

**Supplemental Table 1.** Sample sizes for fat-soluble nutrient biomarkers stratified by sociodemographic and lifestyle variables for adults  $\geq 20$  y, NHANES 2003–2006 <sup>1,2</sup>

	VIA	VIE	CAR	XAN	25OHD	SFA	MUFA	PUFA	tFA
<b>Age, y</b>									
20–39	1688	1688	1663	1679	3262	566	559	599	480
40–59	1365	1365	1346	1357	2660	482	480	511	417
$\geq 60$	1387	1387	1378	1380	3071	639	623	676	548
<b>Sex</b>									
Men	2140	2140	2115	2127	4330	804	797	850	684
Women	2300	2300	2272	2289	4663	883	865	936	761
<b>Race-ethnicity</b>									
Mexican American	903	903	887	901	1814	345	370	374	313
Non-Hispanic black	986	986	974	974	1864	299	283	309	253
Non-Hispanic white	2243	2243	2220	2233	4675	929	889	973	775
<b>Education</b>									
<High school	1230	1230	1220	1224	2559	485	490	518	424
High school	1046	1046	1029	1036	2192	406	399	429	346
>High school	2159	2159	2133	2151	4230	793	771	836	674
<b>PIR<sup>3</sup></b>									
Low	1649	1649	1634	1639	3494	661	663	703	582
Medium	1150	1150	1129	1140	2270	426	419	450	363
High	1441	1441	1427	1437	2779	517	494	541	428

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Supplement user <sup>4</sup>									
No	2192	2192	2164	2179	4320	764	770	807	666
Yes	2246	2246	2222	2236	4661	919	888	975	776
Smoker <sup>5</sup>									
No	3304	3304	3262	3286	6621	1262	1239	1334	1075
Yes	1134	1134	1123	1128	2337	416	414	442	362
Alcohol consumption <sup>6</sup>									
No drinks	1446	1446	1426	1435	3015	589	577	624	495
<1 (not 0)	2160	2160	2137	2150	4329	816	807	861	700
1 – <2	283	283	281	282	547	99	92	107	82
≥2	227	227	226	226	428	75	74	78	70
BMI <sup>7</sup>									
Underweight	72	72	72	72	138	18	20	20	17
Normal weight	1253	1253	1237	1247	2586	482	491	521	423
Overweight	1500	1500	1482	1492	3086	597	584	629	511
Obese	1548	1548	1532	1539	3022	564	544	590	473
Physical activity <sup>8</sup>									
None reported	1587	1587	1563	1576	3338	628	624	672	534
0 – <500	986	986	973	980	1986	382	367	398	329
500 – <1000	543	543	537	539	1092	209	210	226	183
≥1000	1169	1169	1159	1166	2249	405	403	426	350

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- <sup>1</sup> 25OHD, 25-hydroxyvitamin D; CAR, carotenes; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids; tFA, total fatty acids (sum of SFA, MUFA, PUFA); VIA, vitamin A (retinol); VIE, vitamin E (*alpha*-tocopherol); XAN, xanthophylls
- <sup>3</sup> Biomarker data available for analysis: plasma concentrations of SFA, MUFA, PUFA and tFA (NHANES 2003–2004); serum concentrations of 25OHD (NHANES 2003–2006); and serum concentrations of VIA, VIE, CAR and XAN (NHANES 2005–2006)
- <sup>3</sup> PIR, family Poverty Income Ratio; categorized as low: 0–1.85; medium: >1.85–3.5; or high: >3.5
- <sup>4</sup> “Supplement user” defined as one who reported taking any dietary supplement during the 30 d preceding the household interview
- <sup>5</sup> “Smoker” defined by serum cotinine concentration >10 µg/L
- <sup>6</sup> Alcohol consumption: calculated as average daily number of “standard” drinks [(quantity x frequency)/365.25]; 1 drink ~15 g ethanol
- <sup>7</sup> BMI (kg/m<sup>2</sup>) definitions: underweight: <18.5; normal weight: 18.5–<25; overweight: 25–<30; or obese: ≥30
- <sup>8</sup> Physical activity: categorized based on metabolic equivalent task (MET) in MET-min/wk from leisure-time physical activity

