

**Table S2. General characteristics of normal and vitamin D-deficient participants aged 40 to 64 years**

Characteristic	Middle-aged men (n=894)			Middle-aged women(n=1,245)		
	Normal (n=499)	Vitamin D deficiency (n=395)	P-value <sup>a)</sup>	Normal (n=776)	Vitamin D deficiency (n=469)	P-value <sup>a)</sup>
Age (yr)	52.0±0.4	50.9±0.4	0.024	53.3±0.3	50.2±0.4	<0.001
Household income			0.354			0.493
Low	42 (6.3)	34 (7.2)		90 (9.3)	38 (8.0)	
Middle-low	96 (17.5)	76 (18.4)		172 (20.5)	118 (23.1)	
Middle-high	143 (19.7)	128 (34.4)		239 (33.7)	145 (30.5)	
High	218 (46.5)	156 (40.1)		275 (36.5)	167 (38.4)	
Current alcohol consumer	355 (71.9)	289 (73.3)	0.666	329 (40.6)	212 (46.1)	0.098
Current smoker	154 (29.4)	158 (39.2)	0.007	35 (4.4)	27 (4.9)	0.670
Regular aerobic exercise	228 (49.4)	173 (48.0)	0.734	335 (47.7)	197 (44.5)	0.405
Body mass index (kg/m <sup>2</sup> )	25.1±0.2	25.4±0.2	0.235	23.3±0.2	24.0±0.2	0.011
Percent body fat (%)	24.3±0.3	25.2±0.3	0.065	32.6±0.3	33.3±0.3	0.118
Waist circumference (cm)	88.9±0.5	90.3±0.5	0.061	79.3±0.4	80.9±0.6	0.028
TyG index <sup>b)</sup>	8.87±0.03	9.01±0.04	0.011	8.43±0.02	8.51±0.03	0.035
Metabolically unhealthy state <sup>c)</sup>	234 (47.5)	241 (60.8)	0.001	224 (27.6)	157 (31.0)	0.215
25(OH)D3 (ng/mL)	29.2±0.4	14.1±0.2	<0.001	31.4±0.4	13.7±0.2	<0.001
Vitamin D intake (µg)	4.0±0.3	3.4±0.3	0.167	2.9±0.2	2.6±0.2	0.252
Total energy intake (kcal/day)	2,179±40	2150±45	0.629	1,532±21	1,572±26	0.244

Values are presented as mean±standard error of mean for continuous variables or number (%) for categorical variables. Vitamin D deficiency was defined as serum 25(OH)D3 of <20 ng/mL.

TyG index, triglyceride-glucose index; 25(OH)D3, 25-hydroxyvitamin D<sub>3</sub>.

<sup>a)</sup>Differences between normal and vitamin D deficient participants were determined using t-test for continuous variables and Rao-Scott chi-square test for categorical variables. <sup>b)</sup>The TyG index is calculated as  $\ln [\text{fasting triglycerides (mg/dL)} \times \text{fasting glucose (mg/dL)} / 2]$ . <sup>c)</sup>A metabolically unhealthy state is defined as TyG index of  $\geq 8.82$  for men and  $\geq 8.73$  for women.