Supplementary Table 1. Lifespan analysis related to Figure 1.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
N2	1	OP50	14.85 ± 0.60	control	
		OP50+Probio-M9	19.63 ± 1.05	32.19%	$p < 0.0001$
N2	2	OP50	14.38 ± 0.55	control	
		OP50+Probio-M9	19.25 ± 0.79	33.86%	$p < 0.0001$
N2	3	OP50	15.69 ± 1.01	control	
		OP50+Probio-M9	19.50 ± 1.09	24.28%	$p < 0.0001$
N2	1	OP50	12.85 ± 0.67	control	
		OP50+0.01Probio-M9	14.33 ± 0.82	11.52%	$p < 0.05$
		OP50+0.1Probio-M9	14.38 ± 0.84	11.91%	$p < 0.05$
		OP50+Probio-M9	16.57 ± 0.94	28.95%	$p < 0.0001$
		OP50+10Probio-M9	14.53 ± 0.74	13.07%	$p < 0.01$
N2	2	OP50	13.04 ± 0.68	control	
		OP50+0.01Probio-M9	15.02 ± 0.94	15.18%	$p < 0.01$
		OP50+0.1Probio-M9	14.28 ± 0.82	9.51%	$p < 0.05$
		OP50+Probio-M9	17.33 ± 1.08	32.90%	$p < 0.0001$
		OP50+10Probio-M9	14.88 ± 0.69	14.11%	$p < 0.01$
N2	3	OP50	13.29 ± 0.69		
		OP50+0.01Probio-M9	13.65 ± 0.70	2.71%	$p > 0.05$
		OP50+0.1Probio-M9	13.78 ± 0.69	3.69%	$p > 0.05$
		OP50+Probio-M9	16.57 ± 0.94	24.68%	$p < 0.0001$
		OP50+10Probio-M9	13.71 ± 0.65	3.16%	$p > 0.05$

Supplementary Table 2. Lifespan analysis related to Figure 3.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
N2 (L4)	1	OP50	14.43 ± 0.70	control	
		OP50+Probio-M9	15.69 ± 0.77	8.73%	$p < 0.05$
N2 (L4)	2	OP50	13.92 ± 0.69	control	
		OP50+Probio-M9	15.29 ± 0.85	9.84%	$p < 0.05$
N2 (L4)	3	OP50	14.43 ± 0.70	control	
		OP50+Probio-M9	15.46 ± 0.93	7.14%	$p < 0.05$
N2 (day 2 after L4)	1	OP50	12.38 ± 0.88	control	
		OP50+Probio-M9	14.14 ± 0.71	14.21%	$p < 0.01$
N2 (day 2 after L4)	2	OP50	14.07 ± 0.80	control	
		OP50+Probio-M9	15.30 ± 1.07	8.74	$p < 0.05$
N2 (day 2 after L4)	3	OP50	12.69 ± 0.81	control	
		OP50+Probio-M9	14.52 ± 0.82	14.42%	$p < 0.01$
N2 (day 4 after L4)	1	OP50	11.56 ± 0.69	control	
		OP50+Probio-M9	13.15 ± 0.93	13.75%	$p < 0.01$
N2 (day 4 after L4)	2	OP50	12.06 ± 0.78	control	
		OP50+Probio-M9	14.10 ± 1.10	16.92%	$p < 0.01$
N2 (day 4 after L4)	3	OP50	11.43 ± 0.79	control	
		OP50+Probio-M9	13.68 ± 0.83	19.68%	$p < 0.001$
N2	1	OP50	13.27 ± 0.84	control	
		OP50+Heat-inactived Probio-M9	13.96 ± 0.97	5.20%	$p > 0.05$
N2	2	OP50	12.38 ± 0.64	control	
		OP50+Heat-inactived Probio-M9	13.18 ± 0.97	6.46%	$p > 0.05$
N2	3	OP50	13.82 ± 0.94	control	
		OP50+Heat-inactived Probio-M9	14.21 ± 1.00	2.82%	$p > 0.05$

