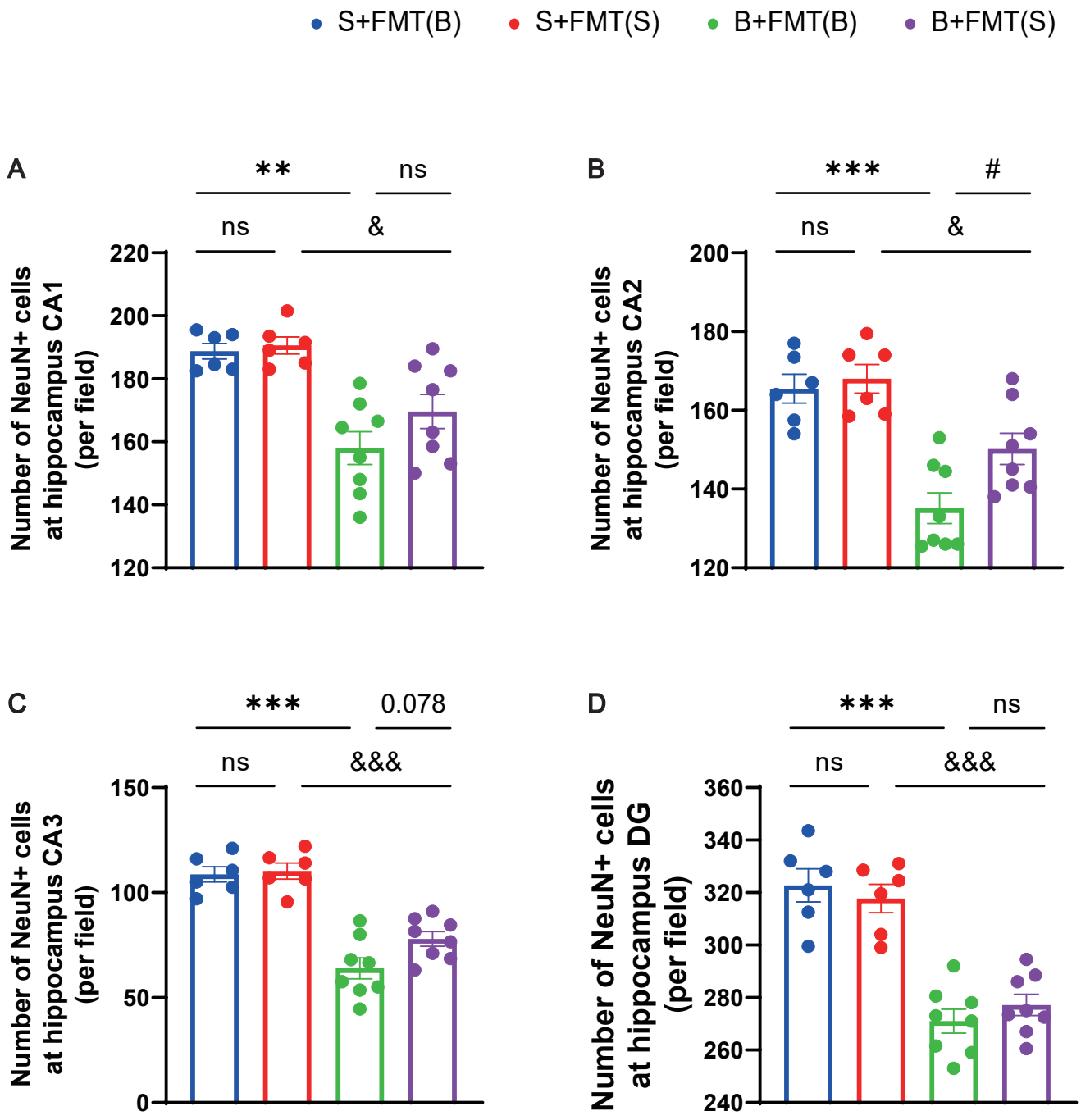

Fig. S9 Effects of FMT on the number of NeuN+ cells in different areas of the hippocampus, namaly (**A**) CA 1, (**B**) CA2, (**C**) CA3, and (**D**) DG (n = 6 S+FMT(B) and S+FMT(S), n = 8 B+FMT(B) and B+FMT(S)). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. ** $p < 0.01$, *** $p < 0.001$ compared to the S+FMT(B) group. & $p < 0.05$, &&& $p < 0.001$ compared to the S+FMT(S) group. # $p < 0.05$ compared to the B+FMT(B) group.

