



J?@GKBFKE8:FDGEJ\*\* @PLD8EJ F1\*\* @E<: 9P8M8
I@PF=JF:GC=EMED<EK8=8KFJ / '- DF;<CJ@LCXJ K? M8@
FLJ GKJLI<J K?KGFJG8KID DFK?IJ JL=4 =FD .? < KNF DF;<Q
J@LCK<@=4<EK:C@8C:8LJ<J 8E; K? JFDGKFDJ N@Q<;@=4<EK
"F N<M! @@UE:C-8 N?@? F=K?KNF DF;<Q @DFI<:FEJ@KEKN@?
K?<:C@8C=8KJL .? <4<=K 8 :FDGK?<EJ@<N8C8KFE F=K?9<
?8M@BC8E; G?P@CE@C@?8KFJ F=K?KNF DF;<Q JF8JKFJ-C?K
K?8GGIFGI@K DF;<C @NIFIK?P==Uk?I JK; P
#EK?@JK; P CE>K4D '- 8E; / '- N<I<:FEJKL:K<; 8E; :FD
G8<; JF8JKFGIFM@ 898J@;8K8=FD DF;<CJ-C?KFE F=\*\* ;@<8J<
I-J-8I:?

2. Materials and methods

2.1. Animals

(< NCP;<C@I<; =D8C< & D@< D > 8E; K?@C@4D8KJ
N<I< GIFM@; 9P OG4 @<EK8 E @8C <EK4 F=-FLK<IE '<; @8C
/E @4J@P!L 8E-QFL ? @E - 2 %3L< .? <D@< N<I<
@EM@8CP?FLJ<; 8KIFFD K@G48KJL< W U N@? W
?LD@?8E; 8 ? C@K;8IB :P:C@ @?KJ FE D CC8E@
D8CJN<I< GIFM@; =k<8:;<JJKF=FF; 8E; N8K4 CC@G4 @<EMN<I<
G4=FD <; 8:FI; @EKFK?;<>LCK@EJFEK?; D@@1BK@EF=OG4
@<EK8 E @8CJF=-FLK<IE '<; @8C/E @4J@P &89F8KFP E @8C
!L @<C@=F K?@C<M@N F= E @8C1<G8< !
8E; &89F8KFP E @8C<HL@D<EK4F=EMED<EK8E; "F LJ@E 8
:@@! 8E; N<I<8GGIFM; 9PK? E @8CK?@ F D
D@<K F=-: ?FFCF=-FLK<IE '<; @8C/E @4J@PFE); K@<

2.2. MS and CUMS modeling

8 DJ N<I< I8E;FDCP 8J@E<; KF8 '- DF;<C n 8 / '-
DF;<Cn 8E; 8:FEKFG<IFLG n .? <8PF=<C@IPN8J8G
GF@K? 8JGFJG8KID ;8P =K4 K?@J8 DJ N<I< C=KLE;@KJ9<; @E
K?:FCEPIFFD K@GFJG8KID ;8P
.? <FG:I8KFE F=- DF;<CN8J KFJ<8I8K<K? ;8DJ =FD K?@
GLGJ=FF ?;8 @C KF 8E; KF =FD GFJG8KID
;8P D 5 D 6 8? ;8D N8JDFM< J<8I8K@PKF8 :8>N@?K?
J8D<C@E:FE;@FEJ
.? <FG:I8KFE F=- DF;<CN8J KF8E;FDCP>@F=FE F=K?FC
C@N@EJK<JJ9<KN<E 8E; @K?DFIE @E=FD GFJG8KID
;8P D -N@D@>N@?@<N8K4 U =F D@ 8 J@E=FF
? GIF?@CN8K4=FF ?<JK@KFEJK<JJ=FF ? "@@?
G6<FD JK<JJ=FF D@ 8 @C8DG@EJK<JJ=FF D@ 8 @C
JLJG<EJ@EJK<JJ=FF D@ 5 6

2.3. wt of dams and pups

.? <;8 DJ 8E; K?@GLGJN<I< N<@?; FEJGFJG8KID ;8P
8E; 8K4 ;<C@IP I<JG<K@CP.? <N<@?KF=;8DJ @E8?
>IFLG8E; K?K@CN<@?KF=GLGJN<I<I<FI; <; 8E; K?N<@?KK4E
: ?8IKN8J ;I 8NE

2.4. Behavioral tests

< ?8M@BCK@KJ @EL; @ED8K4E8C9<?8M@F <GM@< GCJ D8Q<
K4K \* . K@DLJG<EJ@E K4K .- . JLI FJ< GK<I<E< K4K \* .
8E; =F<; JN@D@>K4K - . N<I< G4=FD <; @B:FI;8E:<N@?
GIF<I<LJ<;J:I@< GK-M@J@P 5 6 N@?D@EF DF; @8K@EJ
E 8CPJ<N<I< G4=FD <; @B D8EE<D N@?9@E; Kk8D<EK8J@E
D<EK@BCC9<?8M@BCC@G4 @<EK

2.5. Quantitative RT-PCR

.F K@C( N8J<K8:K? =FD K@LJ?FDF><E@< @B @C FI<
><E ? <E;L ? @E \*LI@@;( N8JLJ<; =ff . \* , KF><E<I8K
: ( N@?8: ( ,<M4J<.I 8EJ:I@KFE%@ ! "L 8E ? @E 8E;
K?I<JL@E: ( N8JLJ<; =ff HL8EK@K@\* , +L8EK@K@I<8C
K@\* , H\* , N8JG4=FD <; LJ@E8 ,F :? <&@?KP:C I<8C
K@\* , .? <I<@K@D, ( <CG<J@E@C@M@CN8J;<K4D@< N@?K?
uy y K D<K?; N@?Gapdh 8J K? @E4E8C I<I<E< :FEKFC CCG<
D@IJLJ<; @E H\* , N<I< GKJ<EK; @EL GC@<E8IP 8.9@

