

Table S1. Clinical trial breakfast menu for the intervention and control groups (Examples)

Group	Mon.	Tue.	Wed.	Thur.	Fri.
Rice based meal					
	Brown rice	Black bean rice	Chicken porridge	Black rice	Omurice
	Mallow doenjang soup	Clam seaweed soup	-	Pork Kimchi Stew	Miso soup
	Duck bulgogi	Pork bulgogi with soy sauce	-	Sweet pumpkin steamed chicken	-
	Fried fishball	Fried potato onion	-	Fried oyster mushroom	-
	Radish and vegetables with mustard sauce	Seasoned young summer radish	Seasoned pickled Uloe	Seasoned cucumber	Boiled shrimp meatballs
	Kimchi	Kimchi	Fried Kimchi with tuna	Radish kimchi	Kimchi
	Fruit	Fruit	Fruit	Fruit	Fruit
	Milk	Yogurt	Soy milk	milk	Yogurt

Wheat based meal					
	Ham cheese sandwich	Bagels and cream cheese	French toast with cinnamon powder	Castella	Hamburger (chicken patty)
	Corn soup	Onion soup	Carrot soup	Broccoli soup	Mushroom soup
	Sweet potato croquette	Omelet	Bacon roast	Cereal	French fries with ketchup / Vegetable pickles
	Macaroni salad	Grilled vegetables	Vegetable salad	Sweet potato buckwheat	Carbonated drink
	Fruit	Fruit	Fruit	Fruit	Fruit
	Milk	Yogurt	String cheese	Milk	Cheese

Table 2. EEG analysis of the subjects*.

Variable	RMG (n=26)	WMG (n=29)	GMG (n=26)	<i>p</i> -value ¹	<i>p</i> -value ²	<i>p</i> -value ³	<i>p</i> -value ⁴
RT_F3							
0 wk	0.54±0.16	0.56±0.19	0.51±0.16				
12 wk	0.44±0.18	0.55±0.19	0.50±0.17		0.100	0.111	0.332
Δ RT_F3	-0.10±0.21	-0.00±0.19	-0.01±0.19	0.130			
<i>p</i> -value ⁵	0.019	0.956	0.729				
RT_F4							
0 wk	0.54±0.18	0.54±0.18	0.50±0.17				
12 wk	0.44±0.19	0.54±0.19	0.48±0.20		0.204	0.178	0.670
Δ RT_F4	-0.09±0.25	0.01±0.19	-0.02±0.22	0.235			
<i>p</i> -value ⁵	0.073	0.841	0.664				
RT_T3							
0 wk	0.56±0.17	0.59±0.22	0.56±0.18				
12 wk	0.47±0.20	0.57±0.19	0.58±0.20		0.195	0.235	0.535
Δ RT_T3	-0.10±0.23	-0.02±0.26	0.02±0.25	0.256			
<i>p</i> -value ⁵	0.040	0.698	0.761				
RT_T4							
0 wk	0.53±0.19	0.56±0.21	0.50±0.19				
12 wk	0.43±0.19	0.54±0.20	0.48±0.21		0.395	0.130	0.568
Δ RT_T4	-0.09±0.20	-0.02±0.24	-0.02±0.25	0.480			
<i>p</i> -value ⁵	0.046	0.619	0.627				
RT_P3							
0 wk	0.54±0.17	0.54±0.20	0.50±0.18				
12 wk	0.40±0.21	0.50±0.21	0.50±0.21		0.065	0.326	0.411
Δ RT_P3	-0.14±0.22	-0.05±0.26	0.00±0.24	0.094			
<i>p</i> -value ⁵	0.002	0.353	0.958				
RT_P4							
0 wk	0.51±0.17	0.52±0.20	0.49±0.18				
12 wk	0.42±0.24	0.50±0.20	0.48±0.21		0.143	0.260	0.048
Δ RT_P4	-0.12±0.24	-0.02±0.24	-0.00±0.23	0.189			
<i>p</i> -value ⁵	0.020	0.656	0.947				