**Supplemental Table 2.** Descriptive information for respondent characteristics stratified by influential factors for adults  $\geq 20$  y, NHANES 2003–2006<sup>1</sup>

Factors	Category	2003–2004 <sup>2</sup>	Fasted adults	
			2003–2004 <sup>2</sup>	2005–2006 <sup>2</sup>
Age, y	20-39	38.8	39.2	38.0
	40-59	38.5	38.3	39.0
	$\geq 60$	22.7	22.5	23.0
Sex	Men	48.0	48.0	48.1
	Women	52.1	52.0	51.9
Race-ethnicity	Mexican American	7.76	7.81	7.96
	Non-Hispanic black	11.2	11.5	11.5
	Non-Hispanic white	72.1	71.8	71.8
	Other Hispanic	3.59	3.05	3.37
	Other (including multiracial)	5.37	5.84	5.35
Education	$\leq$ High school	45.5	44.3	42.8
	$>$ High school	54.5	55.7	57.2
PIR <sup>3</sup>	Low	31.4	31.6	27.4
	Middle	27.6	27.1	28.4
	High	41.1	41.3	44.3
Supplement user <sup>4</sup>	No	46.0	46.2	45.9
	Yes	54.0	53.8	54.2
Smoker <sup>5</sup>	No	70.2	70.5	72.1
	Yes	29.8	29.5	27.9
Alcohol consumption <sup>6</sup>	None	30.6	31.1	28.2
	$<1$ (not 0)	56.6	56.8	57.0
	1- $<2$	7.6	6.8	8.1
	2+	5.2	5.4	6.7

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BMI <sup>7</sup>	Underweight	1.73	NR	1.81
	Normal weight	32.0	31.6	31.2
	Overweight	34.1	34.1	32.8
	Obese	32.2	32.8	34.3
Physical activity <sup>8</sup>	None	33.0	33.2	31.3
	0- <500	25.0	24.4	23.4
	500- <1000	13.6	14.5	14.3
	≥1000	28.4	27.9	31.1

<sup>1</sup> Three time periods are shown because biomarker data are derived from: NHANES 2003-2004 (plasma concentrations of total (free and esterified) saturated-, monounsaturated- and polyunsaturated fatty acids); NHANES 2005-2006 (serum concentrations of vitamins A and E, carotenes and xanthophylls); and NHANES 2003-2006 (serum concentrations of 25OHD)

<sup>2</sup> Estimates provided are percent (%)

<sup>3</sup> PIR, family Poverty Income Ratio; categorized as low: 0–1.85; medium: > 1.85–3.5; or high: >3.5

<sup>4</sup> “Supplement user” defined as one who took any dietary supplement during the 30 d preceding the household interview

<sup>5</sup> “Smoker” defined by serum cotinine concentration > 10 µg/L

<sup>6</sup> Alcohol consumption: calculated as average daily number of “standard” drinks [(quantity x frequency)/365.25]; 1 drink ~15 g ethanol

<sup>7</sup> BMI (kg/m<sup>2</sup>): categorized as underweight (<18.5), normal weight (18.5 – <25), overweight (25 – <30), or obese (≥30)

<sup>8</sup> Physical activity: categorized based on metabolic equivalent task (MET) in MET-min/wk from leisure-time physical activity

**Supplemental Table 3.** Beta coefficients for linear regression models involving sociodemographic and lifestyle factors and nutritional biomarker concentrations for adults  $\geq 20$  y, NHANES 2003-2006<sup>1,2,3</sup>

