

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Figure S1: Metabolic rates of mice fed a high-fat diet with or without *B. adolescentis* supplementation, Figure S2: Effects of *B. adolescentis* supplementations on energy metabolism, Figure 3: Effects of *B. adolescentis* supplementations on immunity, Table S1: Primers for real-time PCR analysis of gene expression.

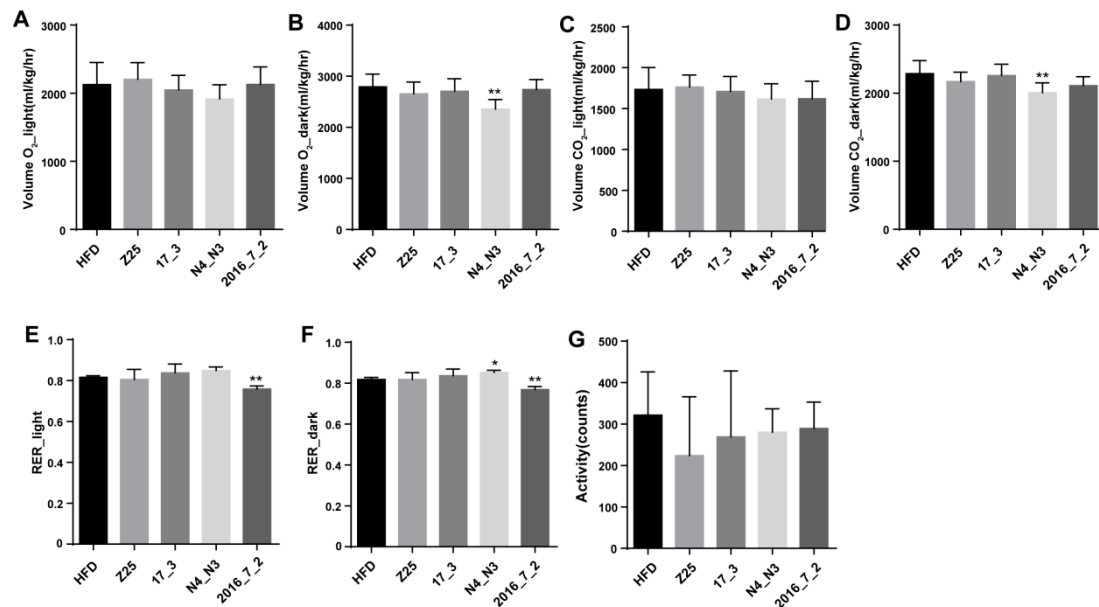


Figure S1: Metabolic rates of mice fed a high-fat diet with or without *B. adolescentis* supplementation. (A, B) Consumption of O₂ in the light and dark. (C,D) Production of CO₂ in the light and dark. (E, F) Respiratory exchange ratio (RER) in the light and dark. (G) Activities of mice in 5 groups. Data are shown as means ± standard deviations (SD). Asterisks indicate significant differences (one-way ANOVA, * p < 0.05, ** p < 0.01,). n = 6 mice per group.