Fig. S10

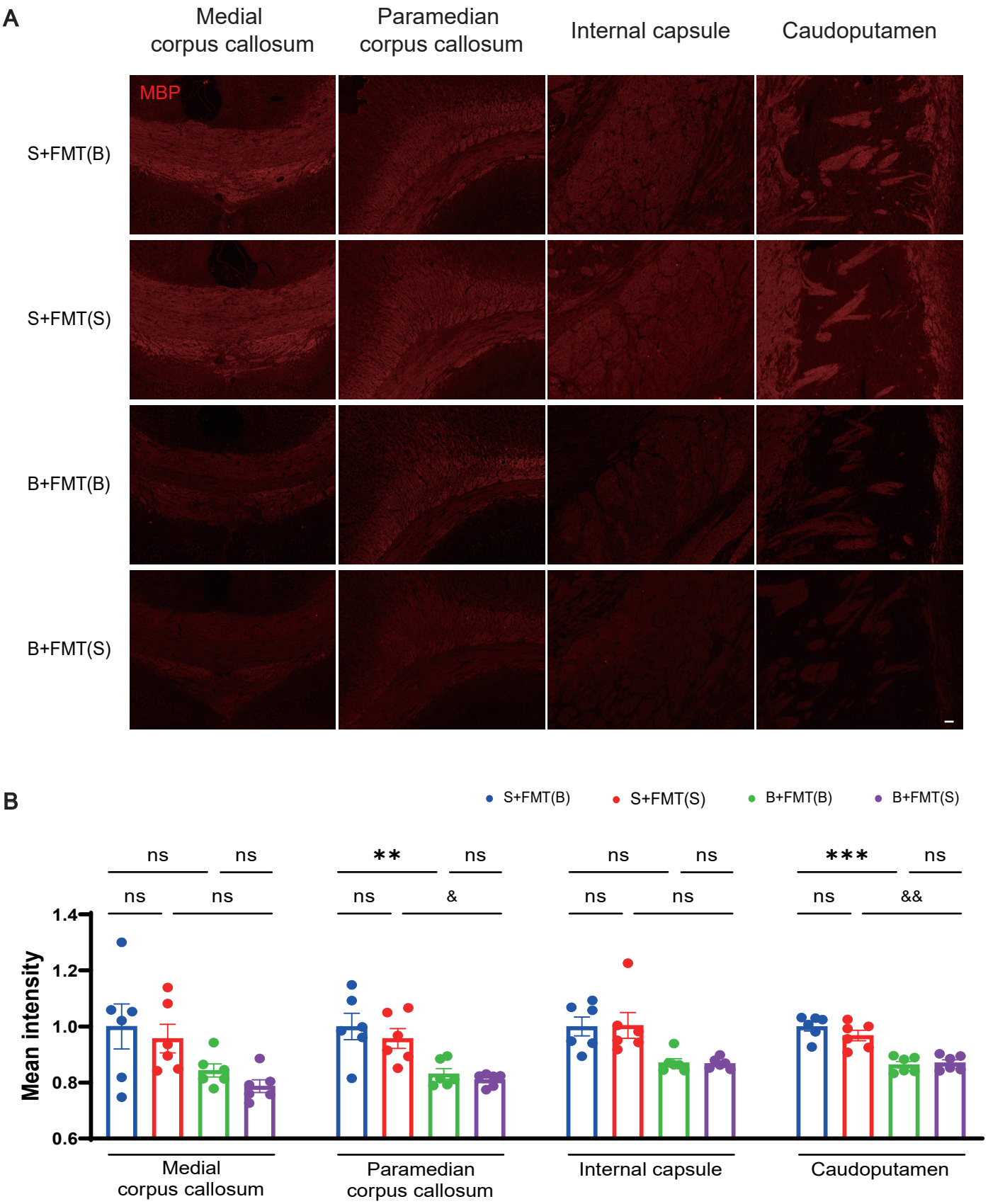

Fig. S10 Effects of FMT on white matter injury after BCCAO. **A** Representative immunofluorescence staining images of MBP in the medial CC, paramedian CC, IC, and caudoputamen regions. Scale bar, 50 μm. **B** Bar plots showing the mean fluorescent intensity (n = 6/group). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. ** $p < 0.01$, *** $p < 0.001$ compared to the S+FMT(B) group. & $p < 0.05$, && $p < 0.01$ compared to the S+FMT(S) group.