2.6. Immunohistochemistry

I 8@K@L<N8J:LK@E8C=@B@<@C=FD 8E; GFJK@< N@?
G88=FD 8C<?P;< #DDLEFJK@<E N8J G4=FD <; FE UD K?@B
J8<@89I8@EJ<K@EJF9K@E N@?8G8?F>P@<I - ?8E>?8@<@8
#EJLKD<EK F &K .? <J<K@EJ N<I< @E 98K? N@?9I8@;<I@M<
E<LIFKFG@ =8KF ( GI@8IP 8EK@P;P =@@K @FJ:@<@J
8K 8E; J<FE; 8EK@P;P LJ@E89IF8; JG<KLD \* <D
DLEF?@K?<D@<CB@ @FJ<@@? @E \* #D8<JN<I<
8:HL@; LJ@E)CPDGLJ GFJ@M<GFJ@E D@ FJ:FG<

2.7. Enzymelinked immunosorbent assay (ELISA)

.? < @E4C@B@E#& C@M<CF=K? :FIK@CK@L< ?FDF>E8K<N8J
K4K; N@? &#- B@GLI: ?8J; =FD @F<? F &K .? <KJ
;@C GIF><K4FE \* GIFC@E ;& C@K@F=K?G8J8 8E; K?
?P;I F@PKPGKD @E . ;FGD@< C@K@F=K? :FIK@CK@
JL<?FDF>E8K<N<I< K4K; N@? &#- B@J+L8EQFL ,L @@E@CF@<
:8C.<? ERF>P F & . +L8EQFL ? @E

2.8. 16S rDNA sequencing

\* , 8DG@8KFEK8>K? K?0 ED 5 6I<>@EF=K? JI (
.? < u<EJ F=K?GI@BIJN<I< K8>; N@?JG:<@8I:F; J G4 J8DG@
8E; J<HL<E @ELE@4J8CGI@BIJ .? <\* , GIF; L:KJN<I< GLU@ 9P
' \*L<2. 9<8; J <:BD8E F L@K4!< EFD@ 8 EM4J ' /- 8E;
HL8EK@ 9P+L9@ #EM@F>E /- .? <8DG@FE GIFQ N<I< GK
G8<; =F J<HL<E @E8E; K?J@<8E; HL8EK@F=K?8DG@FE C@8IP
N<I< 8J<J<J; FE > @EK @F8E8C@4 >@EK/- 8E; N@?K?
&@8IP+L8EK@8KFE%@=FF #CID@8 %8@ @FJ: @E<J 1F 9LIE '
/- I<JG<K@CP.? <C@8I@<N<I< J<HL<E<; FE (F M8<H \*
G6<FD

2.9. Statistical analysis

CC8 K8<O<GK - I ( J<HL<E @E GKJ<EK; 8JD<8E- ' N<I<
:8CL C@< 8E; ;<DFEJ@K@< LJ@EK?< J@K@.@CJF=N8I< || 8G\*8;
\*1 @J -8E @<@F /- #D8>JN<I< HL8EK@ LJ@EK? #D8>
\*1 F<@LJ JF=N8I< )E <N8P FI KNF N8P8E8@F@F=M8@E< () 0
8E; L EE4KJ GFJK?F: K4K=FF DL@C@ :FDG8 @FEJ N8J 8GG@<KF
:FDG8< K?9<?8M@BCK@KJ<JLCK8E; KF<K8C@J@K@.@C@J@E@
:8EK;@=4<E<J

3. Results

3.1. Comparisons of behaviors between MS model and CUMS model

@JK N< @B@K@< K? N<@?K? 8E><J F=GLGJ8E; ;8DJ )E K?
GFJG8KID K?GLGJ8M18>N<@?KF=JK<JJDF;<CJ?FN<; J@E@
:8EICR<;L<; 8E; / '- DF;<Q<L<; DF< F9M@J@P @ .? <
I8K@8E8@J@F=K? N<@?KF=;8DJ FE;8P 8E; ;8P J?FN<; K?K
K?I<N8J EFJ@E@EK;@=4<E< @E? N<@?K18K@F=;8DJ @E8?
>IFLG 8E; K? I8K@N8J C4JK@E @