Supplementary Table 3. Lifespan analysis related to Figure 4.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
nsy-1 (*ag3*)	1	OP50	11.75 ± 1.80	control	
		OP50+Probio-M9	11.07 ± 0.92	-5.79%	$p > 0.05$
nsy-1 (*ag3*)	2	OP50	11.41 ± 0.89	control	
		OP50+Probio-M9	11.75 ± 1.49	2.98%	$p > 0.05$
nsy-1 (*ag3*)	3	OP50	11.58 ± 1.34	control	
		OP50+Probio-M9	11.41 ± 1.20	-1.50%	$p > 0.05$
sek-1 (*km4*)	1	OP50	12.00 ± 0.50	control	
		OP50+Probio-M9	13.19 ± 0.90	9.92%	$p > 0.05$
sek-1 (*km4*)	2	OP50	11.77 ± 0.50	control	
		OP50+Probio-M9	13.14 ± 0.80	11.64%	$p > 0.05$
sek-1 (*km4*)	3	OP50	11.56 ± 0.56	control	
		OP50+Probio-M9	13.10 ± 0.69	13.32%	$p > 0.05$
pmk-1 (*km25*)	1	OP50	10.83 ± 0.85	control	
		OP50+Probio-M9	11.35 ± 0.71	4.80%	$p > 0.05$
pmk-1 (*km25*)	2	OP50	11.00 ± 0.64	control	
		OP50+Probio-M9	11.31 ± 0.86	2.82%	$p > 0.05$
pmk-1 (*km25*)	3	OP50	10.40 ± 0.65	control	
		OP50+Probio-M9	11.68 ± 0.78	12.31%	$p > 0.05$
tir-1 (*tm3036*)	1	OP50	16.23 ± 1.27	control	
		OP50+Probio-M9	16.36 ± 0.74	0.80%	$p > 0.05$
tir-1 (*tm3036*)	2	OP50	15.63 ± 1.14	control	
		OP50+Probio-M9	15.83 ± 1.20	1.28%	$p > 0.05$
tir-1 (*tm3036*)	3	OP50	15.73 ± 1.05	control	
		OP50+Probio-M9	15.97 ± 0.91	1.53%	$p > 0.05$
tir-1 (*ok1052*)	1	OP50	17.26 ± 0.88	control	
		OP50+Probio-M9	16.55 ± 0.77	-4.11%	$p > 0.05$
tir-1 (*ok1052*)	2	OP50	18.42 ± 0.62	control	
		OP50+Probio-M9	18.61 ± 0.86	1.03%	$p > 0.05$

Supplementary Table 3 (continue). Lifespan analysis related to Figure 4.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
tir-1 (*ok1052*)	3	OP50	17.86 ± 0.70	control	
		OP50+Probio-M9	17.75 ± 0.82	-0.62%	$p > 0.05$
atf-7 (*gk715*)	1	OP50	10.28 ± 0.95	control	
		OP50+Probio-M9	10.63 ± 1.29	3.40%	$p > 0.05$
atf-7 (*gk715*)	2	OP50	11.38 ± 0.83	control	
		OP50+Probio-M9	11.05 ± 0.87	-2.90%	$p > 0.05$
atf-7 (*gk715*)	3	OP50	11.24 ± 0.88	control	
		OP50+Probio-M9	12.21 ± 1.21	8.63%	$p > 0.05$