				RT_O1			
0 wk	0.52±0.18	0.55±0.20	0.53±0.18				
12 wk	0.42±0.24	0.51±0.23	0.45±0.23		0.627	0.259	0.945
Δ RT_O1	-0.10±0.23	-0.04±0.26	-0.07±0.33	0.703			
p-value ⁵	0.037	0.448	0.258				
				RT_O2			
0 wk	0.49±0.19	0.49±0.22	0.52±0.18				
12 wk	0.32±0.23	0.43±0.21	0.42±0.24		0.225	0.321	0.123
Δ RT_O2	-0.18±0.30	-0.05±0.26	-0.07±0.26	0.266			
p-value ⁵	0.007	0.265	0.063				
				RA_F3			
0 wk	0.31±0.12	0.31±0.14	0.34±0.15				
12 wk	0.40±0.16	0.31±0.14	0.34±0.14		0.039	0.202	0.534
Δ RA_F3	0.08±0.18	-0.00±0.13	0.00±0.13	0.062			
p-value ⁵	0.024	0.953	0.962				
				RA_F4			
0 wk	0.32±0.14	0.32±0.15	0.34±0.15				
12 wk	0.40±0.16	0.31±0.15	0.35±0.16		0.076	0.267	0.566
Δ RA_F4	0.08±0.21	-0.01±0.13	0.01±0.17	0.104			
p-value ⁵	0.061	0.648	0.710				
				RA_T3			
0 wk	0.27±0.09	0.23±0.10	0.27±0.12				
12 wk	0.35±0.14	0.26±0.12	0.26±0.13		0.048	0.025	0.979
Δ RA_T3	0.08±0.14	0.03±0.14	-0.01±0.14	0.061			
p-value ⁵	0.006	0.254	0.634				
				RA_T4			
0 wk	0.26±0.09	0.25±0.11	0.27±0.13				
12 wk	0.34±0.12	0.26±0.14	0.29±0.14		0.149	0.242	0.670
Δ RA_T4	0.08±0.13	0.02±0.14	0.02±0.12	0.197			
p-value ⁵	0.008	0.542	0.477				
				RA_P3			
0 wk	0.33±0.15	0.33±0.17	0.36±0.17				
12 wk	0.45±0.19	0.36±0.18	0.37±0.18		0.045	0.347	0.476

△ RA_P3	0.12±0.19	0.03±0.19	0.01±0.18	0.079			
<i>p</i> -value ⁵	0.003	0.401	0.851				
			RA_P4				
0 wk	0.35±0.14	0.34±0.17	0.37±0.17				
12 wk	0.45±0.19	0.36±0.17	0.37±0.18	0.057	0.335	0.074	
△ RA_P4	0.13±0.21	0.02±0.17	-0.00±0.15	0.076			
<i>p</i> -value ⁵	0.017	0.621	0.933				
			RA_O1				
0 wk	0.35±0.16	0.32±0.15	0.34±0.20				
12 wk	0.41±0.19	0.33±0.16	0.40±0.20	0.459	0.139	0.841	
△ RA_O1	0.06±0.19	0.01±0.19	0.06±0.26	0.539			
<i>p</i> -value ⁵	0.100	0.829	0.235				
			RA_O2				
0 wk	0.36±0.16	0.38±0.20	0.35±0.17				
12 wk	0.50±0.21	0.38±0.17	0.43±0.22	0.026	0.355	0.086	
△ RA_O2	0.14±0.22 ^{Aa}	-0.00±0.19 ^b	0.08±0.22 ^{ab}	0.041			
<i>p</i> -value ⁵	0.003	0.975	0.063				
			RB_F3				
0 wk	0.31±0.12	0.31±0.14	0.34±0.15				
12 wk	0.40±0.16	0.31±0.14	0.34±0.14	0.671	0.526	0.315	
△ RB_F3	0.08±0.18	-0.00±0.13	0.00±0.13	0.062			
<i>p</i> -value ⁵	0.024	0.953	0.962				
			RB_F4				
0 wk	0.32±0.14	0.32±0.15	0.34±0.15				
12 wk	0.40±0.16	0.31±0.15	0.35±0.16	0.854	0.793	0.860	
△ RB_F4	0.08±0.21	-0.01±0.13	0.01±0.17	0.104			
<i>p</i> -value ⁵	0.061	0.648	0.710				
			RB_T3				
0 wk	0.27±0.09	0.23±0.10	0.27±0.12				
12 wk	0.35±0.14	0.26±0.12	0.26±0.13	0.562	0.775	0.299	
△ RB_T3	0.08±0.14	0.03±0.14	-0.01±0.14	0.061			
<i>p</i> -value ⁵	0.006	0.254	0.634				
			RB_T4				