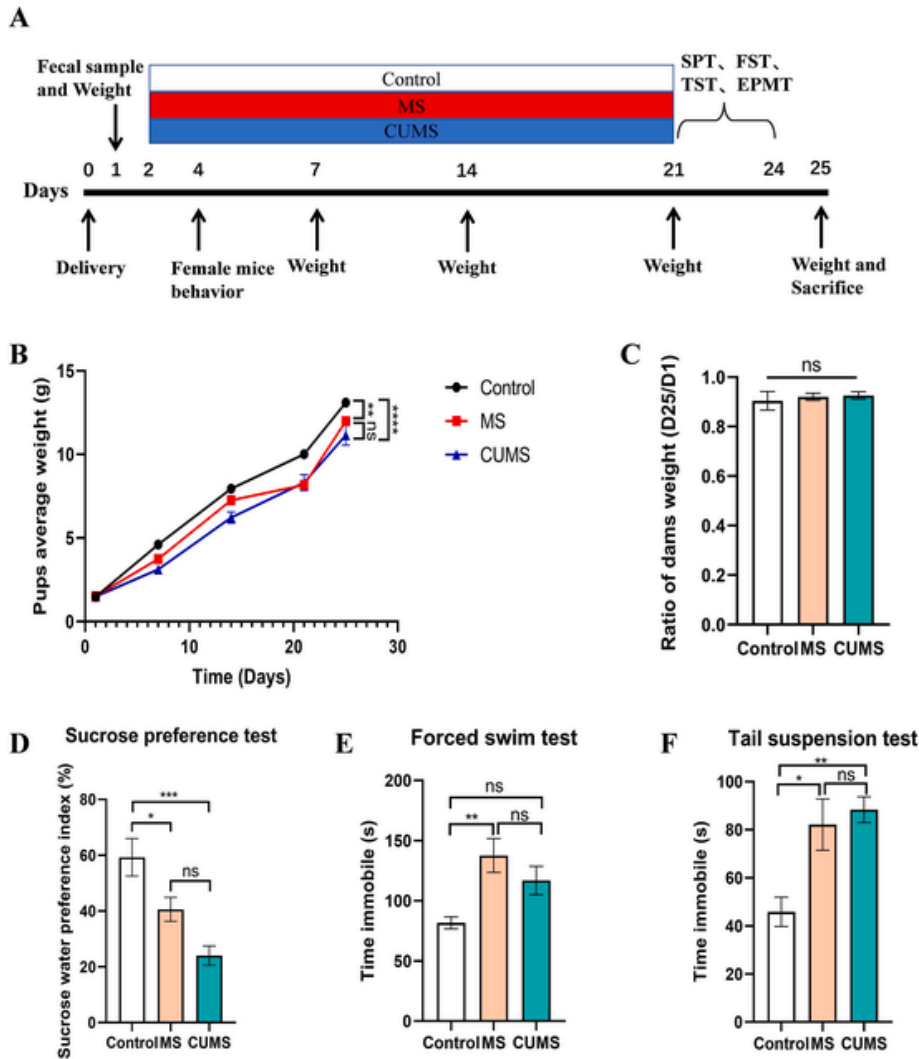


Fig. 1. Behavioral and weight changes in dams and pups. (A) Experimental design. (B) Pups average weight (g) over time (Days). (C) Ratio of dams weight (D25/D1). (D) Sucrose preference test. (E) Forced swim test. (F) Tail suspension test. Data are presented as mean ± SEM. Statistical significance is indicated by asterisks: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, \*\*\*\* p < 0.0001, ns = not significant.

1. The expression of PPD related genes in brain were detected by RT-qPCR. The results showed that the expression of PPD related genes (Cnr1, J7FN, 8JSE, EPK) was significantly increased in the MS and CUMS groups compared with the Control group. The expression of PPD related genes (Cnr1, J7FN, 8JSE, EPK) was significantly increased in the MS and CUMS groups compared with the Control group. The expression of PPD related genes (Cnr1, J7FN, 8JSE, EPK) was significantly increased in the MS and CUMS groups compared with the Control group.

3.2. The expression of PPD related genes in brain were detected by RT-qPCR

The expression of PPD related genes in brain were detected by RT-qPCR. The results showed that the expression of PPD related genes (Cnr1, J7FN, 8JSE, EPK) was significantly increased in the MS and CUMS groups compared with the Control group. The expression of PPD related genes (Cnr1, J7FN, 8JSE, EPK) was significantly increased in the MS and CUMS groups compared with the Control group.

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3.3. The contents of related substances in plasma and cortex were detected by ELISA

The contents of related substances in plasma and cortex were detected by ELISA. The results showed that the contents of related substances (Cnr1, J7FN, 8JSE, EPK) were significantly increased in the MS and CUMS groups compared with the Control group. The contents of related substances (Cnr1, J7FN, 8JSE, EPK) were significantly increased in the MS and CUMS groups compared with the Control group.

