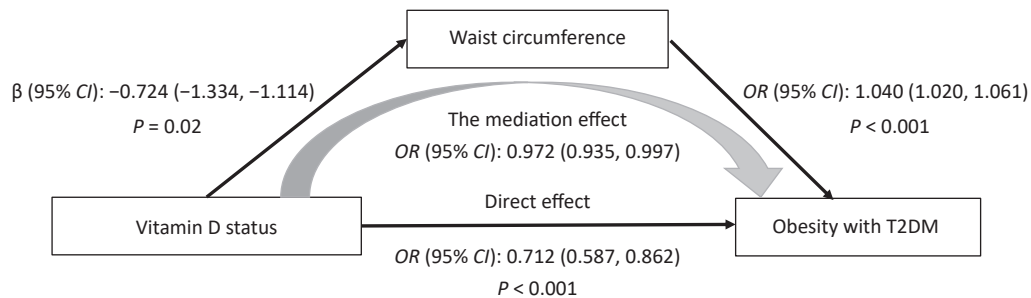


**Supplementary Figure S1.** Interaction effect of vitamin D levels and WC category on glucose metabolism. Adjusted  $\beta$ -coefficients and 95% confidence intervals for the 25(OH)D categories from the interaction models (all models adjusted for age, sex, marital status, education level, monthly income, smoking, drinking, high-fat diet, vegetable intake, and physical activity, family history of T2DM, BMI, SBP and PP). The clinical cut points obtained were as follows: < 20 ng/mL (deficiency); 20–30 ng/mL (insufficiency); and > 30 ng/mL (sufficiency). WC, waist circumference;  $\beta$ -coefficients, beta-coefficients; BMI, body mass index; SBP, systolic blood pressure; and PP, pulse pressure; FPG, fasting plasma glucose; FIns, fasting insulin; HOMA-IR, Homeostasis model assessment insulin resistance; 95% CI, 95% confidence interval; Ln, natural log-transformed. Reference category: 25(OH)D < 20 ng/mL.



**Supplementary Figure S2.** Mediation analysis to examine the association between vitamin D status and obesity with T2DM through WC (unit, cm). The analyses controlled for age, sex, marital status, education level, monthly income, smoking, drinking, high-fat diet, vegetable intake, and physical activity, family history of T2DM. OR, odds ratio; 95% CI, 95% confidence interval.