0 wk	0.26±0.09	0.25±0.11	0.27±0.13			
12 wk	0.34±0.12	0.26±0.14	0.29±0.14		0.708	0.486
Δ RB_T4	0.08±0.13	0.02±0.14	0.02±0.12	0.197		0.834
<i>p</i> -value ⁵	0.008	0.542	0.477			
RB_P3						
0 wk	0.33±0.15	0.33±0.17	0.36±0.17			
12 wk	0.45±0.19	0.36±0.18	0.37±0.18		0.220	0.712
Δ RB_P3	0.12±0.19	0.03±0.19	0.01±0.18	0.079		0.480
<i>p</i> -value ⁵	0.003	0.401	0.851			
RB_P4						
0 wk	0.35±0.14	0.34±0.17	0.37±0.17			
12 wk	0.45±0.19	0.36±0.17	0.37±0.18		0.705	0.669
Δ RB_P4	0.13±0.21	0.02±0.17	-0.00±0.15	0.076		0.126
<i>p</i> -value ⁵	0.017	0.621	0.933			
RB_O1						
0 wk	0.35±0.16	0.32±0.15	0.34±0.20			
12 wk	0.41±0.19	0.33±0.16	0.40±0.20		0.581	0.859
Δ RB_O1	0.06±0.19	0.01±0.19	0.06±0.26	0.548		0.949
<i>p</i> -value ⁵	0.100	0.829	0.235			
RB_O2						
0 wk	0.36±0.16	0.38±0.20	0.35±0.17			
12 wk	0.50±0.21	0.38±0.17	0.43±0.22		0.551	0.716
Δ RB_O2	0.14±0.22 ^a	-0.00±0.19 ^b	0.08±0.22 ^{ab}	0.041		0.731
<i>p</i> -value ⁵	0.003	0.975	0.063			
RSMT_F3						
0 wk	0.25±0.26	0.21±0.16	0.22±0.11			
12 wk	0.30±0.17	0.19±0.13	0.25±0.19		0.346	0.179
Δ RSMT_F3	0.05±0.22	-0.01±0.15	0.04±0.19	0.371		0.314
<i>p</i> -value ⁵	0.227	0.592	0.345			
RSMT_F4						
0 wk	0.26±0.30	0.22±0.16	0.23±0.14			
12 wk	0.29±0.17	0.21±0.16	0.30±0.30		0.603	0.319
Δ RSMT_F4	0.03±0.25	-0.01±0.15	0.07±0.30	0.513		0.781

<i>p</i> -value ⁵	0.524	0.722	0.286			
	RSMT_T3					
0 wk	0.25±0.24	0.32±0.52	0.23±0.15			
12 wk	0.35±0.25	0.22±0.18	0.23±0.21	0.175	0.334	0.318
Δ RSMT_T3	0.10±0.27	-0.10±0.50	-0.00±0.24	0.134		
<i>p</i> -value ⁵	0.072	0.285	0.945			
	RSMT_T4					
0 wk	0.31±0.33	0.25±0.28	0.29±0.19			
12 wk	0.40±0.26	0.25±0.23	0.33±0.29	0.462	0.168	0.252
Δ RSMT_T4	0.09±0.34	-0.01±0.28	0.05±0.32	0.549		
<i>p</i> -value ⁵	0.216	0.893	0.458			
	RSMT_P3					
0 wk	0.23±0.21	0.22±0.21	0.26±0.17			
12 wk	0.40±0.30	0.25±0.19	0.26±0.21	0.038	0.119	0.747
Δ RSMT_P3	0.17±0.27 ^a	0.03±0.26 ^b	0.00±0.22 ^b	0.045		
<i>p</i> -value ⁵	0.004	0.602	0.961			
	RSMT_P4					
0 wk	0.24±0.14	0.26±0.26	0.24±0.14			
12 wk	0.41±0.31	0.24±0.19	0.28±0.24	0.016	0.098	0.396
Δ RSMT_P4	0.17±0.27	-0.01±0.31	0.04±0.26	0.052		
<i>p</i> -value ⁵	0.003	0.836	0.434			
	RSMT_O1					
0 wk	0.26±0.31	0.23±0.21	0.23±0.19			
12 wk	0.46±0.44	0.25±0.24	0.39±0.50	0.387	0.249	0.611
Δ RSMT_O1	0.20±0.43	0.06±0.32	0.15±0.45	0.438		
<i>p</i> -value ⁵	0.026	0.299	0.091			
	RSMT_O2					
0 wk	0.24±0.15	0.25±0.24	0.20±0.09			
12 wk	0.66±0.61	0.31±0.23	0.45±0.56	0.025	0.085	0.313
Δ RSMT_O2	0.42±0.60 ^a	0.06±0.33 ^b	0.25±0.56 ^{ab}	0.034		
<i>p</i> -value ⁵	0.001	0.345	0.032			