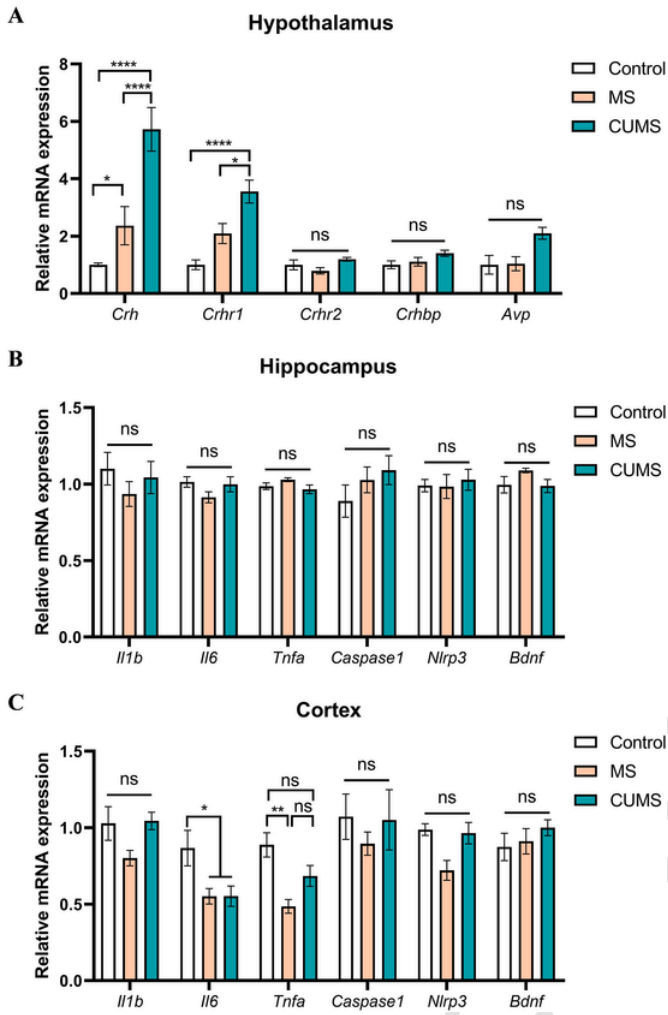


Fig. 2. Relative mRNA expression of *Crh*, *Crhr1*, *Crhr2*, *Crhbp*, *Avp* in the hypothalamus, *Il1b*, *Il6*, *Tnfa*, *Caspase1*, *Nlrp3*, *Bdnf* in the hippocampus, and *Il1b*, *Il6*, *Tnfa*, *Caspase1*, *Nlrp3*, *Bdnf* in the cortex of Control, MS, and CUMS groups. Data are presented as mean ± SEM. Statistical significance is indicated by asterisks (\*, \*\*, \*\*\*, \*\*\*\*) and 'ns' for non-significant.

Relative mRNA expression of *Crh*, *Crhr1*, *Crhr2*, *Crhbp*, *Avp* in the hypothalamus, *Il1b*, *Il6*, *Tnfa*, *Caspase1*, *Nlrp3*, *Bdnf* in the hippocampus, and *Il1b*, *Il6*, *Tnfa*, *Caspase1*, *Nlrp3*, *Bdnf* in the cortex of Control, MS, and CUMS groups. Data are presented as mean ± SEM. Statistical significance is indicated by asterisks (\*, \*\*, \*\*\*, \*\*\*\*) and 'ns' for non-significant.

### 3.4. CUMS model and MS model showed different changes in BDNF

BDNF mRNA expression was significantly increased in the CUMS group compared to the Control and MS groups in the hypothalamus, hippocampus, and cortex. In the hypothalamus, BDNF expression was significantly higher in the CUMS group compared to the Control and MS groups. In the hippocampus and cortex, BDNF expression was significantly higher in the CUMS group compared to the Control and MS groups.

### 3.5. 16s rDNA sequencing

#### 3.5.1. Alpha diversity

Alpha diversity indices (Shannon, Simpson, and Chao1) were significantly lower in the CUMS group compared to the Control and MS groups in the hypothalamus, hippocampus, and cortex. In the hypothalamus, alpha diversity was significantly lower in the CUMS group compared to the Control and MS groups. In the hippocampus and cortex, alpha diversity was significantly lower in the CUMS group compared to the Control and MS groups.

#### 3.5.2. Beta diversity

Beta diversity analysis (PCoA) showed that the bacterial community structure in the CUMS group was significantly different from the Control and MS groups in the hypothalamus, hippocampus, and cortex. In the hypothalamus, the bacterial community structure was significantly different from the Control and MS groups. In the hippocampus and cortex, the bacterial community structure was significantly different from the Control and MS groups.

#### 3.5.3. Composition of bacterial community structure

The composition of bacterial community structure was significantly different in the CUMS group compared to the Control and MS groups in the hypothalamus, hippocampus, and cortex. In the hypothalamus, the bacterial community structure was significantly different from the Control and MS groups. In the hippocampus and cortex, the bacterial community structure was significantly different from the Control and MS groups.

#### 3.5.4. Significant species differences

Significant species differences were identified in the CUMS group compared to the Control and MS groups in the hypothalamus, hippocampus, and cortex. In the hypothalamus, significant species differences were identified in the CUMS group compared to the Control and MS groups. In the hippocampus and cortex, significant species differences were identified in the CUMS group compared to the Control and MS groups.

### 4. Discussion

The present study investigated the effects of CUMS and MS on the hypothalamus, hippocampus, and cortex. CUMS and MS significantly altered the expression of *Crh*, *Crhr1*, *Crhr2*, *Crhbp*, *Avp* in the hypothalamus, *Il1b*, *Il6*, *Tnfa*, *Caspase1*, *Nlrp3*, *Bdnf* in the hippocampus, and *Il1b*, *Il6*, *Tnfa*, *Caspase1*, *Nlrp3*, *Bdnf* in the cortex. CUMS and MS also significantly altered the bacterial community structure and alpha diversity in the hypothalamus, hippocampus, and cortex. Significant species differences were identified in the CUMS group compared to the Control and MS groups in the hypothalamus, hippocampus, and cortex.