Fig. S11

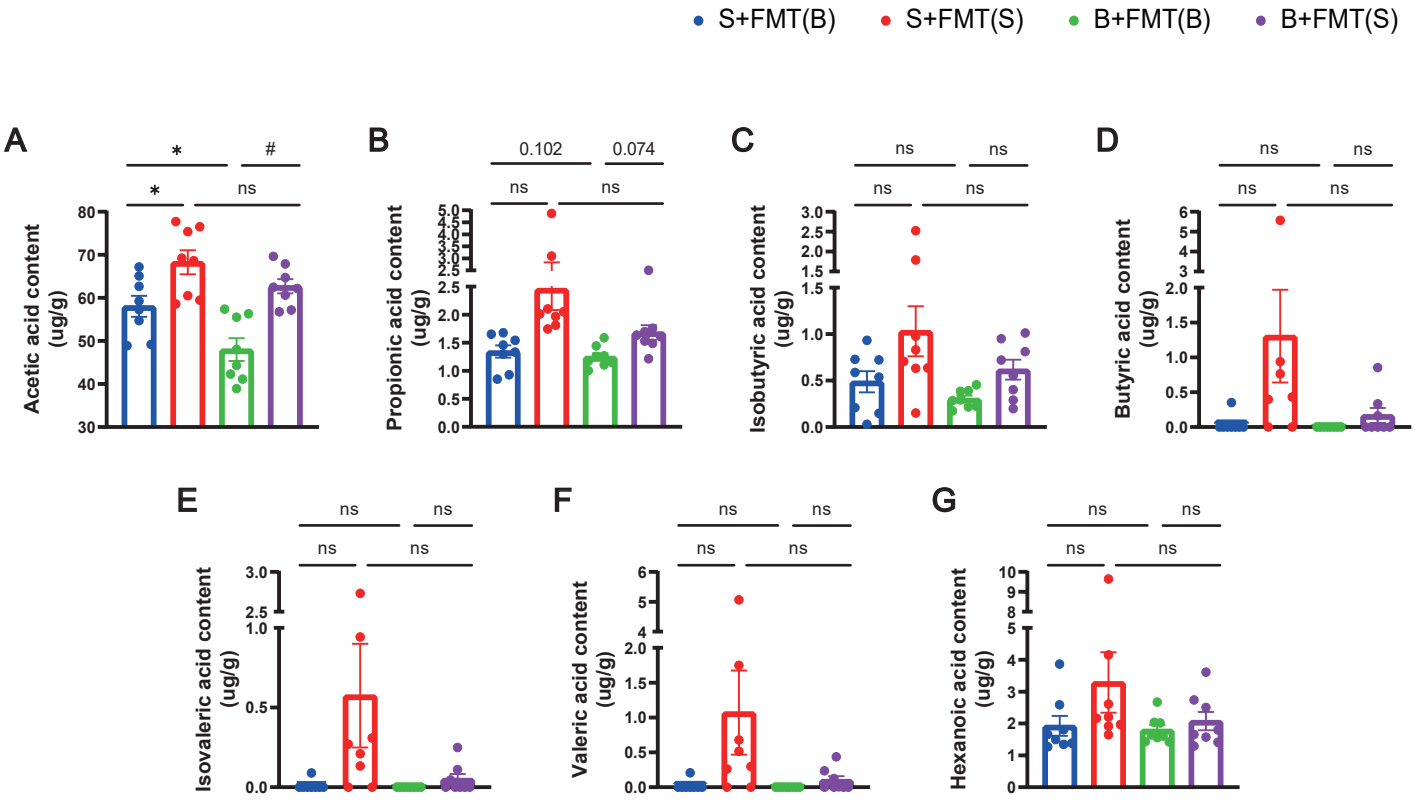

Fig. S11 Effects of FMT on SCFA levels in the hippocampus of recipient rats, including acetic acid (**A**), propionic acid (**B**), isobutyric acid (**C**), butyric acid (**D**), isovaleric acid (**E**), valeric acid (**F**), and hexanoic acid (G) (n = 8/group). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. * $p < 0.05$ compared to the S+FMT(B) group. # $p < 0.05$ compared to the B+FMT(B) group.

