

**Table A1.** Baseline participant characteristics by 25(OH)D quartiles, PROMISE cohort study

		Serum 25(OH)D concentration (nmol/L)				p value*	Spearman correlation	
		Q1 (≤ 39.40)	Q2 (39.41 – 53.55)	Q3 (53.56 – 70.30)	Q4 (70.31 – 161.00)		r value	p value
n (%)		175 (25.22)	172 (24.78)	176 (25.36)	171 (24.64)			
Age (years)		46.86	48.65	51.18	51.69	<0.0001	0.18	<0.0001
Sex	Males	52 (24.88)	56 (26.79)	50 (23.92)	51 (24.40)	0.86		
	Females	123 (25.36)	116 (23.92)	126 (25.98)	120 (24.74)			
Ethnicity	Caucasian	86 (19.03)	103 (22.79)	127 (28.10)	136 (30.09)	<0.0001		
	Hispanic	30 (28.85)	37 (35.58)	25 (24.04)	12 (11.54)			
	South Asian	25 (48.08)	11 (21.15)	11 (21.15)	5 (9.62)			
	Other	34 (39.53)	21 (24.42)	13 (15.12)	18 (20.93)			
Smoking (% current)		14 (28.57)	10 (20.41)	15 (30.61)	10 (20.41)	0.93		
Anthropometry	BMI (kg/m <sup>2</sup> )	32.29 (28.84, 37.28)	31.16 (27.38, 35.31)	29.71 (25.96, 32.86)	29.10 (25.84, 32.67)	<0.0001	-0.25	<0.0001
	Waist circumference (cm)	104.05 ± 14.94	99.23 ± 15.42	96.44 ± 15.43	95.08 ± 14.72	<0.0001	-0.21	<0.0001
Parathyroid Hormone (PTH) (pmol/L)		5.06 ± 2.03	4.76 ± 1.67	4.30 ± 1.57	4.23 ± 1.39	<0.0001	-0.20	<0.0001
Family history of DM (%)		110 (25.52)	105 (24.36)	111 (25.75)	105 (24.36)	0.90		
Total activity (MET-h/wk)	(leisure + occupational)	25.87 (8.77, 61.05)	28.62 (10.89, 74.15)	35.60 (13.15, 100.16)	36.78 (17.56, 88.04)	0.0031	0.15	0.0002
Supplement Use	Multi-vitamin (n=265, 42.46%)	39 (15.42)	48 (18.97)	79 (31.23)	87 (34.39)	<0.0001		
	Vitamin D (n=93, 14.83%)	17 (18.89)	13 (14.44)	27 (30.00)	33 (36.67)	0.0183		
	Vitamin D + Calcium (n=77, 12.28%)	5 (6.58)	15 (19.74)	24 (31.58)	32 (42.11)	<0.0001		
	Calcium (n=134, 21.37%)	21 (16.15)	27 (20.77)	41 (31.54)	41 (31.54)	0.0312		
Insulin Sensitivity	IS OGTT index <sup>†</sup>	9.21 (5.91, 14.58)	11.60 (7.47, 16.95)	14.37 (8.77, 22.95)	16.74 (10.75, 25.05)	<0.0001	0.30	<0.0001
Insulin Resistance	HOMA-IR <sup>‡</sup>	2.77 (1.70, 4.26)	2.21 (1.45, 3.56)	1.69 (1.09, 2.86)	1.46 (0.93, 2.34)	<0.0001	-0.29	<0.0001
Beta-cell Function	Insulinogenic index / HOMA-IR (IGI/IR) <sup>§</sup>	7.22 (4.37, 1.97)	7.50 (4.43, 12.65)	9.47 (4.90, 14.77)	10.42 (5.60, 17.00)	0.0024	0.14	0.0002
Beta-cell Function	ISSI-2 <sup>  </sup>	641.93 (507.39, 803.45)	693.54 (526.07, 895.47)	690.70 (528.74, 918.60)	770.53 (572.23, 956.92)	0.0024	0.14	0.0002

Data are n (%) for categorical variables, mean  $\pm$  SD for continuous variables, or median (25% & 75% interquartiles) for non-normally distributed variables.

\*P values are tests for proportions for categorical variables or tests for equality among quartiles for continuous variables.

†The IS<sub>OGTT</sub> index is calculated as follows:  $10000 / \sqrt{(FPG * FPI) * (G * I)}$ , where FPG = fasting plasma glucose, FPI = fasting plasma insulin, G = mean glucose during the OGTT, and I = mean insulin during the OGTT (calculated from glucose and insulin samples at 0, 30 and 120 minutes). Glucose and insulin values were in SI units.

‡HOMA-IR is defined as  $FPG * FPI / 22.5$ , using SI and metric units for glucose and insulin values respectively

§IGI/IR is calculated as follows: the insulinogenic index ((30 min insulin - fasting insulin) / (30 min glucose - fasting glucose)) divided by HOMA-IR.

||ISSI-2 is defined as the product of the ratio of total area-under-the-insulin curve to total area-under-the-glucose curve and IS<sub>OGTT</sub>.

**Table A2. Association of Vitamin D with Measures of Insulin Resistance and Beta-Cell Function, Stratified by BMI**

Outcome per unit increase in baseline 25(OH)D		Model 1*		Model 2†		Model 3‡	
		$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value
IS-OGTT§	BMI < 30	0.007 (0.004, 0.010)	<0.0001	0.007 (0.004, 0.011)	<0.0001	0.006 (0.002, 0.009)	0.001
	BMI $\geq$ 30¶	0.005 (0.002, 0.008)	0.002	0.004 (0.0002, 0.007)	0.04	0.003 (-0.001, 0.006)	0.13
HOMA-IR§	BMI < 30	-0.007 (-0.010, -0.004)	<0.0001	-0.007 (-0.011, -0.003)	0.0002	-0.005 (-0.008, -0.002)	0.004
	BMI $\geq$ 30¶	-0.005 (-0.008, -0.002)	0.003	-0.003 (-0.007, 0.001)	0.11	-0.001 (-0.005, 0.002)	0.51
IGI/IR§	BMI < 30	0.007 (0.003, 0.012)	0.002	0.009 (0.004, 0.014)	0.0009	0.008 (0.003, 0.013)	0.003
	BMI $\geq$ 30¶	0.004 (-0.001, 0.008)	0.10	0.001 (-0.004, 0.007)	0.59	-0.001 (-0.006, 0.005)	0.82
ISSI-2§	BMI < 30	0.004 (0.002, 0.006)	0.0006	0.005 (0.002, 0.007)	0.0001	0.004 (0.002, 0.007)	0.0007
	BMI $\geq$ 30¶	0.003 (0.001, 0.005)	0.008	0.002 (-0.001, 0.004)	0.14	0.001 (-0.002, 0.003)	0.45

\* Model 1: adjusted for age, sex, season, ethnicity

† Model 2: adjusted as in model 1 plus supplements, total physical activity, parathyroid hormone

‡ Model 3: adjusted as in model 2 plus BMI

§ Log transformations

|| n=345

¶ n=367