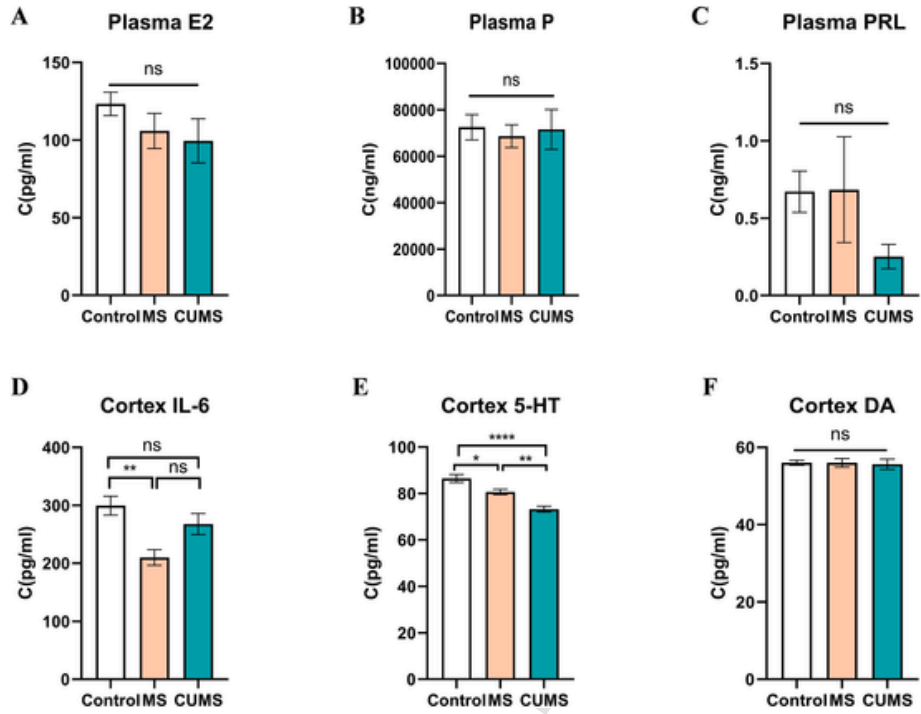


Fig. 3. Effect of MS and CUMS on the levels of E2, P, PRL, IL-6, 5-HT, and DA in plasma and cortex. Data are presented as mean ± SEM. ns, not significant; \*\*P < 0.01; \*\*\*P < 0.001; \*\*\*\*P < 0.0001.

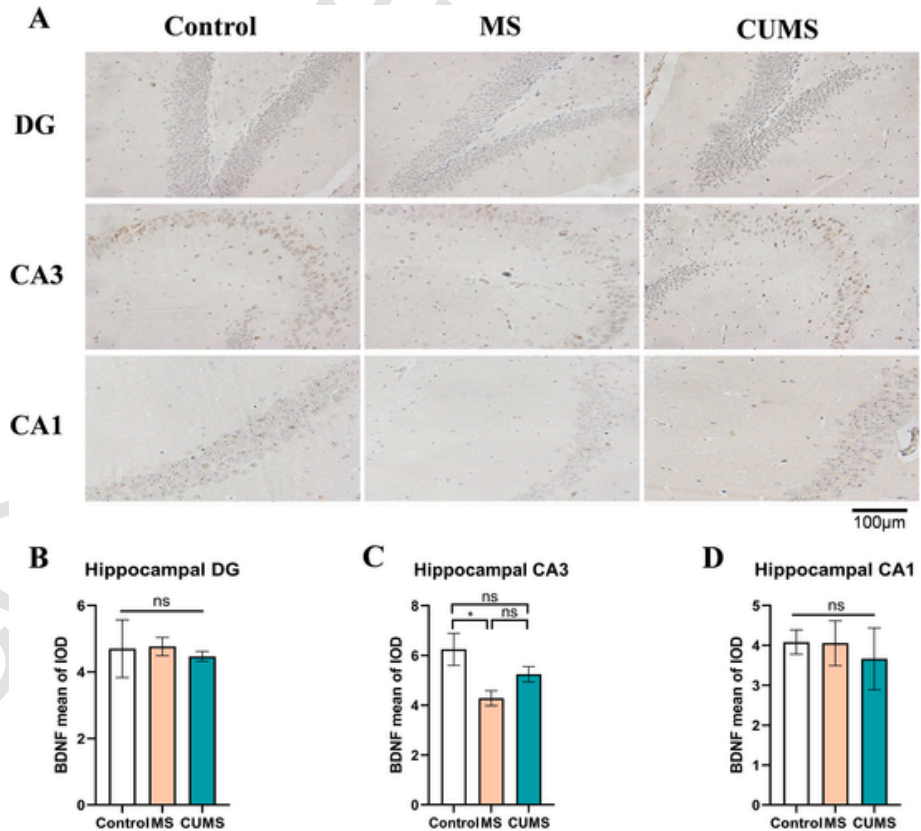


Fig. 4. Effect of MS and CUMS on the expression of BDNF in the hippocampus. (A) Representative immunohistochemical images of BDNF in DG, CA3, and CA1. (B–D) Quantification of BDNF expression in DG, CA3, and CA1. Data are presented as mean ± SEM. ns, not significant; \*P < 0.05; \*\*P < 0.01; \*\*\*P < 0.001; \*\*\*\*P < 0.0001.