Fig. S12

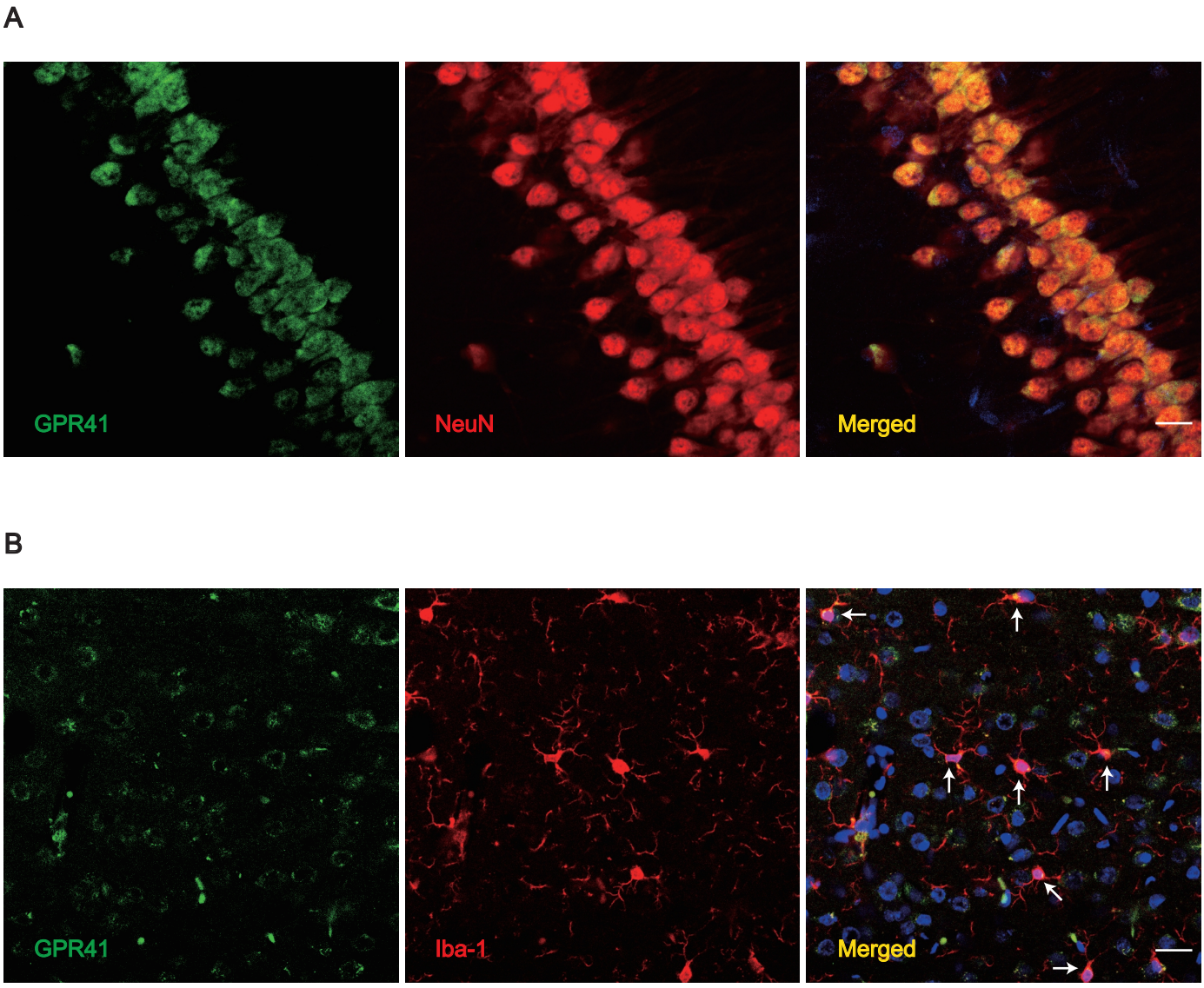

Fig. S12 Immunofluorescence staining of the GPR41-a receptor of SCFAs with hippocampal neurons (**A**) and microglia (**B**). Arrows indicate the expression of GPR-41 on microglia. Scale bar, 20 μm.