Data shown as mean±SD. F3: Left frontal lobe; F4: Right frontal lobe; GMG: general meal group; RA: relative alpha; RB: relative beta; RMG: rice meal group;

RSMT: ratio of SMR~mid beta to theta; RT: relative theta; SMR: sensory moto rhythm; T3: left temporal lobe; T4: right temporal lobe; O1: left occipital lobe; O2: right occipital lobe; P3: left parietal lobe; P4: right parietal lobe; wk week; WMG: wheat meal group.

Δ = 12 week – 0 week. *EEG analysis of 81 study subjects with suitable meal compliance among per protocol set. ¹Analyzed by GLM (difference between change value, RMG vs. WMG vs. GMG) after adjusting for age, sex, school, physical activity; ²⁻⁴Interaction, group effect, and time effect of two-way repeated measure ANOVA, respectively; ⁵Analyzed by paired t-test between 0 week and 12 week.

Table S3. The nutrient intakes of the subjects*.

	RMG (n=26)	WMG (n=29)	GMG (n=26)	<i>P</i> -value ¹	<i>P</i> -value ²	<i>P</i> -value ³	<i>P</i> -value ⁴
Energy (kcal/d)							
0 wk	1,784.97±596.38	1,661.45±585.18	1,781.19±420.57	0.349	0.815	0.226	0.440
12 wk	1,901.17±661.23	2,011.75±524.98	1,832.18±411.72	0.553	0.916	0.469	0.716
ΔIntake	116.20±681.44	350.30±539.15	50.99±52.51	0.168	0.697	0.086	0.171
<i>P</i> -value ⁵	0.393	0.003	0.631				
Carbohydrate (g/d)							
0 wk	227.13±69.05	214.61±78.81	232.52±56.20	0.466	0.568	0.303	0.476
12 wk	251.97±85.59	264.48±76.12	243.25±57.17	0.598	0.788	0.571	0.730
ΔIntake	24.84±77.24	49.87±76.11	10.73±77.95	0.219	0.414	0.134	0.169
<i>P</i> -value ⁵	0.114	0.003	0.498				
Protein (g/d)							
0 wk	65.64±22.62	61.10±24.61	65.51±19.81	0.338	0.912	0.222	0.445
12 wk	72.85±30.87	77.04±28.04	71.06±20.74	0.694	0.863	0.818	0.912
ΔIntake	7.21±32.88	15.93±34.88	5.55±21.08	0.370	0.964	0.263	0.482
<i>P</i> -value ⁵	0.274	0.031	0.200				
Fat (g/d)							
0 wk	65.82±30.56	59.56±30.73	63.30±20.21	0.376	0.899	0.450	0.569
12 wk	64.31±30.93	69.57±22.07	62.33±17.55	0.541	0.860	0.402	0.741
ΔIntake	-1.51±37.07	10.01±34.48	-0.97±22.56	0.256	0.886	0.218	0.363
<i>P</i> -value ⁵	0.837	0.160	0.832				
SFA (g/d)							