Variable	VIA	VIE	CAR	XAN	25OHD	SFA	MUFA	PUFA	tFA
<i>Sociodemographic</i>									
Age (continuous, every 10 y)									
Model 1	0.04 <sup>*</sup>	0.08 <sup>*</sup>	-0.01 <sup>*</sup>	0.02 <sup>*</sup>	-0.33	0.03 <sup>*</sup>	0.05 <sup>*</sup>	0.02 <sup>*</sup>	0.03 <sup>*</sup>
Model 2	0.04 <sup>*</sup>	0.08 <sup>*</sup>	-0.01 <sup>*</sup>	0.04 <sup>*</sup>	-1.05 <sup>*</sup>	0.03 <sup>*</sup>	0.05 <sup>*</sup>	0.02 <sup>*</sup>	0.03 <sup>*</sup>
Model 3	0.04 <sup>*</sup>	0.07 <sup>*</sup>	-0.01 <sup>*</sup>	0.04 <sup>*</sup>	-0.74 <sup>*</sup>	0.03 <sup>*</sup>	0.05 <sup>*</sup>	0.02 <sup>*</sup>	0.03 <sup>*</sup>
Model 4	0.02 <sup>*</sup>	0.05 <sup>*</sup>	-0.03 <sup>*</sup>	0.02 <sup>*</sup>	-0.83 <sup>*</sup>	0.00	0.02 <sup>*</sup>	-0.00	0.01
PIR <sup>4</sup> (continuous)									
Model 1	0.02 <sup>*</sup>	0.04 <sup>*</sup>	0.06 <sup>*</sup>	0.03 <sup>*</sup>	2.25 <sup>*</sup>	0	-0.01 <sup>*</sup>	0.01	0.003
Model 2	0.01 <sup>*</sup>	0.03 <sup>*</sup>	0.05 <sup>*</sup>	0.04 <sup>*</sup>	0.89 <sup>*</sup>	0	-0.02 <sup>*</sup>	0.01 <sup>*</sup>	0
Model 3	0.01	0.02 <sup>*</sup>	0.03 <sup>*</sup>	0.02 <sup>*</sup>	0.32	-0.01	-0.02 <sup>*</sup>	0.01	-0
Model 4	0.00	0.01 <sup>*</sup>	0.02 <sup>*</sup>	0.02 <sup>*</sup>	0.28	-0.00	-0.02 <sup>*</sup>	0.01 <sup>*</sup>	-0.00
Education <sup>5</sup> ( $\leq$ HS vs > HS)									
Model 1	-0.03 <sup>*</sup>	-0.06 <sup>*</sup>	-0.21 <sup>*</sup>	-0.12 <sup>*</sup>	-4.20 <sup>*</sup>	0.05 <sup>*</sup>	0.06 <sup>*</sup>	0.01	0.02
Model 2	-0.02	-0.06 <sup>*</sup>	-0.16 <sup>*</sup>	-0.15 <sup>*</sup>	-0.55	0.03	0.02	0.01	0
Model 3	-0.01	-0.03 <sup>*</sup>	-0.10 <sup>*</sup>	-0.08 <sup>*</sup>	1.57 <sup>*</sup>	0.01	0.00	0.01	-0.01
Model 4	-0.01	-0.03 <sup>*</sup>	-0.10 <sup>*</sup>	-0.08 <sup>*</sup>	1.60 <sup>*</sup>	0.02	0.01	0.02	0.01
Sex (men vs women)									
Model 1	0.11 <sup>*</sup>	-0.04 <sup>*</sup>	-0.08 <sup>*</sup>	-0.04 <sup>*</sup>	0.22	-0.02	0.02	-0.04 <sup>*</sup>	-0.01
Model 2	0.11 <sup>*</sup>	-0.04 <sup>*</sup>	-0.08 <sup>*</sup>	-0.04 <sup>*</sup>	-0.42	-0.02	0.03	-0.04 <sup>*</sup>	-0.01
Model 3	0.09 <sup>*</sup>	-0.02	-0.07 <sup>*</sup>	-0.00	-0.34	-0.04 <sup>*</sup>	-0.01	-0.04 <sup>*</sup>	-0.02
Model 4	0.10 <sup>*</sup>	0.01	-0.03	0.03 <sup>*</sup>	-0.14	-0.02	0.01	-0.02	-0.01
Race-ethnicity <sup>6</sup> (MA vs. NHW)									
Model 1	-0.16 <sup>*</sup>	-0.09 <sup>*</sup>	-0.09 <sup>*</sup>	0.37 <sup>*</sup>	-14.76 <sup>*</sup>	0.05	0.06	0.05 <sup>*</sup>	0.06 <sup>*</sup>
Model 2	-0.10 <sup>*</sup>	0.05 <sup>*</sup>	0.03	0.52 <sup>*</sup>	-13.85 <sup>*</sup>	0.07 <sup>*</sup>	0.08 <sup>*</sup>	0.08 <sup>*</sup>	0.09 <sup>*</sup>
Model 3	-0.09 <sup>*</sup>	0.06 <sup>*</sup>	0.00	0.46 <sup>*</sup>	-11.87 <sup>*</sup>	0.08 <sup>*</sup>	0.10 <sup>*</sup>	0.08 <sup>*</sup>	0.10 <sup>*</sup>
Model 4	-0.09 <sup>*</sup>	0.05 <sup>*</sup>	-0.01	0.45 <sup>*</sup>	-11.97 <sup>*</sup>	0.08 <sup>*</sup>	0.10 <sup>*</sup>	0.08 <sup>*</sup>	0.10 <sup>*</sup>