**Supplementary Table S1.** Characteristics of obese participants with and without T2DM

Variables	Total	Non-T2DM	T2DM	P
	(n = 901)	(n = 694)	(n = 207)	
Sex, n (%)				
Male	438 (48.61)	356 (52.82)	82 (39.61)	0.003
Female	463 (51.39)	318 (47.18)	125 (60.39)	
Age (year)	51.85 ± 14.29	50.01 ± 14.57	58.00 ± 11.38	< 0.001
Education, n (%)				
No education	160 (17.82)	105 (15.20)	55 (26.57)	< 0.001
Primary or Middle school	698 (77.73)	548 (79.31)	150 (72.46)	
High school or more	40 (4.45)	38 (5.50)	2 (0.97)	
Occupation, n (%)				
Migrant workers	127 (14.11)	107(15.44)	20 (9.66)	0.002
Farmers	684 (76.00)	508 (73.30)	176 (85.02)	
Office workers	89 (9.89)	78 (11.26)	11 (5.31)	
Income, n (%)				
< 1,000 CNY	826 (91.68)	631 (90.92)	195 (94.20)	0.134
≥ 1,000 CNY	75 (8.32)	63 (9.08)	12 (5.80)	
Drinking, n (%)				
Yes	205 (22.91)	174 (25.25)	31 (15.05)	0.002
No	690 (77.09)	515 (74.75)	175 (84.95)	
Smoking, n (%)				
Yes	241 (26.75)	205 (29.54)	36 (17.39)	0.002
No	660 (73.25)	489 (70.46)	171 (82.61)	
High-fat diet, n (%)				
Yes	180 (19.98)	153 (22.05)	27 (13.04)	0.004
No	721 (80.11)	541 (77.95)	180 (86.96)	
Vegetables and fruit intake, n (%)				
A little or no	640 (71.03)	480 (69.16)	160 (77.29)	0.024
More	261 (28.97)	214 (30.84)	47 (22.71)	
Salt intake, n (%)				
A little or no	840 (93.23)	644 (92.80)	196 (94.69)	0.342
More	61 (6.77)	50 (7.20)	11 (5.31)	
Physical activity, n (%)				
Mild	329 (36.51)	237 (34.15)	92 (44.44)	0.009
Moderate	190 (21.09)	145 (20.89)	45 (21.73)	
Severe	382 (42.40)	312 (44.96)	70 (33.82)	
BMI (kg/m <sup>2</sup> )	27.39 ± 1.09	27.39 ± 1.09	27.94 ± 1.09	0.013
WC (cm)	92.89 ± 8.66	92.27 ± 8.66	94.97 ± 8.37	< 0.001
FPG (mmol/L)	5.26 ± 1.43	3.16 ± 1.20	8.58 ± 1.43	< 0.001
Flns (mIU/L)	12.06 ± 1.68	11.47 ± 1.67	14.01 ± 1.72	< 0.001
HOMA-IR	2.80 ± 1.97	2.32 ± 1.73	5.31 ± 1.93	< 0.001
DBP (mmHg)	84.05 ± 10.28	83.93 ± 10.53	84.46 ± 9.38	0.485
SBP (mmHg)	130.63 ± 17.98	128.82 ± 17.72	136.67 ± 17.56	< 0.001
PP (mmHg)	46.57 ± 14.05	44.89 ± 13.51	52.20 ± 14.36	< 0.001
25(OH)D (ng/mL)	27.11 ± 2.22	28.50 ± 2.27	23.81 ± 2.05	0.003
25(OH)D category, n (%)				
< 20 ng/mL	444 (49.28)	324 (46.69)	120 (57.97)	0.001
20–30 ng/mL	134 (14.87)	99 (14.27)	35 (16.91)	
> 30 ng/mL	323 (35.85)	271 (39.05)	52 (25.12)	

**Note.** Data were given as the mean ± SD or n (%). Smoking was defined as at least 1 cigarette per day for more than 6 months; drinking was defined as more than 12 times in the past 12 months; more vegetable and fruit intake was defined as ≥ 500 g/d; meat ≥ 75 g/d was high-fat diet. The clinical cut points obtained were as follows: < 20 ng/mL (deficiency); 20–30 ng/mL (insufficiency); and > 30 ng/mL (sufficiency). FPG, fasting plasma glucose; Flns, fasting insulin; HOMA-IR, Homeostasis model assessment insulin resistance; BMI, body mass index; WC, waist circumference; DBP, diastolic blood pressure; SBP, systolic blood pressure; PP, pulse pressure; Ln, natural log-transformed.

**Supplementary Table S2.** The adjusted  $\beta$  coefficients (95% CIs) in markers of glucose metabolism associated with Ln25(OH)D in the total obese sample and stratified by WC category

