

# **SUPPLEMENTAL MATERIAL**

**Table S1. Anthropometric and biochemical parameters in 1065 subjects according obesity class and sex.**

	Normal BMI $\leq$ 25 kg/m <sup>2</sup> n= 35	Overweight subjects BMI >25-29.9 kg/m <sup>2</sup> n=312	Obesity Class I subjects BMI 30-34.9 kg/m <sup>2</sup> n=412	Obesity Class II subjects BMI 35-39.9 kg/m <sup>2</sup> n= 210	Obesity Class III subjects BMI $\geq$ 40 kg/m <sup>2</sup> n= 92	<i>P</i> BMI	<i>P</i> sex	<i>P</i> BMI x sex
Sex								
M/W								
Men	9	51	96	35	14			
Women	26	261	316	175	78			
Age (years)								
Men	33.1 $\pm$ 3.25	39.9 $\pm$ 1.50	40.7 $\pm$ 1.12	36.8 $\pm$ 1.65	32.7 $\pm$ 2.53	0.026	0.006	0.021
Women	38.5 $\pm$ 2.58	40.6 $\pm$ 0.61	39.3 $\pm$ 0.57	40.6 $\pm$ 0.71	39.7 $\pm$ 1.11			
Weight (Kg)								
Men	67.2 $\pm$ 1.28	80.2 $\pm$ 0.86	92.3 $\pm$ 0.80	108 $\pm$ 1.97	135 $\pm$ 4.50	0.0001	0.0001	0.0001

Women	60.7 ± 0.64	69.0 ± 0.40	80.2 ± 0.42	90.5 ± 0.68	109 ± 1.95			
BMI (Kg/ m <sup>2</sup> )								
Men	22.8 ± 0.63	27.9 ± 0.19	32.6 ± 0.14	37.0 ± 0.28	43.7 ± 0.92	0.0001	0.192	0.559
Women	23.5 ± 0.24	27.9 ± 0.08	32.4 ± 0.07	37.0 ± 0.10	44.3 ± 0.45			
Waist circumference (cm)								
Men	81.8 ± 2.87	96.0 ± 0.93	107 ± 0.62	116 ± 1.38	133 ± 3.45	0.0001	0.0001	0.0001
Women	80.4 ± 1.55	89.5 ± 0.40	97.7 ± 0.40	104 ± 0.73	116 ± 1.21			
Body fat (%)								
Men	39.5 ± 0.00	39.0 ± 0.18	38.1 ± 0.20	38.0 ± 0.40	39.0 ± 0.31	0.009	0.387	0.0001
Women	38.2 ± 0.36	37.8 ± 0.11	39.4 ± 0.08	39.5 ± 0.08	39.5 ± 0.06			
Lean mass (%)								
Men	56.1 ± 0.00	55.7 ± 0.29	55.8 ± 0.32	55.9 ± 0.32	50.4 ± 3.34	0.0001	0.0001	0.0001
Women	56.2 ± 0.10	56.4 ± 0.08	54.0 ± 0.19	51.1 ± 0.27	48.0 ± 0.68			





(mmol/L)								
Men	3.40 ± 0.19	3.30 ± 0.13	3.45 ± 0.11	3.25 ± 0.17	3.05 ± 0.20	0.106	0.899	0.984
Women	3.37 ± 0.11	3.30 ± 0.05	3.40 ± 0.05	3.22 ± 0.06	3.12 ± 0.09			
C - reactive protein (mg/dL)								
Men	0.54 ± 0.16	2.48 ± 0.75	2.91 ± 0.27	5.04 ± 0.75	5.55 ± 0.86	0.0001	0.058	0.720
Women	1.54 ± 0.41	3.15 ± 0.30	3.65 ± 0.20	5.03 ± 0.35	8.14 ± 1.00			
Adiponectin (mg/L)								
Men		3.86 ± 0.65	3.85 ± 0.27	4.52 ± 0.50	3.26	0.930	0.112	0.931
Women	4.62 ± 0.76	5.34 ± 0.37	5.38 ± 0.25	5.35 ± 0.35	4.66 ± 0.82			
Leptin (µg/L)								
Men		12.6 ± 1.72	20.7 ± 1.56	31.4 ± 3.22	62.6 ± 8.37	0.0001	0.0001	0.207
Women	37.24 ± 7.71	40.7 ± 1.70	58.2 ± 2.03	69.5 ± 3.16	82.6 ± 4.15			

**Table S2. Anthropometric and biochemical parameters in subjects with overweight and obesity with and without metabolic syndrome (MetS).**