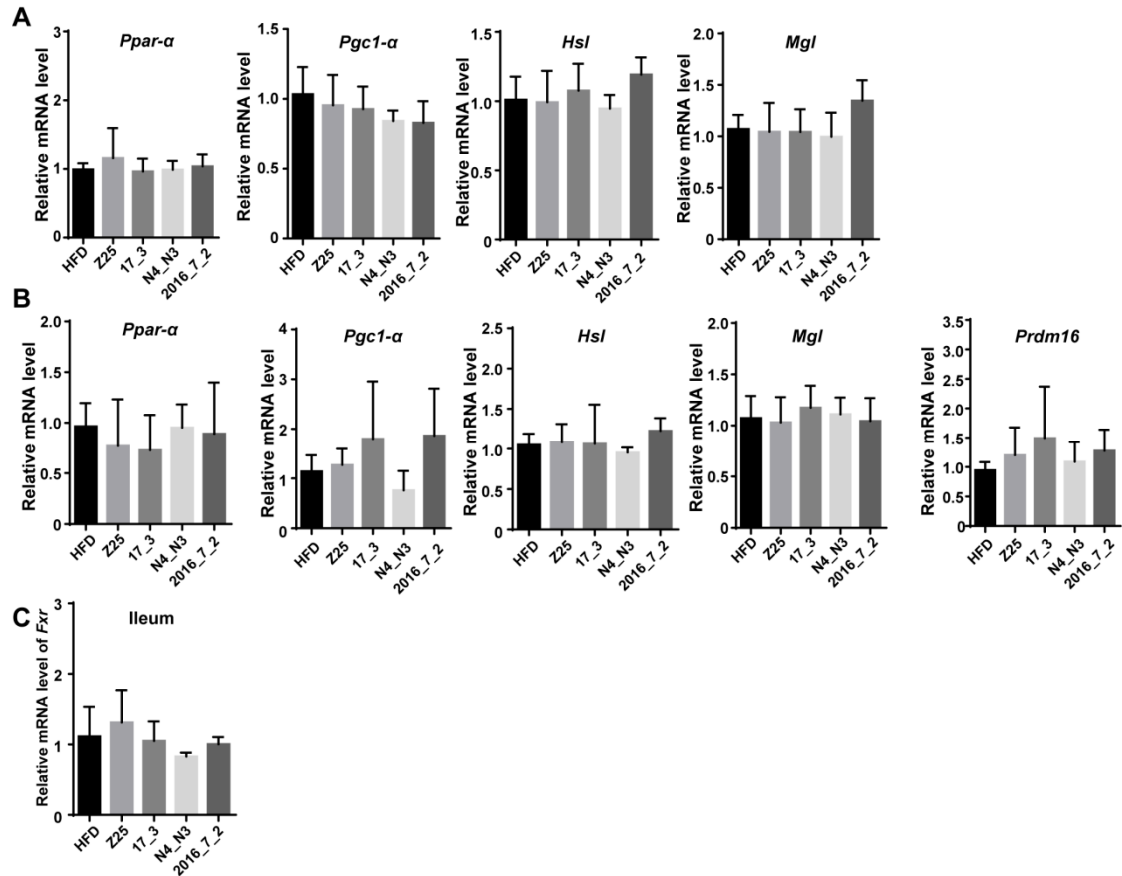


Figure S2: Effects of *B. adolescentis* supplementations on energy metabolism. (A) Relative mRNA expression of thermogenesis related genes and lipolytic enzyme genes in the liver. (B) Relative mRNA expression of thermogenesis related genes and lipolytic enzyme genes in the subcutaneous white adipose tissue (sWAT). (C) Relative mRNA expression of bile acid receptor farnesoid X receptor (*Fxr*) in the ileum. Data are shown as means $\pm$ standard deviations (SD). n = 5 mice per group.

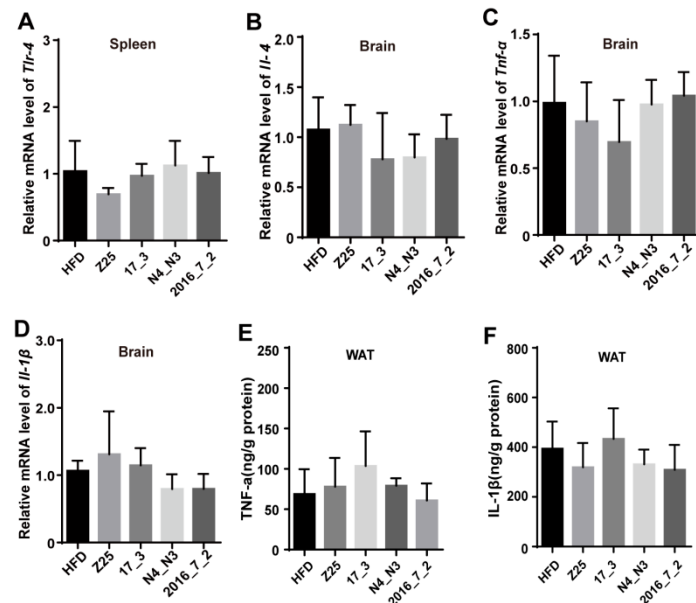


Figure S3: Effects of *B. adolescentis* supplementations on immunity. (A) Relative mRNA expression of immune-related toll-like receptor 4 (*Tlr4*) in the spleen. (B-D) Relative mRNA expression of immune-related receptor and cytokines in the hypothalamus, (B) interleukin 4 (*Il-4*), (C) tumor necrosis factor α (*Tnf-\alpha*), and (D) *Il-1\beta*. (E, F) Concentrations of cytokines in the abdominal white adipose tissue (aWAT), (E) *TNF-\alpha*, and (F) *IL-1\beta*. Data are shown as means $\pm$ standard deviations (SD). n = 6 mice or n = 5 (for A-D) per group.