Variables	$\beta$ coefficients (95% CIs)			
	N	Model 1	Model 2	Model 3
<b>LnFPG</b>				
Ln25(OH)D				
Total				
continuous		-0.045 (-0.074, -0.016)	-0.041 (-0.069, -0.012)	-0.035 (-0.063, -0.006)
< 20 ng/mL	444	Ref.	Ref.	Ref.
20–30 ng/mL	134	0.008 (-0.077, 0.060)	0.019 (-0.086, 0.048)	0.010 (-0.077, 0.057)
> 30 ng/mL	323	-0.098 (-0.149, -0.047)	-0.098 (-0.148, -0.047)	-0.086 (-0.136, -0.036)
Abdominal obesity				
continuous		-0.056 (-0.089, -0.024)	-0.048 (-0.081, -0.016)	-0.044 (-0.077, -0.012)
< 20 ng/mL	372	Ref.	Ref.	Ref.
20–30 ng/mL	110	-0.031 (-0.108, 0.045)	-0.046 (-0.121, 0.029)	-0.004 (-0.115, 0.035)
> 30 ng/mL	255	-0.116 (-0.173, -0.059)	-0.11 (-0.167, -0.053)	-0.103 (-0.160, -0.046)
Non-abdominal obesity				
continuous		0.023 (-0.039, 0.085)	0.004 (-0.058, 0.066)	0.017 (-0.045, 0.08)
< 20 ng/mL	72	Ref.	Ref.	Ref.
20–30 ng/mL	23	0.109 (-0.041, 0.258)	0.121 (-0.033, 0.274)	0.14 (-0.015, 0.296)
> 30 ng/mL	67	0.02 (-0.086, 0.126)	0.003 (-0.103, 0.109)	0.026 (-0.08, 0.132)
<b>LnHOMA-IR</b>				
Ln25(OH)D				
Total				
continuous		-0.058 (-0.114, -0.002)	-0.054 (-0.111, 0.003)	-0.039 (-0.095, 0.017)
< 20 ng/mL	444	Ref.	Ref.	Ref.
20–30 ng/mL	134	0.06 (-0.072, 0.191)	0.061 (-0.070, 0.193)	0.092 (-0.037, 0.222)
> 30 ng/mL	323	-0.123 (-0.221, -0.025)	-0.119 (-0.218, -0.020)	-0.0877 (-0.185, 0.010)
Abdominal obesity				
continuous		-0.081 (-0.142, -0.020)	-0.074 (-0.136, -0.011)	-0.065 (-0.126, -0.003)
< 20 ng/mL	372	Ref.	Ref.	Ref.
20–30 ng/mL	110	-0.023 (-0.166, 0.012)	-0.025 (-0.168, 0.119)	0.004 (-0.138, 0.146)
> 30 ng/mL	255	-0.167 (-0.275, -0.059)	-0.164 (-0.273, -0.055)	-0.146 (-0.254, -0.037)
Non-abdominal obesity				
continuous		0.072 (-0.064, 0.208)	0.061 (-0.078, 0.201)	0.088 (-0.050, 0.227)
< 20 ng/mL	72	Ref.	Ref.	Ref.
20–30 ng/mL	23	0.466 (0.149, 0.783)	0.499 (0.164, 0.835)	0.501 (0.167, 0.836)
> 30 ng/mL	67	0.146 (-0.080, 0.372)	0.172 (-0.060, 0.403)	0.220 (-0.009, 0.449)

**Note.** The Clinical cut points obtained were as follows: < 20 ng/mL (deficiency); 20–30 ng/mL (insufficiency); and > 30 ng/mL (sufficiency). FPG, fasting plasma glucose; FIns, fasting insulin; HOMA-IR, Homeostasis model assessment insulin resistance; 95% CI: 95% confidence interval; Tertile 1, the first/ lowest tertile; Tertile 2, the second tertile; Tertile 3, the third tertile; Model 1: no adjustment. Model 2: adjusted for age, sex, marital status, education level, monthly income, smoking, drinking, high-fat diet, vegetables and fruit intake, and physical activity, family history of T2DM. Model 3: further adjusted for BMI, body mass index; SBP, systolic blood pressure; and PP, pulse pressure; 95% CI, 95% confidence interval; Ln, natural log-transformed.

**Supplementary Table S3.** Interaction effect of 25(OH)D levels and WC category on glucose metabolism

Variables	25(OH)D category, ng/mL			<i>P</i> <sub>interaction</sub>
	< 20	20–30	> 30	
LnFPG				
WC category				
Abdominal obesity	ref.	−0.041 (−0.114, 0.032)	−0.102 (−0.157, −0.047)	0.071
Non-abdominal obesity	ref.	0.147 (−0.018, 0.312)	0.010 (−0.106, 0.126)	
LnHOMA-IR				
WC category				
Abdominal obesity	ref.	0.004 (−0.138, 0.146)	−0.139 (−0.247, −0.031)	0.004
Non-abdominal obesity	ref.	0.538 (0.220, 0.856)	0.175 (−0.050, 0.400)	

**Note.** Adjusted  $\beta$ -coefficients and 95% confidence intervals for the 25(OH)D categories from the interaction models (all models adjusted for age, sex, marital status, education level, monthly income, smoking, drinking, high-fat diet, vegetables and fruit intake, and physical activity, family history of T2DM, BMI, SBP and PP). The Clinical cut points obtained were as follows: < 20 ng/mL (deficiency); 20–30 ng/mL (insufficiency); and > 30 ng/mL (sufficiency). WC, waist circumference; FPG, fasting plasma glucose; HOMA-IR, Homeostasis model assessment insulin resistance; 95% CI: 95% confidence interval; Ln, natural log-transformed.