Variable	w/o MetS n=501	MetS n=564	P Value
Men/Women No (%)	84 (16.8)/417 (83.2)	121(21.5) / 443 (78.5)	0.001
Age (years)	38.7 ± 0.45	40.8 ± 0.42	0.001
Weight (Kg)	80.1 ± 0.71	86.4 ± 0.68	0.0001
BMI (Kg/ m <sup>2</sup> )	31.5 ± 0.23	33.8 ± 0.21	0.0001
Waist circumference (cm)	95.6 ± 0.55	102 ± 0.48	0.0001
Body fat (%)	38.8 ± 0.07	38.8 ± 0.07	0.83
Lean mass (%)	54.4 ± 0.18	53.7 ± 0.18	0.04
Systolic blood Pressure (mmHg)	108 ± 0.40	113 ± 0.42	0.0001
Diastolic blood pressure (mmHg)	74.7 ± 0.29	79.5 ± 0.35	0.0001
Glucose (mmol/L)	4.79 ± 0.02	5.46 ± 0.06	0.0001
Insulin (pmol/L)	62.0 ± 1.86	83.9 ± 1.93	0.0001
HOMA index	1.88 ± 0.05	2.94 ± 0.08	0.0001
Total cholesterol (mmol/L)	4.97 ± 0.04	5.35 ± 0.04	0.0001
Triglycerides (mmol/L)	1.43 ± 0.02	2.60 ± 0.05	0.0001
HDL- cholesterol (mmol/L)	1.29 ± 0.01	0.94 ± 0.01	0.0001
LDL- cholesterol (mmol/L)	3.22 ± 0.03	3.40 ± 0.04	0.006
C-reactive protein (mg/L)	3.21 ± 0.21	4.21 ± 0.18	0.0001
Adiponectin (mg/L)	5.61 ± 0.27	4.81 ± 0.17	0.012

Leptin ( $\mu\text{g/L}$ )	$49.7 \pm 1.90$	$50.8 \pm 1.65$	0.649
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The values are means  $\pm$  SD; \* Data were analyzed using Independent Student's t test (w/o MetS and MetS group). MetS, metabolic syndrome; BMI, Body mass index.



**Table S3. Clinical and biochemical characteristics of normal weight group before and after the lifestyle intervention.**

Variable	DI+P (n=10)		P value	DI+FF (n=11)		P value
	Baseline	After treatment		Baseline	After treatment	
<b>Weight, kg</b>	59.4 ± 2.15	59 ± 2.07	0.35	62.4 ± 2.49	62.5 ± 2.74	0.67
<b>BMI, kg/m<sup>2</sup></b>	22.4 ± 0.28	22.3 ± 0.31	0.32	23.3 ± 0.57	23.3 ± 0.62	0.95
<b>Waist, cm</b>	76.0 ± 1.49	74.7 ± 1.36	0.16	78.8 ± 1.89	77.3 ± 1.73	0.24
<b>SBP, mmHg</b>	101 ± 4.00	99.6 ± 2.85	0.60	99.5 ± 2.68	100 ± 2.91	0.78
<b>DBP, mmHg</b>	68.4 ± 2.49	68.9 ± 2.37	0.77	64.3 ± 1.83	64.3 ± 2.36	0.79
<b>Glucose, mmol/L</b>	4.59 ± 0.16	4.67 ± 0.13	0.38	4.83 ± 0.10	4.52 ± 0.09	0.03
<b>Cholesterol, mmol/L</b>	4.53 ± 0.31	4.25 ± 0.32	0.13	4.15 ± 0.25	3.89 ± 0.22	0.18
<b>HDL-C, mmol/L</b>	1.62 ± 0.16	1.50 ± 0.12	0.50	1.39 ± 0.10	1.43 ± 0.12	0.85
<b>LDL-C, mmol/L</b>	2.51 ± 0.21	2.37 ± 0.20	0.13	2.30 ± 0.22	2.07 ± 0.169	0.15
<b>Triglycerides, mmol/L</b>	0.97 ± 0.14	0.88 ± 0.09	0.57	0.82 ± 0.05	0.90 ± 0.09	0.59
<b>HOMA-IR</b>	0.74 ± 0.14	0.76 ± 0.11	0.95	1.15 ± 0.16	1.00 ± 0.14	0.85
<b>AUC glucose, mmol/L</b>	673 ± 36.4	644 ± 29.2	0.79	707 ± 52.4	651 ± 59.7	0.07
<b>AUC insulin pmol/L</b>	27632 ± 2977	22883 ± 3509	0.02	38801 ± 5279	35908 ± 4513	0.47

BMI indicates body mass index; SBP indicates systolic blood pressure; DBP indicates diastolic blood pressure; HDL-C indicates high density lipoprotein cholesterol; LDL-C indicates low density lipoprotein cholesterol; AUC indicates area under the curve; DI+P indicates dietary intervention plus placebo; DI+FF indicates dietary intervention plus functional foods. All values are presented as mean  $\pm$  SEM. Paired T-test was performed for all variables. Significant at  $p < 0.05$ .