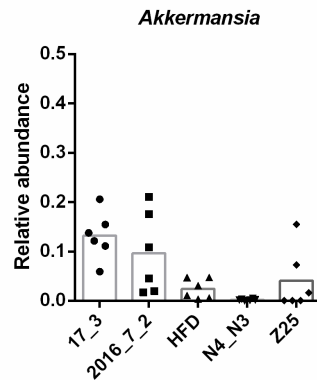


Figure S4 Relative abundance of *Akkermansia* in the colon

Table S1. The diet composition of the high-fat diet (TP 23300) ¹

Ingredient, g/kg	TP 23300
Casein	259
Maltodextrin	166
Sucrose	91
Corn Starch	0
Soybean Oil	33
Lard	313
Cellulose	67
Mineral Mix, M1020	52
Vitamin Mix, V1010	13
L-Cystine	3
Choline	3
Bitartrate	0.067
TBHQ	1000.
Total	067

¹ The purified diet TP 23300 supplies energy as 20% carbohydrate (7% sucrose calories), 20% protein, 60% fat with total 5.1 kcal/g.

Table S2. Primers for real-time PCR analysis of gene expression¹.

Gene	PrimerBank ID	Forward Primer	Reverse Primer
<i>Ucp1</i>	6678497a1	AGGCTTCCAGTACCATTAGGT	CTGAGTGAGGCAAAGCTGATTT
<i>Pgc1-α</i>	6679433a1	TATGGAGTGACATAGAGTGTGCT	CCACTTCAATCCACCCAGAAAG
<i>Ppar-α</i>	31543500a1	AGAGCCCCATCTGTCCTCTC	ACTGGTAGTCTGCAAAACCAAA
<i>Ppar-γ</i>	6755138a1	TCGCTGATGCACTGCCTATG	GAGAGGTCCACAGAGCTGATT
<i>Fasn</i>	30911099a1	GGAGGTGGTGATAGCCGGTAT	TGGGTAATCCATAGAGCCCAG
<i>Hsl</i>	26325924a1	CCAGCCTGAGGGCTTACTG	CTCCATTGACTGTGACATCTCG
<i>Mgl</i>	6754690a1	CGGACTTCCAAGTTTTTGTGAGA	GCAGCCACTAGGATGGAGATG
<i>Fxr</i>	254911038c1	GGCAGAATCTGGATTTGGAATCG	GCCCAGGTTGGAATAGTAAGACG
<i>Tgr5</i>	27923942c2	CTGTGTGAGATCCGCCGAC	CGACGCTCATAGGCCAAGA
<i>Prdm16</i>	124107622c3	CCCCACATTCCGCTGTGAT	CTCGCAATCCTTGCACTCA
<i>Il-17f</i>	22003916a1	TGCTACTGTTGATGTTGGGAC	AATGCCCTGGTTTTGGTTGAA
<i>Tnf-α</i>	133892368c2	CTGAACCTCGGGGTGATCGG	GGCTTGCTACTCGAATTTTGAGA
<i>Tlr4</i>	10946594a1	ATGGCATGGCTTACACCACC	GAGGCCAATTTTGTCTCCACA
<i>Il-6</i>	13624311a1	TAGTCCTTCCTACCCCAATTTCC	TTGGTCCTTAGCCACTCCTTC
<i>Il-4</i>	10946584a1	GGTCTCAACCCCCAGCTAGT	GCCGATGATCTCTCTCAAGTGAT
<i>Il-10</i>	6754318a1	GCTCTTACTGACTGGCATGAG	CGCAGCTCTAGGAGCATGTG
<i>Il-1β</i>	118130747c1	GAAATGCCACCTTTTGACAGTG	TGGATGCTCTCATCAGGACAG
<i>Foxp3</i>	16905075a1	CCCATCCCCAGGAGTCTTG	ACCATGACTAGGGGCACTGTA
<i>Gapdh</i>	6679937a1	AGGTCGGTGTGAACGGATTTG	TGTAGACCATGTAGTTGAGGTCA

¹. The validated primers were obtained from Primerbank.