Supplementary Table 4. Lifespan analysis related to Figure 5.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
daf-2 (*e1370*)	1	OP50	47.15 ± 1.29	control	
		OP50+Probio-M9	47.21 ± 1.73	0.13%	$p > 0.05$
daf-2 (*e1370*)	2	OP50	49.25 ± 1.64	control	
		OP50+Probio-M9	48.39 ± 1.36	-1.75%	$p > 0.05$
daf-2 (*e1370*)	3	OP50	49.39 ± 1.61	control	
		OP50+Probio-M9	51.16 ± 1.59	3.58%	$p > 0.05$
age-1 (*hx546*)	1	OP50	21.04 ± 1.38	control	
		OP50+Probio-M9	25.17 ± 1.00	19.63%	$p < 0.0001$
age-1 (*hx546*)	2	OP50	22.18 ± 1.70	control	
		OP50+Probio-M9	26.65 ± 1.89	20.15%	$p < 0.0001$
age-1 (*hx546*)	3	OP50	21.73 ± 1.46	control	
		OP50+Probio-M9	26.33 ± 1.32	21.17%	$p < 0.0001$
daf-16 (*mgDf50*)	1	OP50	11.67 ± 0.41	control	
		OP50+Probio-M9	15.97 ± 0.54	36.85%	$p < 0.0001$
daf-16 (*mgDf50*)	2	OP50	11.31 ± 0.53	control	
		OP50+Probio-M9	15.08 ± 0.48	33.33%	$p < 0.0001$
daf-16 (*mgDf50*)	3	OP50	11.54 ± 0.45	control	
		OP50+Probio-M9	15.50 ± 0.52	34.31%	$p < 0.0001$
skn-1 (*mg570*)	1	OP50	13.79 ± 0.96	control	
		OP50+Probio-M9	14.36 ± 1.29	4.13%	$p > 0.05$
skn-1 (*mg570*)	2	OP50	13.30 ± 0.94	control	
		OP50+Probio-M9	13.77 ± 0.93	3.53%	$p > 0.05$
skn-1 (*mg570*)	3	OP50	13.15 ± 0.90	control	
		OP50+Probio-M9	14.31 ± 1.02	8.82%	$p > 0.05$
hsf-1 (*sy441*)	1	OP50	11.98 ± 0.35	control	
		OP50+Probio-M9	11.39 ± 0.32	-4.92%	$p > 0.05$
hsf-1 (*sy441*)	2	OP50	12.05 ± 0.31	control	
		OP50+Probio-M9	12.56 ± 0.43	4.23%	$p > 0.05$

Supplementary Table 4 (continue). Lifespan analysis related to Figure 5.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
hsf-1 (*sy441*)	3	OP50	12.24 ± 0.34	control	
		OP50+Probio-M9	11.70 ± 0.41	-4.41%	$p > 0.05$

Supplementary Table 5. Lifespan analysis related to Figure S2.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
raga-1 (*ok386*)	1	OP50	16.79 ± 0.80	control	
		OP50+Probio-M9	23.15 ± 1.91	37.88%	$p < 0.0001$
raga-1 (*ok386*)	2	OP50	16.11 ± 0.98	control	
		OP50+Probio-M9	22.46 ± 1.60	39.42%	$p < 0.0001$
raga-1 (*ok386*)	3	OP50	16.69 ± 0.92	control	
		OP50+Probio-M9	24.59 ± 1.90	47.33%	$p < 0.0001$
rsks-1 (*ok1255*)	1	OP50	23.93 ± 0.83	control	
		OP50+Probio-M9	29.94 ± 1.54	25.11%	$p < 0.0001$
rsks-1 (*ok1255*)	2	OP50	22.60 ± 0.82	control	
		OP50+Probio-M9	30.73 ± 1.55	35.97%	$p < 0.0001$
rsks-1 (*ok1255*)	3	OP50	23.01 ± 0.89	control	
		OP50+Probio-M9	29.38 ± 1.43	27.68%	$p < 0.0001$
eat-2 (*ad1116*)	1	OP50	20.33 ± 1.30	control	
		OP50+Probio-M9	25.67 ± 1.43	26.27%	$p < 0.0001$
eat-2 (*ad1116*)	2	OP50	19.18 ± 1.24	control	
		OP50+Probio-M9	22.85 ± 1.52	19.13%	$p < 0.0001$
eat-2 (*ad1116*)	3	OP50	19.70 ± 1.33	control	
		OP50+Probio-M9	24.85 ± 1.50	26.14%	$p < 0.0001$
aak-2 (*ok524*)	1	OP50	14.64 ± 1.02	control	
		OP50+Probio-M9	18.03 ± 1.72	23.16%	$p < 0.0001$
aak-2 (*ok524*)	2	OP50	14.03 ± 0.89	control	
		OP50+Probio-M9	18.58 ± 1.25	32.43%	$p < 0.0001$
aak-2 (*ok524*)	3	OP50	14.23 ± 0.93	control	
		OP50+Probio-M9	18.40 ± 1.41	29.30%	$p < 0.0001$