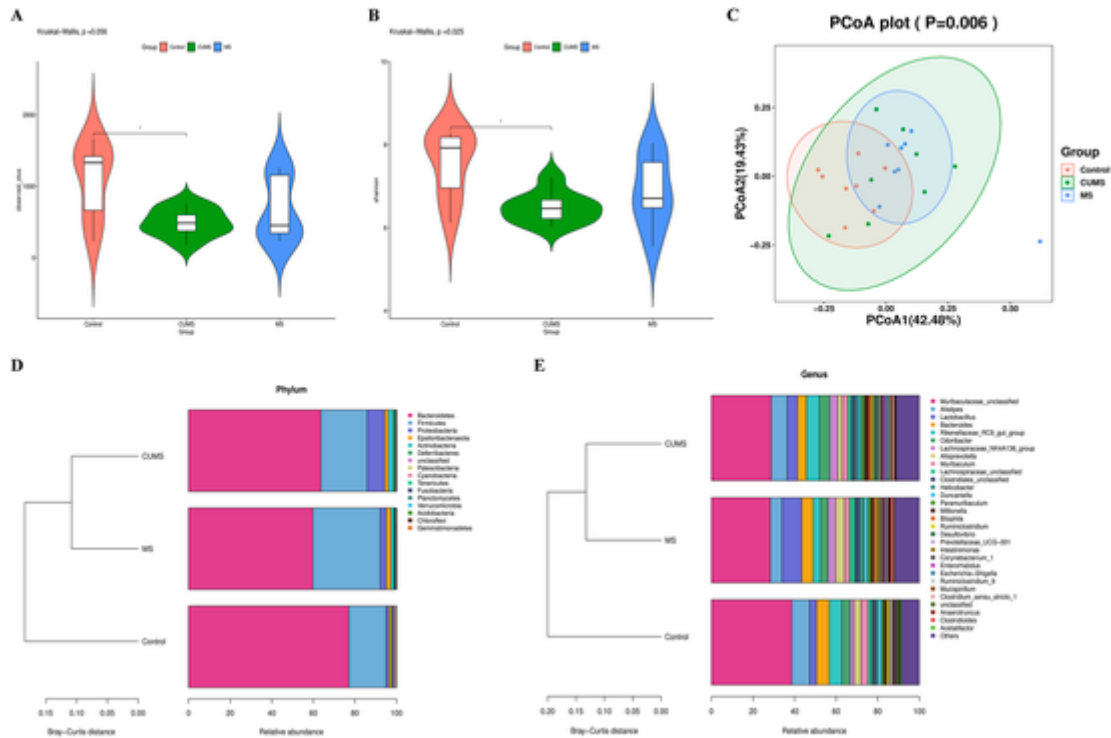


Fig. 5.  $\beta$  diversity (A, B) and PCoA plot (C) of the gut microbiome. D and E show the relative abundance of phyla and genera, respectively. \* indicates statistical significance.

.? <I=<F< :? 8E<J @D8K4E8C9F;P N<@?K:8 EEFK9<LJ<; 8J8 D<8  
 JLI<F=K? JL: :<JJ F=;<GkJ @E DF; <Q 5 6 .? <JLI FJk Gk<I<E<  
 @E O@E ' - DF;<C<:I <8J< DFI<F9M@J@ .? @@;@8 KJ K?K?<  
 / ' - DF;<C@DFI<F9M@J @BE?<F E @ #E - . 8E; . - ' - DF;<C  
 8E; / ' - DF;<CG4=<HD <; ;@=<EK@ .? <' - DF;<CJ?FN<; CE>I  
 @DF9@PK@ @E . 8E; K? / ' - DF;<CJ?FN<; CE>I @DF9@PK  
 K@< @E . ? <I<N8J EF; @=<4<E< @K? JI8PK@ @K? :CFk; 8ID  
 8I<89<KN<E K? KNF >IFLGJN? @? JI>>JK; K?K & D@<N<I<  
 D<<B8E; K@< 8E; N<I< DFI< @B JI8K F=8MF@8E< 8E; 8E@R @E  
 K? E<N <BMI@ED<EK5 6  
 #DDLE<JRK@ 8E; :PKB@<J 8I< @IFCM; @K? ;<M@CD<EKF=  
 \*\* 5 D 6 (&,\* @E8DD8JFD<; <=<@EP @DIFM; ;<GkJ@E  
 C@<9<?8M@F@D@< 8E; Caspase1 8E; Nlrp3 D, ( C@<Q @E<8J< @E  
 K? 9CF; ;<C@F=<; GkJ@< Gk@K.5 6 #KJL>><JK K?K\*\* D8P8QF  
 9<I<C@K? KF@E8D8K@E -F N<D<8JLI<; K? @E88 K@J +\* , I<  
 JLCJK?FN<; K?KI<@K@<I1b, I16, Tnfa, Caspase1 8E; Nlrp3 D, ( <Q  
 GkJ@EJ?FN<; EFJ8K@K@C @=<4<E< @K? ?@GF8 DGLJN? @<Q<C  
 8K@<I16 8E; Tnfa D, ( <GKJ@E; ;<I <8J< @K?:FIK@F=K? JK<JJ  
 DF;<C & # - I<JLCJK8QF J?FN<; K?K#& C@<M@N8J; ;<I <8J< @K?  
 :FIK@F=JK<Jk; ;8 DJ <JG<@CP@K? ' - DF;<C CK?L? K?Jk I<  
 JLCJk; @=<4 =IFD JFD< GL9C@<; JK; @k K?I< 8I< 8QF :F=@<E I<  
 GRKJ F=@E8D8K@P :? 8E>J 8JF@K; N@? \*\* 8E; K? C@<K  
 ELD9<I F=<I<G@IKJ D8B<J @<@=<@CKF; <K4D@<8 IFC-F=E<LIF @E8D  
 D8K@E @K? LE;<I<C@E@E<I F9@CF>PF \*\* 5 6 1< JG: LC@<K?K  
 E<LIF @E8D8K@E I<C@K? :PKB@<J @B@<Jk; ;8 DJ N<I< @B JI8K F=  
 =<; 98; B I<JLCJK8QF J?FN<; K?K#& C@<M@N8J; ;<I <8J< @K?<  
 8E; K? 8E@R @E C@<K@E8K@P I<JCFEJ< @B@<JF JF K?K?K? @E8D8K@P =8 K@J  
 ;<I <8J< J?8IG@  
 \*I<M@J JK; @k?8M<J?FNE ;<I <8J< ". 8E; ( C@<Q  
 @E8K@KJN@? \*\* 5 6 .? <I<@K@< Bdhf D, ( <GKJ@E  
 J?FN<; EF J@E @E EK; @=<4<E< 9<KN<E :FIK@ 8E; ?@GF8 DGLJ  
 "F N<M@ I<DLEF?@K?<D@C JI8@E@E I<JLCJk F= ?@GF8 DGLJ  
 J?FN<; K?K?<@GkJ@E F= ( J@E @E EICP; ;<I <8J< @K?<  
 DF;<C8E; J@<K@P<:I <8J< @K? / ' - DF;<C :? @JK; P?8J9<E  
 LE89C<KF; <DFEJ8K@<K? :? 8E>J F= @K?:FIK@ .? <C@CF=