Fig. S13

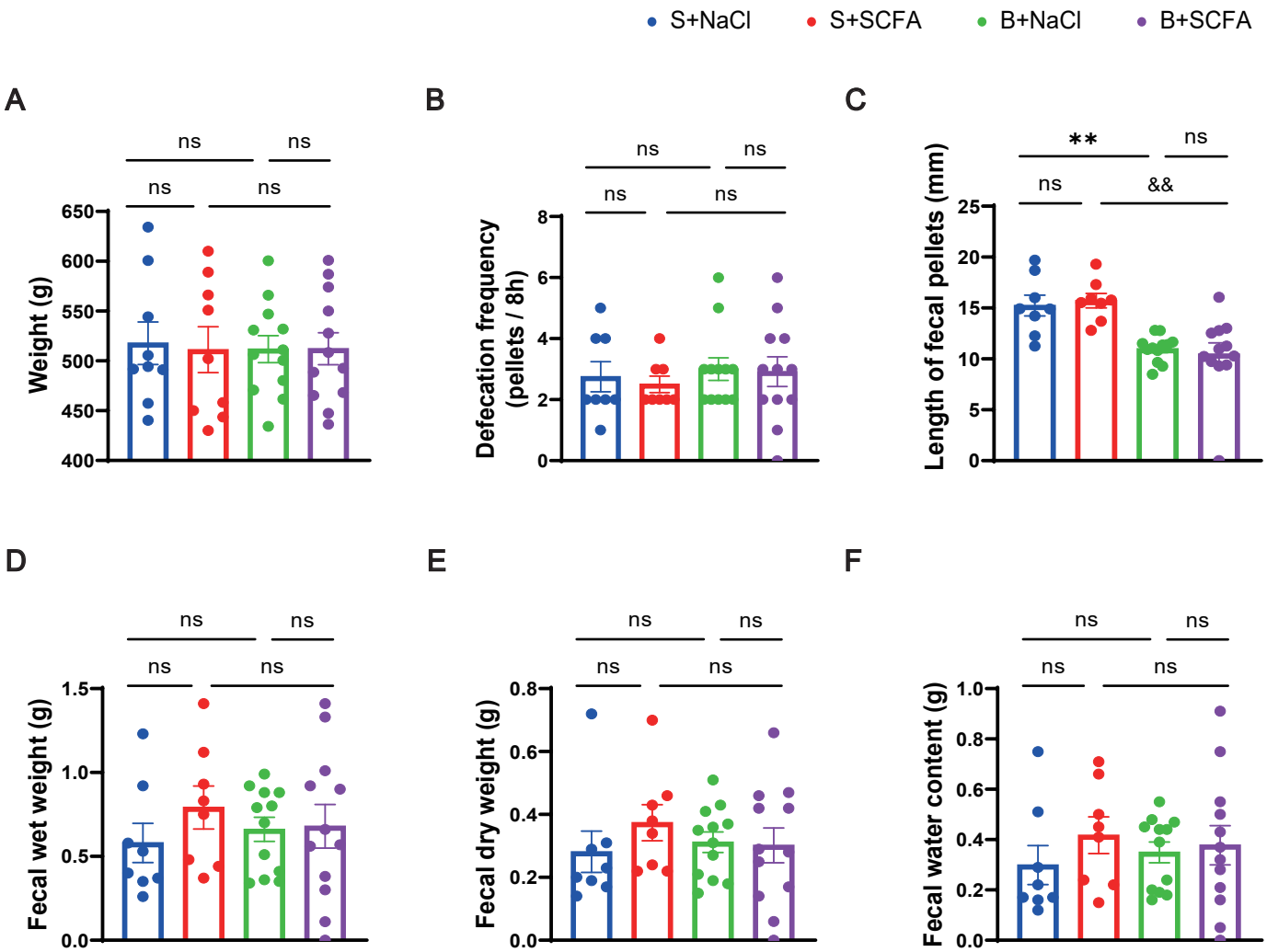

Fig. S13 Effects of long-term SCFA supplementation on body weight (**A**), defecation frequency (**B**), length of fecal pellets (**C**), fecal wet weight (**D**), fecal dry weight (**E**), and fecal water content (**F**) in rats (n = 8 S+NaCl and S+SCFA, n = 12 B+NaCl and B+SCFA). S+NaCl, sham rats treated with sodium chloride (NaCl). S+SCFA, sham rats that received short chain fatty acids (SCFAs) (acetate, propionate and butyrate) supplementation. B+NaCl, BCCAO rats treated with NaCl. B+SCFA, BCCAO rats received SCFAs supplementation. The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. ** $p < 0.01$ compared to S+NaCl group. && $p < 0.01$ compared to the S+SCFA group.