Supplementary Table 6. Lifespan analysis related to Figure 6.

C. elegans strain	Repeats	Strain	Mean ± SEM (days)	Lifespan Extension	*p*-value
atfs-1 (*gk3094*)	1	OP50	11.50 ± 0.73	control	
		OP50+Probio-M9	11.83 ± 1.05	2.87%	$p > 0.05$
atfs-1 (*gk3094*)	2	OP50	12.83 ± 1.21	control	
		OP50+Probio-M9	13.19 ± 1.00	2.81%	$p > 0.05$
atfs-1 (*gk3094*)	3	OP50	11.90 ± 0.90	control	
		OP50+Probio-M9	12.84 ± 1.03	7.90%	$p > 0.05$
isp-1 (*qm150*)	1	OP50	22.34 ± 2.84	control	
		OP50+Probio-M9	22.31 ± 2.04	-0.13%	$p > 0.05$
isp-1 (*qm150*)	2	OP50	19.55 ± 1.77	control	
		OP50+Probio-M9	21.81 ± 2.95	11.56%	$p > 0.05$
isp-1 (*qm150*)	3	OP50	20.39 ± 2.06	control	
		OP50+Probio-M9	22.06 ± 2.48	8.19%	$p > 0.05$
nuo-6 (*qm200*)	1	OP50	32.61 ± 1.58	control	
		OP50+Probio-M9	33.93 ± 1.49	4.05%	$p > 0.05$
nuo-6 (*qm200*)	2	OP50	28.63 ± 1.41	control	
		OP50+Probio-M9	28.65 ± 1.55	0.07%	$p > 0.05$
nuo-6 (*qm200*)	3	OP50	29.61 ± 1.51	control	
		OP50+Probio-M9	31.78 ± 1.49	7.33%	$p > 0.05$

Supplementary Table 7. 304 differentially expressed metabolites

Metabolite	Formula	VIP	Log_2FC	Type
Glu-Phe	$C_{14}H_{18}N_2O_5$	1.441995149	1.266940116	up
Hesperetin	$C_{16}H_{14}O_6$	1.471227032	1.828172434	up
N-Oleoylethanolamine	$C_{20}H_{39}NO_2$	1.496519241	2.445183825	up
Asp-phe	$C_{13}H_{16}N_2O_5$	1.504070607	2.684609116	up
N-Acetylaspartate	$C_6H_9NO_5$	1.434197143	1.829581938	up
2-Picolinic Acid	$C_6H_5NO_2$	1.372294741	1.488776137	up
D-Glucoronic Acid	$C_6H_{10}O_7$	1.340615271	1.162171924	up
2-Aminoethanesulfonic Acid	$C_2H_7NO_3S$	1.482331859	2.181425546	up
Creatine	$C_4H_9N_3O_2$	1.451724239	1.504420454	up
L-Tartaric Acid	$C_4H_6O_6$	1.455703344	1.043308731	up
O-Phosphorylethanolamine	$C_2H_8NO_4P$	1.368195074	1.199885146	up
2-(Formylamino)Benzoic Acid	$C_8H_7NO_3$	1.488386142	1.353245923	up
D-Glucarate	$C_6H_{10}O_8$	1.477954517	1.268472877	up
N-Acetyl-L-alanine	$C_5H_9NO_3$	1.400876203	1.35336825	up
Carbamoyl phosphate	CH_4NO_5P	1.290262671	1.035857227	up
N-acetyl-beta-alanine	$C_5H_9NO_3$	1.345033592	1.25383593	up
3-Dehydroshikimate	$C_7H_8O_5$	1.478761281	2.084695478	up
7alpha,12beta-Dihydroxy-5alpha-cholan-24-oic acid	$C_{24}H_{40}O_4$	1.50795024	12.47721297	up
2-amino-4-oxovaleric acid	$C_5H_9NO_3$	1.345033592	1.25383593	up
L-2-amino-6-oximelic acid	$C_7H_{11}NO_5$	1.218537824	1.083175174	up
Ureidosuccinic acid	$C_5H_8N_2O_5$	1.405835164	1.633547191	up
Mucic Acid	$C_6H_{10}O_8$	1.477954517	1.268472877	up
tetranor-PGFM	$C_{16}H_{26}O_7$	1.428429401	1.144247167	up
Allantoic acid	$C_4H_8N_4O_4$	1.453915083	1.974689166	up
Coproporphyrin III	$C_{36}H_{38}N_4O_8$	1.143952365	1.583760612	up
Xanthosine-5'-monophosphate	$C_{10}H_{13}N_4O_9P$	1.44888842	1.609347276	up
L-Cystine	$C_6H_{12}N_2O_4S_2$	1.353198082	2.007389725	up
Glyc-Pro	$C_7H_{12}N_2O_3$	1.307698346	4.076804767	up