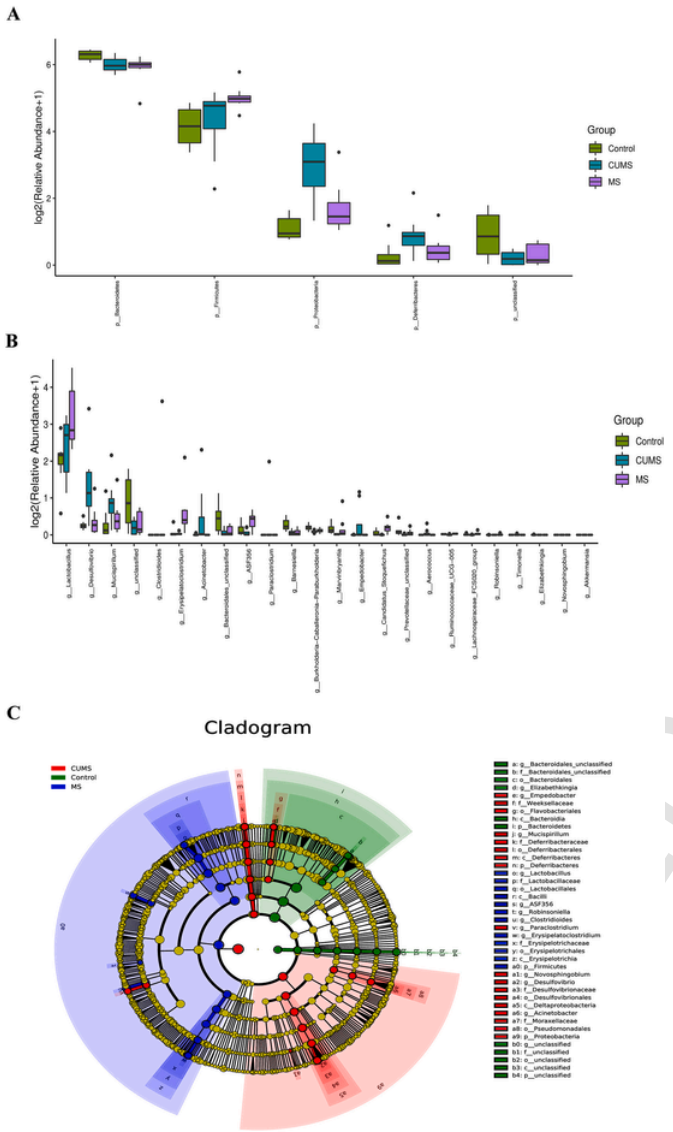


Fig. 6. E 8PJ@F=J@E@EK;@=4<E F=>LKD@ F9@6 8 IGCK;@=4 <E 8E8PJ@F=G?PCID CMC n 8 IGCK;@=4<E 8E8PJ@F=>ELJ CMC n & =;<;@=4<E 8E8PJ@ n

KJ@K@CD@ F9@D<5 6 <;FE =;<; @E<EMI@ED<EKF=DF;< CD@< @EL; @E;@K :@D8K< K@D G48KLL < 8E; ?LD@@FN @C@QF 8=>K :?8E>@ @E@K@CD@ F9@D< @E8C@; @=4<EKDF;< @E@D<K F; J 8I< 8; FGK; ? < K@< @E@E@P8E; ;L I8K@E F=JK<J@JF 8QF C8; KF ;@=4<EK :?8E>@ @BE@8C G?J@E>P 8E; @E@K@CD@ F9@D< 5 6

)L I JK; P GIFM;@J K? =@K<M@E< KFFLI BFNQ;> <K@BKK?K KNF DF;< <G ?8; JFD<; @=4<EK;< Gk@J@<9?>8M@IB? @GF8 D G8C ( :?8E>@ :FIK@C ". :?8E>@ \*\* 80@J?8E>@8E; @E@K@CD@ F9@D< :?8E>@ <O<GK=@ F JFD< :FDDFE =8KLL J ? <P 8C J?FN;<; <Gk@J@E@C@>9?>8M@IF 9LK / '- DF;<C?8; DFI< F9M@J 8E?;<FE@ @E\*. 8E; CE>X I @DF9@<K@< @E. N?@C- DF;<C ?8; CE>X I @DF9@<K@< @E. / '- DF;<C?8; K?C FN<K:FIK@C ". :FEK@K N?@C- DF;<C?8; K?C FN<K?@GF8 D G8C ( <O Gk@J@E / '- DF;<C @G8P;< 8?@?<?PGK@B@DLJ I<C@< D; ( <OGk@J@E Ctrh Ctrh1 K@E '- DF;<C #E>>E<I8C '- DF;<C 8E; / '- DF;<C?8M;<@=4<EK G4=FD8E< @ @<?8M@IF8E; G?J@E>P ? < / '- DF;<C J?FN;<; DFI< F9M@J G88D<K@ :?8E>@ N?@? D8P 9<DFI< JL@8C<@F \*\* @E :<; 9P M8 @L JF :@C<EMI@ED<EK@<8 KKF

Funding source

.? @J<J@8I: ? N8J JLGGFK<; 9P >I8EKJ=IFD K? "L E8E \*I FM@E@C: @E< .< :? ERF>P < G8K<EK \$\$ 8E; , 8E; K? ? 8E>J?8 -: @E< .< :? ERF>P < G8K<EK B?