0 wk	7.70±3.74	9.40±6.20	10.41±6.00	0.269	0.023	0.548	0.167
12 wk	9.26±6.83	11.92±6.86	8.81±4.30	0.147	0.939	0.085	0.183
ΔIntake	1.57±6.82	2.52±9.93	-1.80±7.90	0.681	0.123	0.126	0.181
P-value ⁵	0.253	0.216	0.312				
MUFA (g/d)							
0 wk	9.55±4.63	11.62±5.64	11.88±5.52	0.190	0.035	0.714	0.172
12 wk	12.15±8.71	15.08±8.47	10.89±4.98	0.191	0.916	0.060	0.177
ΔIntake	2.61±9.70	3.47±10.61	-1.14±7.22	0.726	0.143	0.100	0.190
P-value ⁵	0.183	0.116	0.493				
PUFA (g/d)							
0 wk	10.65±5.72	10.23±4.21	10.17±4.74	0.705	0.747	0.737	0.937
12 wk	11.47±6.74	13.63±8.81	9.38±3.89	0.285	0.183	0.032	0.101
ΔIntake	0.83±9.16	3.40±9.00	-0.97±5.47	0.270	0.431	0.066	0.156
P-value ⁵	0.648	0.071	0.486				
Fiber, g/d							
0 wk	14.49±4.31	12.55±4.01	14.67±5.39	0.084	0.685	0.153	0.146
12 wk	17.45±6.89	16.90±5.71	15.10±4.49	0.839	0.196	0.360	0.351
ΔIntake	2.95±7.81	4.34±5.57	0.27±6.84	0.371	0.172	0.053	0.086
P-value ⁵	0.065	0.001	0.737				
Vitamin A (ug RAE/d)							
0 wk	317.48±140.60	336.24±107.92	367.37±166.86	0.503	0.198	0.607	0.416
12 wk	378.68±189.65	438.39±146.89	375.26±122.60	0.256	0.733	0.275	0.446
ΔIntake	61.20±243.29	102.14±143.99	2.62±200.11	0.602	0.462	0.175	0.426
P-value ⁵	0.211	0.002	0.843				
Vitamin D, ug/d							
0 wk	1.94±1.63	2.34±1.79	1.70±1.04	0.481	0.737	0.293	0.542
12 wk	2.16±2.23	2.76±1.72	3.00±2.60	0.380	0.088	0.565	0.221
ΔIntake	0.22±2.55	0.42±2.41	1.33±2.62	0.847	0.081	0.253	0.215
P-value ⁵	0.663	0.389	0.021				
Vitamin E (mg/d)							
0 wk	16.85±9.05	14.47±5.64	16.57±6.48	0.219	0.957	0.390	0.403
12 wk	17.83±9.12	17.53±5.47	14.21±4.52	0.928	0.146	0.034	0.173
ΔIntake	0.98±13.86	3.07±5.75	-2.36±7.72	0.441	0.278	0.015	0.136

<i>P</i> -value ⁵	0.722	0.014	0.139				
Vitamin K (ug/d)							
0 wk	83.04±87.19	102.42±80.62	77.97±71.11	0.494	0.772	0.379	0.758
12 wk	85.07±50.25 ^b	138.33±85.94 ^a	86.86±60.87 ^b	0.006	0.859	0.034	0.008
ΔIntake	2.03±102.32	35.91±112.42	9.19±74.59	0.179	0.904	0.352	0.283
<i>P</i> -value ⁵	0.920	0.123	0.556				
Thiamine (mg/d)							
0 wk	1.62±0.51	1.68±0.69	2.10±2.17	0.847	0.181	0.161	0.214
12 wk	1.92±1.10	1.88±0.62	1.60±0.49	0.703	0.335	0.24	0.488
ΔIntake	0.31±1.13	0.19±0.81	-0.51±2.03	0.667	0.089	0.067	0.094
<i>P</i> -value ⁵	0.181	0.255	0.231				
Rivoflavin (mg/d)							
0 wk	1.22±0.46	1.29±0.49	1.25±0.40	0.646	0.640	0.792	0.843
12 wk	1.40±0.54	1.54±0.39	1.37±0.41	0.264	0.793	0.230	0.490
ΔIntake	0.17±0.61	0.25±0.56	0.11±0.59	0.678	0.906	0.522	0.834
<i>P</i> -value ⁵	0.165	0.034	0.333				
Vitamin C (mg/d)							
0 wk	42.73±33.38	42.12±26.15	46.81±25.87	0.945	0.577	0.855	0.852
12 wk	48.61±29.24	55.56±21.52	44.40±26.87	0.247	0.401	0.135	0.199
ΔIntake	5.88±47.04	13.43±34.26	-2.41±31.27	0.454	0.352	0.230	0.327
<i>P</i> -value ⁵	0.530	0.062	0.704				
Folate (ug/d)							
0 wk	277.63±112.90	289.90±109.53	274.93±102.66	0.748	0.888	0.568	0.929
12 wk	331.86±128.74 ^{ab}	382.04±105.78 ^a	306.67±78.56 ^b	0.082	0.449	0.013	0.041
ΔIntake	54.23±175.59	92.14±131.62	31.74±114.54	0.344	0.513	0.180	0.303
<i>P</i> -value ⁵	0.128	0.002	0.179				
Vitamin B6 (mg/d)							
0 wk	1.59±1.20	1.44±0.75	1.43±0.61	0.438	0.736	0.841	0.723
12 wk	1.94±1.27	1.54±0.56	1.52±0.70	0.151	0.181	0.446	0.177
ΔIntake	0.34±1.84	0.10±0.65	0.09±0.78	0.623	0.463	0.697	0.690
<i>P</i> -value ⁵	0.350	0.458	0.585				
Vitamin B12 (ug/d)							
0 wk	3.54±2.08 ^b	4.42±2.60 ^{ab}	5.90±3.02 ^a	0.209	0.003	0.056	0.005