**Table S4. Clinical and biochemical characteristics of metabolic syndrome group before and after the lifestyle intervention.**

Variable	DI+P (n=17)		P value	DI+FF (n=18)		P value
	Baseline	After treatment		Baseline	After treatment	
<b>Weight, kg</b>	86.3 ± 3.08	84.4 ± 3.00	0.001	82.6 ± 2.5	79 ± 2.51	0.0001
<b>BMI, kg/m<sup>2</sup></b>	34.3 ± 0.89	33.6 ± 0.87	0.001	32.3 ± 0.76	30.8 ± 0.67	0.0001
<b>Waist, cm</b>	102 ± 2.89	98.4 ± 2.58	0.02	102 ± 1.94	97.2 ± 1.85	0.001
<b>SBP, mmHg</b>	108 ± 3.03	101 ± 6.03	0.55	115 ± 2.64	108 ± 2.69	0.01
<b>DBP, mmHg</b>	76.3 ± 1.85	74.7 ± 2.1	0.18	80.0 ± 1.92	73 ± 2.09	0.002
<b>Glucose, mmol/L</b>	5.51 ± 0.19	5.29 ± 0.23	0.03	5.43 ± 0.10	4.97 ± 0.168	0.04
<b>Cholesterol, mmol/L</b>	4.94 ± 0.25	4.85 ± 0.27	0.52	5.27 ± 0.17	5.02 ± 0.28	0.08
<b>HDL-C, mmol/L</b>	0.87 ± 0.05	0.91 ± 0.05	0.26	0.93 ± 0.06	0.84 ± 0.03	0.14
<b>LDL-C, mmol/L</b>	2.91 ± 0.22	2.96 ± 0.24	0.72	3.11 ± 0.16	3.27 ± 0.26	0.74
<b>Triglycerides, mmol/L</b>	2.27 ± 0.21	2.26 ± 0.32	0.08	2.62 ± 0.38	2.16 ± 0.24	0.11
<b>HOMA-IR</b>	4.75 ± 1.31	3.82 ± 0.91	0.43	3.60 ± 1.18	2.07 ± 0.29	0.09
<b>AUC glucose mmol/L</b>	1089 ± 69.0	961 ± 40.7	0.04	988 ± 43.5	947 ± 34.1	0.10
<b>AUC insulin pmol/L</b>	100447±12241	98159±12349	0.65	75627±7903	76952±12224	0.98

BMI indicates body mass index; SBP indicates systolic blood pressure; DBP indicates diastolic blood pressure; HDL-C indicates high density lipoprotein cholesterol; LDL-C indicates low density lipoprotein cholesterol; AUC indicates area under the curve; DI+P

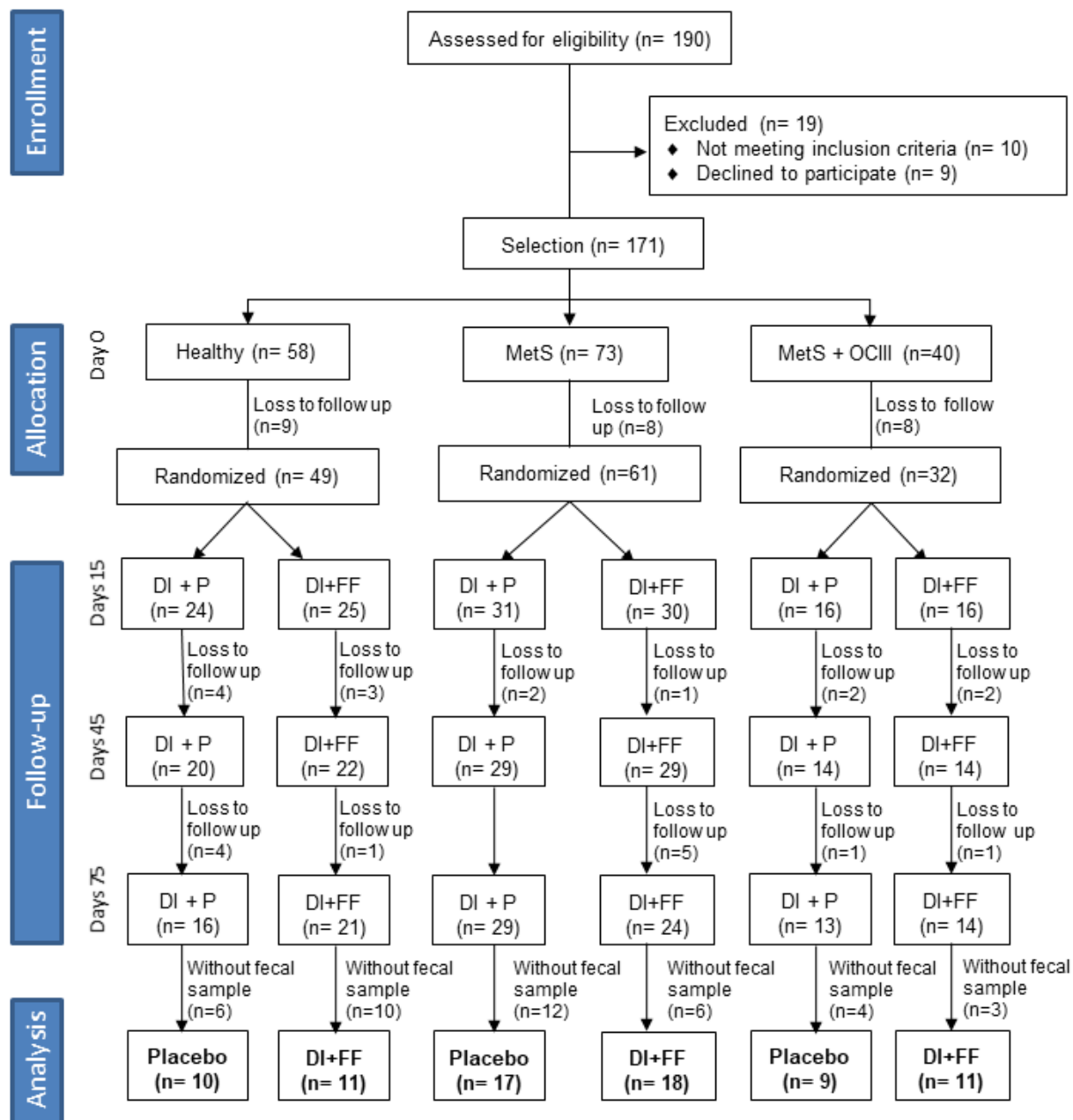
indicates dietary intervention plus placebo; DI+FF indicates dietary intervention plus functional foods. All values are presented as mean $\pm$  SEM. Paired T-test was performed for all variables. Significant at  $p < 0.05$ .