Author contribution statement

38E 4?8E> ' < E>?L8 @ & @?8E> 8E; 1< @4FL ;<J@E<; K? <O G4 @<EKJ 38E 4?8E> G4=FD <; DF JKF=K?<OG4 @<EKJ 8E8C@<; K? I<JLCK 8E; NIFK D8ELJ: I@GK @L @? @G4=FD <; K? <OG4 @<EKJ 8E; D8ELJ: I@GK<M@EJ ' < E>?L8 @ & @?8E> 8E; 1< @4FL I<M@<; K? D8ELJ: I@GK CC8LKFIJ :FEK@GK<; 8E; ?8M<8GGIFM; K? =@C D8ELJ: I@GK

Declaration of competing interest

.? < 8LKFIJ ; :@8I< K@BKK?P?8M<EF BFN E :FD G4@E =@E: @C @E@<KJFI G4JFE8C I<C@K@EJ?@GK@K:FLC ?8M<8GG8I<; KF@EC <E< K? NFIB I<GFK<; @E@G8G4

Acknowledgements

(F E<

Appendix A. Supplementary data

-L GG@D<EK8P ; 8 K8KFK?@8IK@< :8E 9< =fLE; FE@< 8K?HKG ;F @F I> A99I:

References

5 6 ' FO -8E;D8E \* 8 M@&' !CPEE CE>@K @E@KJ; PF=NFD<E@ <;Gk@J@E JFDCKID GIF=@G;L I@>8E; 8<K? K?GFJG8KLD G8K < Gk@J E O@P D ?HKG ;F @F I> ;8

5 6 &@3 &@3 ?<E " &@3 -?< 2 4?8E> - ?<E 1 ?<E ! +@ " "L 8E> - 4?8E> (<L IFGFK<@EF=<L;<; K?PIF@?FID FE<N@?@E<8J< <KF>E 8E; GIF>K@E @BFJG8KLD ;<Gk@J@E @FJ@<G ?HKG ;F @F I> 9J

5 6 \$ & \*8NLJ@<@< &FEK@E - C@D@E ?<E<L I F9@CFPF=GFJG8KLD 8E@P8E ;<Gk@J@E .I <EJ (<L IFJ@ D ?HKG ;F @F I> AK@

5 6 3 "8E> ! , 4<E> & 1L 3 " 18E> \$ \$@E> ;<J@8I: ? GIF>KJFE 8E@BCDF;<C F=GFJG8KLD ;<Gk@J@E 8E; K?@>?8M@<M@C@K@E@D<K F; J : K8&@ E @D: @<@E D

5 6 ! ?<M@< @FG@& !L <E@B :S " \*8J:8C. &8M@ @<@K#! FE<8 <D8E>C F C?P " I LMFJK ? L08E ' < JB>X I &L@<K! &<GRLJQ! 9<IC \* " &@; F =>K F=>LKD@ F9@K8FE;< Gk@J@<C@< 9<?8M@J @D@< @D<;@K; 9PK?<EF :8EB9@E@J@KJ (8 K F DDLE ?HKG ;F @F I> J

5 6 3 4?8E> , "L 8E> " ?<E & 18E> \$ ?8F \$ @? 4?<E \* 2 @ 4 4?8E> " 38F IL KD@ F9@K@<FD (& \* ;<=@@EKD@< 8D<@@B KJ ;<Gk@J@<C@< 9<?8M@J 9P I<L@<@< 8K F PK; P J@E K@EM@<@ " \*% " @. I F9@< ?HKG ;F @F I> J

5 6 3 ' &@ 3 "L \$ -?<E - " 1L 3 @&@. 3 @ C<M@E@FF=JFE8G@< GIFK@<@J@F@<K; N@?K?8EK@Gk@J@E K@<=<KJ F=4L C@< @ @B :? IFE@ DF;<CF=<; Gk@J@E " ?P@<?8M @ ?HKG ;F @F I> AG?P@<?

5 6 ' 8 EHL@? ' S E; <Q\$ & I @@ <?8M@8C=<KJ @B; F@J<E<;<8E <8P 8; L@K F; @KNF CE<K?DF;<C F=D8K@E8CJ-G88K@E @B8C48KJ <?8M I 8@ <J D ?HKG ;F @F I> A99I

5 6 3 & "F " 3 2L 2 " -L 2 4?8E> ! " 3L8E & \$@E> 4 <@=><K F= D8K@E8C<G@M@E@FF=CG@E8FIP 9<?8M@ 8E; , <OGk@J@E @P@CF:8DGLJ F=I8KJ ? @E (<L IFJ I> @J <J D

5 6 \$ 0<KIC@<8 I@P D8K@E8CJ-G88K@E 8 IF;<EKDF;<CF=<; Gk@J@E 8E 8 Gk@J@E ?L D8E :FE; @E@E " ?8I D8:FC <G \* , D ?HKG ;F @F I> J

5 6 ' & F :: @8 8 Q@< \* 08; C8DL; @1 .I LD9LCC 8 C@<@< \*;<; IJ<E '< G8K; CE>J-G88K@E J=IFD GLJGJIF; L :<; Gk@J@E C@<9<?8M@ @B K DFK@J "JP:FE<L I F<E; F: I@CF5P D ?HKG ;F @F I> AGPE<L<E

5 6 1 -?@< 4?8E> 3 &L 3 18E> \$ 4?8F & @ < :C@JFEJ@<@< Gk@J@< D@< @E :<; 9P :? IFE@LEGI; @K@G D@<J K@J \$ =>K @JF; D ?HKG ;F @F I> AA8

5 6 . 2L < & -L 2 ' &@ + 18E> <J@8I: ? GIF>KJFE 8E@BCDF;<C F=