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(NHB vs. NHW)

Model 1	-0.16 <sup>*</sup>	-0.20 <sup>*</sup>	-0.04	0.14 <sup>*</sup>	-26.54 <sup>*</sup>	-0.09 <sup>*</sup>	-0.18 <sup>*</sup>	-0.03	-0.08 <sup>*</sup>
Model 2	-0.13 <sup>*</sup>	-0.13 <sup>*</sup>	0.01	0.21 <sup>*</sup>	-26.09 <sup>*</sup>	-0.08 <sup>*</sup>	-0.17 <sup>*</sup>	-0.02	-0.07 <sup>*</sup>
Model 3	-0.12 <sup>*</sup>	-0.11 <sup>*</sup>	0.05	0.25 <sup>*</sup>	-23.78 <sup>*</sup>	-0.09 <sup>*</sup>	-0.18 <sup>*</sup>	-0.01	-0.08 <sup>*</sup>
Model 4	-0.10 <sup>*</sup>	-0.07 <sup>*</sup>	0.09 <sup>*</sup>	0.29 <sup>*</sup>	-23.61 <sup>*</sup>	-0.06 <sup>*</sup>	-0.16 <sup>*</sup>	0.00	-0.06 <sup>*</sup>

### *Lifestyle*

Smoker<sup>7</sup>

(yes vs no)

Model 1	-0.001	0.14 <sup>*</sup>	0.22 <sup>*</sup>	0.34 <sup>*</sup>	0.86	-0.02	-0.05	0.04 <sup>*</sup>	-0.004
Model 3	0	0.04 <sup>*</sup>	0.18 <sup>*</sup>	0.28 <sup>*</sup>	1.45 <sup>*</sup>	-0.02	-0.06 <sup>*</sup>	0.02	-0.02
Model 4	0.00	0.05 <sup>*</sup>	0.19 <sup>*</sup>	0.28 <sup>*</sup>	1.54	-0.01	-0.05 <sup>*</sup>	0.02 <sup>*</sup>	-0.01

Alcohol consumption<sup>8</sup>

(continuous, ln + 1)

