NHANES (National Health and Nutrition Examination Survey) are nationally representative surveys conducted by the National Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention. Survey participants from the US noninstitutionalized civilian population were selected using a stratified multistage probability sample design (although we will be ignoring this probability sampling here). In order to increase the reliability and precision of estimates, participant recruitment included oversampling of adolescents, elderly persons, non-Hispanic blacks, Mexican Americans, and low income non-Hispanic whites. Survey participants were interviewed and invited for a clinical examination. Physical examinations and collection of blood samples were conducted in a mobile examination clinic.

25(OH)D concentration is generally understood to reflect total intake of vitamin D from cutaneous synthesis and dietary intake. The Institute of Medicine (IOM) released a report in November 2010 on vitamin D status categorizing serum 25(OH)D: risk of deficiency(<12 ng/mL), risk of inadequacy(12–19 ng/mL), sufficiency(20–50 ng/mL), and possible harm (>50 ng/mL). Few (~1%) participants are at risk of possible harm due to high serum 25(OH)D concentration.

Case definition of type 2 diabetes was based on fulfillment of the American Diabetes Association criteria for diabetes diagnosis (fasting plasma glucose concentration$\geq$126 mg/dL or two-hour plasma glucose$\geq$200 mg/dL during an oral glucose tolerance test or A1c$\geq$6.5%) or an answer of "yes" to any of the following questions: (1) Other than during pregnancy, have you ever been told by a doctor or other health professional that you have diabetes or sugar diabetes?; (2) Are you taking insulin now?; (3) Are you taking diabetic pills to lower your blood sugar?

Age, race/ethnicity, gender, education, physical activity, and smoking were obtained by self-report. The average level of physical activity was reported on a scale of 1 to 4 (least vigorous to most vigorous). Participants were asked whether they had smoked at least 100 cigarettes in their entire life to classify their smoking status. Those who answered "yes" were asked whether they now smoke cigarettes every day, some days, or not at all. Current smokers were those who had smoked at least 100 cigarettes during their lifetime and, at the time of the interview, reported smoking either every day or some days. Former smokers were those who reported smoking at least 100 cigarettes during their lifetime but currently did not smoke. Never smokers were those who reported never having smoked 100 cigarettes during their lifetime. Data on anthropometric measurements were obtained by health staff. BMI was calculated from measured weight and height following a standardized protocol. For adults aged 20 years or older, normal weight was defined as a BMI of 18.5 to 24.99; overweight was defined as a BMI of 25.0 to 29.99; and obesity as a BMI of 30.0 or higher. Underweight adults were excluded because they comprise a small proportion of the sample. Waist circumference (WC) may correlate better with insulin resistance and type 2 diabetes because it is a better measure of body fat. Abdominal obesity was defined as WC ≥102 cm for men and ≥88 cm for women.

Table 1 - *Characteristics of participants ≥ 20 years of age stratified by type 2 diabetes mellitus,*
NHANES 2001-2006 (for your reference only, since numbers are from the weighted sample)

Variable	Characteristic	Diabetes Dm2=1	No Diabetes Dm2=0	P*
	Unweighted sample size	991	11909	
age	Age (years)	57.1±0.7	45.2±0.3	<0.0001
gender	Gender (%)			0.0015
1	Male	523 (52.8)	5657(47.5)	
2	Female	468 (47.2)	6252 (52.5)	
race	Race (%)			<0.0001
1	Non-Hispanic White	362 (36.5)	6393 (53.7)	
2	Non-Hispanic Black	261 (26.3)	2267 (19.0)	
3	Mexican-American	291 (29.4)	2386 (20.0)	
4	Other	77 (7.8)	863 (7.3)	
edu	Education (%)			<0.0001
1	Less than high school	443 (44.7)	3193 (26.8)	
2	High school diploma	210 (21.2)	2903 (24.4)	
3	Some college	338 (34.1)	5813 (48.8)	
BMXBMI	BMI categories (%)			<0.0001
	Underweight	3 (0.3)	206 (1.7)	
	Normal	141 (14.2)	3700 (31.1)	
	Overweight	316 (31.9)	4300 (36.1)	
	Obese	531 (53.6)	3703 (31.1)	
BMXWAIST	Waist circumference (%)			
	Abdominally obese	767 (77.4)	6314 (53.0)	<0.0001
	Not abdominally	224 (22.6)	5595 (47.0)	
PAQ180 1= "Mainly sit" 2= "Walk a lot" 3= "Carry light loads" 4= "Carry heavy loads"	Average level of physical activity each day	1.89±0.03	2.12±0.01	<0.0001
smstat	Smoking status (%)			<0.0001
3	Current smoker	466 (47.0)	6142 (51.6)	
2	Former smoker	346 (34.9)	3054 (25.6)	
1	Never smoked	179 (18.1)	2713 (22.8)	
lbdvid	Vitamin D status (%)			<0.0001
	Possibly harmful (>50 ng/mL)	0.0	80 (0.67)	
	Sufficiency (20–50 ng/mL)	393 (39.7)	7004 (58.8)	
	At risk of inadequacy (12– 19 ng/mL)	353 (35.6)	3042 (25.5)	
	Risk of deficiency (<12 ng/mL)	245 (24.7)	1783 (15.0)	