Supplementary Table 7 (continue). 304 differentially expressed metabolites

Metabolite	Formula	VIP	Log_2FC	Type
Acetylcholine	$C_7H_{15}NO_2$	1.354103285	2.622936359	up
N-Acetyl-L-Glutamic Acid	$C_7H_{11}NO_5$	1.330755162	1.005625134	up
Nicotinic Acid	$C_6H_5NO_2$	1.467156632	1.493258823	up
4-Guanidinobutyric Acid	$C_5H_{11}N_3O_2$	1.488360443	1.739226667	up
Kynurenic Acid	$C_{10}H_7NO_3$	1.496727722	1.651821379	up
N'-Formylkynurenine	$C_{11}H_{12}N_2O_4$	1.490648119	1.888088599	up
Sn-Glycero-3-Phosphocholine	$C_8H_{20}NO_6P$	1.372845363	1.136812666	up
DL-Carnitine	$C_7H_{15}NO_3$	1.465273919	1.166239626	up
Dihydro-D-sphingosine	$C_{18}H_{39}NO_2$	1.50917781	14.34891254	up
N-Alpha-Acetyl-L-Asparagine	$C_6H_{10}N_2O_4$	1.466108058	1.174846493	up
γ-L-Glutamate-Cysteine	$C_8H_{14}N_2O_5S$	1.45738741	2.851765456	up
N-(2-hydroxyethyl) stearamide	$C_{20}H_{41}NO_2$	1.495587529	1.976214778	up
3-Carboxypropyltrimethylammonium	$C_7H_{15}NO_2$	1.354103285	2.622936359	up
Biotinamide	$C_{10}H_{17}N_3O_2S$	1.476078372	1.856802207	up
2,4-diacetamino-2,4,6-triphenoxy-D-mannopyranose	$C_{10}H_{18}N_2O_5$	1.506827994	3.260334999	up
Menadione-9	$C_{56}H_{80}O_2$	1.486035004	6.240774649	up
Carnitine C5:1	$C_{12}H_{21}NO_4$	1.394320129	1.493766686	up
Leu-Val	$C_{11}H_{22}N_2O_3$	1.099679405	1.413849218	up
Phe-Met	$C_{14}H_{20}N_2O_3S$	1.44447554	1.415856579	up
Glu-Met	$C_{10}H_{18}N_2O_5S$	1.465415342	1.898007605	up
Met-Glu	$C_{10}H_{18}N_2O_5S$	1.465415342	1.898007605	up
Isopentenyl pyrophosphate	$C_5H_{12}O_7P_2$	1.477249859	1.168307396	up
Phe-Glu	$C_{14}H_{18}N_2O_5$	1.451803449	1.351142353	up
Sphingosyl-phosphocholine	$C_{23}H_{50}N_2O_5P$	1.501775705	2.079502217	up
Leucyl-phenylalanine	$C_{15}H_{22}N_2O_3$	1.489782521	1.331233253	up
Palmitoylethanolamide (PEA)	$C_{18}H_{37}NO_2$	1.490142129	1.815771496	up
Asp-Tyr	$C_{13}H_{16}N_2O_6$	1.468763001	1.693351211	up
Glu-Tyr	$C_{14}H_{18}N_2O_6$	1.452469193	1.721536995	up