Model 1	0.12 <sup>*</sup>	-0.01	0.01	-0.06	5.02 <sup>*</sup>	0.07 <sup>*</sup>	0.07 <sup>*</sup>	-0.001	0.04 <sup>*</sup>
Model 3	0.10 <sup>*</sup>	0.03	0.04	0.01	2.54 <sup>*</sup>	0.11 <sup>*</sup>	0.10 <sup>*</sup>	0.03	0.07 <sup>*</sup>
Model 4	0.09 <sup>*</sup>	-0.01	0.00	-0.02	2.32 <sup>*</sup>	0.07 <sup>*</sup>	0.08 <sup>*</sup>	-0.01	0.04 <sup>*</sup>

BMI<sup>9</sup>

(continuous, ln)

Model 1	-0.03	0.05 <sup>*</sup>	-0.42 <sup>*</sup>	-0.56 <sup>*</sup>	-24.35 <sup>*</sup>	0.22 <sup>*</sup>	0.22 <sup>*</sup>	0.07	0.14 <sup>*</sup>
Model 3	-0.01	0.06 <sup>*</sup>	-0.38 <sup>*</sup>	-0.62 <sup>*</sup>	-18.78 <sup>*</sup>	0.27 <sup>*</sup>	0.27 <sup>*</sup>	0.07	0.17 <sup>*</sup>
Model 4	-0.06 <sup>*</sup>	-0.04 <sup>*</sup>	-0.49 <sup>*</sup>	-0.72 <sup>*</sup>	-19.20 <sup>*</sup>	0.19 <sup>*</sup>	0.18 <sup>*</sup>	0.01	0.09 <sup>*</sup>

Physical activity<sup>10</sup>

(continuous, ln + 1)

Model 1	0.01 <sup>*</sup>	0.004	0.03 <sup>*</sup>	0.02 <sup>*</sup>	1.42 <sup>*</sup>	-0.01 <sup>*</sup>	-0.01 <sup>*</sup>	-0.002	-0.004
Model 3	0.004 <sup>*</sup>	0.00	0.02 <sup>*</sup>	0.02 <sup>*</sup>	0.94 <sup>*</sup>	-0.00	-0.00	0.00	0.00
Model 4	0.004 <sup>*</sup>	0.00	0.02 <sup>*</sup>	0.02 <sup>*</sup>	0.95 <sup>*</sup>	-0.00	-0.00	0.00	0.00

Supplement user<sup>11</sup>

(yes vs no)

Model 1	0.09 <sup>*</sup>	0.27 <sup>*</sup>	0.18 <sup>*</sup>	0.12 <sup>*</sup>	8.63 <sup>*</sup>	0.06 <sup>*</sup>	0.06 <sup>*</sup>	0.04 <sup>*</sup>	0.06 <sup>*</sup>
Model 3	0.05 <sup>*</sup>	0.19 <sup>*</sup>	0.11 <sup>*</sup>	0.06 <sup>*</sup>	5.25 <sup>*</sup>	0.05 <sup>*</sup>	0.04	0.03	0.04
Model 4	0.05 <sup>*</sup>	0.19 <sup>*</sup>	0.11 <sup>*</sup>	0.06 <sup>*</sup>	5.23 <sup>*</sup>	0.04 <sup>*</sup>	0.02	0.01	0.02