Fig. S14

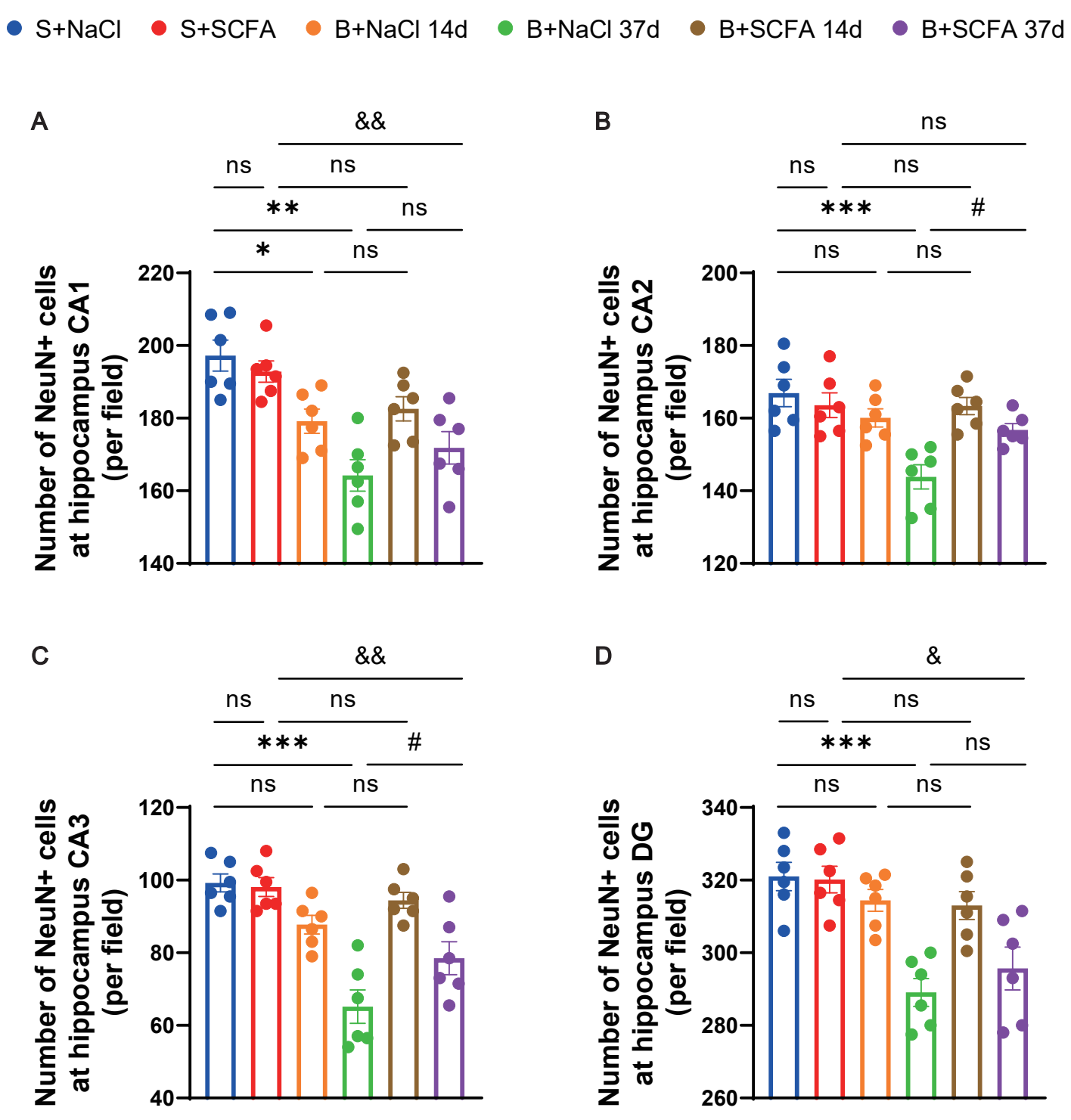

Fig. S14 Effects of long-term SCFA supplementation on the number of NeuN+ cells in different areas of the hippocampus, namaly (**A**) CA 1, (**B**) CA2, (**C**) CA3, and (**D**) DG (n = 6). The data represent the mean ± SEM, $p < 0.05$ was set as the threshold for significance. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ compared to the S+NaCl group. & $p < 0.05$, && $p < 0.01$ compared to the S+SCFA group. # $p < 0.05$ compared to the B+NaCl 37 d group.