Supplementary Table 7 (continue). 304 differentially expressed metabolites

Metabolite	Formula	VIP	Log_2FC	Type
FAHFA (16:0/12-O-18:0)	$C_{34}H_{66}O_4$	1.481673753	2.170455677	up
Geranyl acetate	$C_{12}H_{20}O_2$	1.456796857	1.892453967	up
Hexadecanedioic acid,3,3,14,14-tetramethyl	$C_{20}H_{38}O_4$	1.322592992	4.382444157	up
MG (0:0/13:0/0:0)	$C_{16}H_{32}O_4$	1.436747655	3.640162996	up
MG (15:0/0:0/0:0)	$C_{18}H_{36}O_4$	1.500120259	1.693567438	up
MG (16:1(9Z)/0:0/0:0)	$C_{19}H_{36}O_4$	1.485507144	2.552697195	up
Palmitoylserinol	$C_{19}H_{39}NO_3$	1.50302996	2.272599198	up
Codeine-6-β-D-glucuronide	$C_{24}H_{29}NO_9$	1.419880627	1.393576782	up
Cytochalasin B	$C_{29}H_{37}NO_5$	1.469565354	1.943103255	up
Ile-Met	$C_{11}H_{22}N_2O_3S$	1.458466688	1.904147536	up
Ile-Asp	$C_{10}H_{18}N_2O_5$	1.506577817	3.35917709	up
Cephaeline	$C_{28}H_{38}N_2O_4$	1.406802146	1.871899843	up
2-aminohexadecanoic acid	$C_{16}H_{33}NO_2$	1.482723729	1.389309765	up
N-Carboxyethyl-γ-aminobutyric acid	$C_7H_{13}NO_4$	1.147970258	6.194673531	up
Sumatriptan	$C_{14}H_{21}N_3O_2S$	1.460217576	1.507741628	up
Asp Leu Leu	$C_{16}H_{29}N_3O_6$	1.497826383	2.715732889	up
Gluten exorphin C	$C_{29}H_{57}N_5O_{12}$	1.509292878	17.3301038	up
Ile Glu	$C_{11}H_{20}N_2O_5$	1.007453232	3.718908143	up
Leucyl-Methionine	$C_{11}H_{22}N_2O_3S$	1.420632325	1.240290732	up
Phenylalanyl-Isoleucine	$C_{15}H_{22}N_2O_3$	1.463596363	1.305538289	up
Sarcodon scabrosus Depsipeptide	$C_{23}H_{39}N_3O_8$	1.50940095	12.76822109	up
5(S),6(R),15(R)-Lipoxin A4	$C_{20}H_{32}O_5$	1.507106433	5.097765608	up
5,8-Epoxy-5,8-dihydro-3-hydroxy-8'-apo-b, y-carotenal	$C_{30}H_{40}O_3$	1.464442154	1.004062886	up
5α-Pregnane-3α,21-diol-20-one	$C_{21}H_{34}O_3$	1.486224964	1.929371668	up
Val-Met	[redacted]$_{20}N_2O_3S$	1.42756666	1.183649126	up
Bispyribac	$C_{19}H_{18}N_4O_8$	1.426144517		