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Sample size, <i>n</i>									
Model 2	<b>4239</b>	<b>4239</b>	<b>4189</b>	<b>4215</b>	<b>8537</b>	<b>1602</b>	<b>1575</b>	<b>1692</b>	<b>1372</b>
Model 3	<b>3773</b>	<b>3773</b>	<b>3732</b>	<b>3751</b>	<b>7513</b>	<b>1426</b>	<b>1402</b>	<b>1506</b>	<b>1222</b>
Model 4	<b>3771</b>	<b>3771</b>	<b>3730</b>	<b>3749</b>	<b>7503</b>	<b>1424</b>	<b>1400</b>	<b>1504</b>	<b>1220</b>
<i>R</i> <sup>2</sup> value, %									
Model 2	<b>13<sup>&amp;</sup></b>	<b>17<sup>&amp;</sup></b>	<b>6<sup>&amp;</sup></b>	<b>10<sup>&amp;</sup></b>	<b>17<sup>&amp;</sup></b>	<b>6<sup>&amp;</sup></b>	<b>10<sup>&amp;</sup></b>	<b>5<sup>&amp;</sup></b>	<b>6<sup>&amp;</sup></b>
Model 3	<b>17<sup>&amp;</sup></b>	<b>23<sup>&amp;</sup></b>	<b>10<sup>&amp;</sup></b>	<b>22<sup>&amp;</sup></b>	<b>23<sup>&amp;</sup></b>	<b>11<sup>&amp;</sup></b>	<b>15<sup>&amp;</sup></b>	<b>6</b>	<b>10<sup>&amp;</sup></b>
Model 4	<b>24<sup>&amp;</sup></b>	<b>55<sup>&amp;</sup></b>	<b>26<sup>&amp;</sup></b>	<b>32<sup>&amp;</sup></b>	<b>23<sup>&amp;</sup></b>	<b>47<sup>&amp;</sup></b>	<b>40<sup>&amp;</sup></b>	<b>55</b>	<b>53<sup>&amp;</sup></b>

<sup>1</sup> Model 1 represents simple linear regression; model 2 represents multiple linear regression with sociodemographic factors; model 3 represents multiple linear regression with sociodemographic and lifestyle factors; and model 4 represents multiple linear regression with sociodemographic, lifestyle and lipid-related (use of lipid altering medications and adjustment for total cholesterol) factors

<sup>2</sup> 25OHD, 25-hydroxyvitamin D; CAR, carotenes; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids; tFA, total fatty acids (sum of SFA, MUFA, PUFA); VIA, vitamin A (retinol); VIE, vitamin E (*alpha*-tocopherol); XAN, xanthophylls. Natural logarithm-transformed biomarker concentrations, except for 25OHD.

<sup>3</sup> Biomarker data available for analysis: plasma concentrations of SFA, MUFA, PUFA and tFA (NHANES 2003-2004); serum concentrations of 25OHD (NHANES 2003-2006); and serum concentrations of VIA, VIE, CAR and XAN (NHANES 2005-2006)

<sup>4</sup> PIR, family Poverty Income Ratio

<sup>5</sup> High school (HS)

<sup>6</sup> Mexican American (MA); non-Hispanic white (NHW); non-Hispanic black (NHB)

<sup>7</sup> "Smoker" defined by serum cotinine concentration >10 µg/L

<sup>8</sup> Alcohol consumption: calculated as average daily number of "standard" drinks [(quantity x frequency)/365.25]; 1 drink ~15 g ethanol

<sup>9</sup> BMI measured in kg/m<sup>2</sup>

<sup>10</sup> Physical activity: categorized based on metabolic equivalent task (MET) in MET-min/wk from leisure-time physical activity

<sup>11</sup> "Supplement user" defined as one who took any dietary supplement during the 30 d preceding the household interview

\* Wald F *P*-value <0.05; *beta* coefficient is significantly different from zero

& Satterthwaite adjusted *F* *P*-value for chunk test <0.05; testing whether at least 1 beta coefficient for the set of variables in the chunk is different than 0



**Supplemental Table 4.** Unadjusted serum 25-hydroxyvitamin D concentrations stratified by sun exposure-related variables for adults  $\geq 20$  y, NHANES 2003–2006<sup>1</sup>