**Table S5. Clinical and biochemical characteristics of metabolic syndrome + obesity class III group before and after the lifestyle intervention.**

Variable	DI+P (n=9)		P value	DI+FF (n=11)		P value
	Baseline	After treatment		Baseline	After treatment	
<b>Weight, kg</b>	110.7±4.71	105.6±3.86	0.008	117.5±5.33	111.3±5.38	0.006
<b>BMI, kg/m<sup>2</sup></b>	43±0.928	41±0.703	0.008	44±1.08	41.8±1.3	0.006
<b>Waist, cm</b>	122±2.88	119±3.28	0.05	123±3.99	116±3.88	0.009
<b>SBP, mmHg</b>	109±3.4	113±3.28	0.26	112±3.27	107±2.93	0.44
<b>DBP, mmHg</b>	79±2.63	81±1.97	0.32	78.5±2.67	74.2±3.16	0.24
<b>Glucose, mmol/L</b>	5.79±0.25	4.89±0.21	0.03	5.84±0.33	4.94±0.158	0.008
<b>Cholesterol, mmol/L</b>	4.72±0.291	4.41±0.315	0.26	4.6±0.269	4.22±0.189	0.13
<b>HDL-C, mmol/L</b>	0.988±0.073	1±0.048	0.85	0.935±0.049	0.917±0.046	0.92
<b>LDL-C, mg/dL</b>	2.95±0.225	2.79±0.243	0.44	2.78±0.217	2.61±0.141	0.47
<b>Triglycerides, mmol/L</b>	1.8±0.17	1.560±0.128	0.03	1.99±0.143	1.56±0.177	0.02
<b>HOMA-IR</b>	4.89±0.696	3.12±0.226	0.03	8.67±1.94	3.6±0.468	0.01
<b>AUC glucose, mmol/L</b>	1112±63.3	929±20.9	0.03	1090±78.1	912±49.5	0.003
<b>AUC insulin pmol/L</b>	95819±15010	90752±13789	0.51	108348±10225	76501±10301	0.004

BMI indicates body mass index; SBP indicates systolic blood pressure; DBP indicates diastolic blood pressure; HDL-C indicates high density lipoprotein cholesterol; LDL-C indicates low density lipoprotein cholesterol; AUC indicates area under the curve; DI+P indicates dietary intervention plus placebo; DI+FF indicates dietary intervention plus functional foods. All values are presented as mean $\pm$  SEM. Paired T-test was performed for all variables. Significant at  $p < 0.05$ .

**Figure S1. Flow chart of the randomized control-placebo study.**



**Figure S2. Physical activity and presence of intestinal bowel syndrome prevalence in the population. A) Physical activity in 1032 participants with and without metabolic syndrome and B) presence of intestinal bowel syndrome in 509 participants.**