12 wk	5.18±2.80	5.52±4.46	5.99±2.52	0.689	0.293	0.438	0.458
ΔIntake	1.64±3.51	1.10±3.55	0.09±3.85	0.585	0.180	0.353	0.343
P-value ⁵	0.025	0.134	0.907				
Biotin (ug/d)							
0 wk	0.47±0.79	1.14±1.32	1.21±1.32	0.019	0.033	0.880	0.057
12 wk	1.15±1.55 ^b	2.81±1.66 ^a	0.45±0.69 ^b	0.001	0.050	0.0001	0.0001
ΔIntake	0.68±1.53 ^a	1.67±2.50 ^a	-0.76±1.52 ^B	0.119	0.004	0.001	0.001
P-value ⁵	0.033	0.003	0.020				
Calcium (mg/d)							
0 wk	322.53±163.09	339.40±148.10	373.40±154.21	0.551	0.229	0.623	0.510
12 wk	387.87±158.41	469.41±164.17	456.60±171.13	0.058	0.134	0.798	0.134
ΔIntake	65.34±159.39	130.01±168.16	78.72±199.66	0.225	0.773	0.478	0.773
P-value ⁵	0.047	0.001	0.046				
Iron (mg/d)							
0 wk	10.14±4.38 ^b	9.93±3.33 ^b	15.26±10.69 ^a	0.775	0.019	0.011	0.004
12 wk	13.90±8.56	13.48±4.38	13.44±5.59	0.899	0.660	0.887	0.973
ΔIntake	3.76±7.96	3.55±4.29	-1.90±11.13	0.973	0.045	0.024	0.504
P-value ⁵	0.024	0.0001	0.422				
Magnesium (mg/d)							
0 wk	64.69±30.06	67.68±29.56	80.18±40.92	0.727	0.039	0.177	0.407
12 wk	82.76±38.41	90.19±36.28	97.29±32.21	0.358	0.099	0.354	0.401
ΔIntake	18.07±50.71	22.51±39.30	15.97±44.85	0.603	0.514	0.476	0.574
P-value ⁵	0.081	0.009	0.021				

Data shown as Mean±SD. GMG: general meal group; RMG: rice meal group; SFA: saturated fatty acid; wk: week; WMG: wheat meal group; PUFA: polyunsaturated fatty acid. Δintake = 12 wk - 0wk. * the nutrient intake of 81 study subjects with suitable meal compliance among per protocol set.

¹Analyzed by ANCOVA between RMG group and WMG group after adjusting for age, sex and school. ²Analyzed by ANCOVA between RMG group and GMG group after adjusting for age, sex and school. ³Analyzed by ANCOVA between WMG group and GMG group after adjusting for age, sex and school.

⁴Analyzed by ANCOVA among three groups (RMG vs. WMG vs. GMG) after adjusting for age, sex, and school. ⁵Analyzed by paired t-test between 0 week and 12 week.