Variables	Sample Size	25OHD <sup>2</sup>
Latitude <sup>3</sup> , °N		
25– <30	633	58.7 (32.4 – 85.1)
30– <35	2355	54.4 (49.2– 59.7)
35– <40	2978	56.8 (52.0 – 61.5)
$\geq 40$	3027	63.3 (60.2 – 66.4)
<i>P</i> -value <sup>4</sup>		0.0032
<i>r</i> <sup>2</sup> , % <sup>5</sup>		2
Quarter <sup>6</sup>		
Jan-Mar	2101	49.9 (47.0 – 52.3)
Apr-Jun	2490	58.0 (50.6 – 65.3)
Jul-Sep	2191	65.2 (61.9 – 68.5)
Oct-Dec	2211	59.5 (53.2 – 65.8)
<i>P</i> -value		<0.0001
<i>r</i> <sup>2</sup> , %		5

<sup>1</sup> values are weighted arithmetic means (95% CI)

<sup>2</sup> 25OHD, serum 25-hydroxyvitamin D, nmol/L

<sup>3</sup> latitude, in degrees north, of mobile examination center location when the participant was examined

<sup>4</sup> *P*-value based on the Wald *F* test

<sup>5</sup> *r*<sup>2</sup> based on model 1 (simple linear regression) using categories as shown

<sup>6</sup> quarter of the calendar year in which the participant was examined

**Supplemental Table 5.** Beta coefficients for multiple linear regression models involving sociodemographic, lifestyle, sun-exposure variables and 25-hydroxyvitamin D concentrations for adults  $\geq 20$  y, NHANES 2003-2006<sup>1,2,3</sup>

Variable	Model 3	Model 5
Age, y	-0.07*	-0.08*
Sex		
Women	ref	ref
Men	-0.34	-0.15
Race-ethnicity		
Mexican-Americans	-11.87*	-8.33*
Non-Hispanic Blacks	-23.77*	-23.02*
Non-Hispanic Whites	ref	ref
Education		
$\leq$ High school	1.57*	1.44*
>High school	ref	ref
PIR <sup>4</sup>	0.32	0.37
Smoker <sup>5</sup>		
No	1.45	1.55
Yes	ref	ref
BMI <sup>6</sup>	-18.77*	-18.78*
Physical activity <sup>7</sup> (continuous, ln + 1)	0.94*	0.87*
Alcohol consumption <sup>8</sup> (continuous, ln+1)	2.54*	2.19*
Supplement user <sup>9</sup>		
No	ref	ref
Yes	5.25*	5.51*
Latitude <sup>10</sup> , °N		
25-30		5.01*
30-35		-0.25
35-40		-0.7
40+		ref
Quarter <sup>11</sup>		
Apr-June		-0.31
Jan-Mar		-6.68*
July-Sept		5.68*
Oct-Dec		Ref
Sample size	7513	7513
$R^2$ , %	26.1	26.2

## Online Supporting Material

- <sup>1</sup> Model 3 represents multiple linear regression with sociodemographic and lifestyle factors; model 5 represents multiple linear regression with sociodemographic, lifestyle and sun-exposure related factors (latitude and time of year)
- <sup>2</sup> 25OHD, 25-hydroxyvitamin D, in nmol/L
- <sup>3</sup> Biomarker data available for analysis: serum concentrations of 25OHD (NHANES 2003-2006)
- <sup>4</sup> PIR, family Poverty Income Ratio
- <sup>5</sup> “Smoker” defined by serum cotinine concentration >10 µg/L
- <sup>6</sup> BMI, kg/m<sup>2</sup>
- <sup>7</sup> Physical activity: categorized based on metabolic equivalent task (MET) in MET-min/wk from leisure-time physical activity
- <sup>8</sup> Alcohol consumption: calculated as average daily number of “standard” drinks [(quantity x frequency)/365.25]; 1 drink ~15 g ethanol
- <sup>9</sup> “Supplement user” defined as one who reported taking any dietary supplement during the 30 d preceding the household interview
- <sup>10</sup> Latitude, degrees north
- <sup>11</sup> Quarter of the calendar year in which the participant was examined
- \**P* value <0.05 for *t*-test beta = 0