

Vitamin D is associated with improved lung function but not with asthma, emphysema and bronchitis

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ABSTRACT

Background: Hypovitaminosis D has been linked to several non-bone related diseases. Relation between serum 25-hydroxyvitamin D [25(OH)] and lung function and lung diseases has received less attention. **Methods:** Data from 3 National Health and Nutrition Examination Survey (NHANES) cycles, 2007-2012 were used. The sample size was 11983. Lung function markers such as forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1) were collected with Spirometry. Relation between serum 25(OH)D and lung function makers was assessed by the multivariate regression. Relation between serum 25(OH)D and prevalence of asthma, emphysema, and chronic bronchitis were assessed with multivariate-adjusted logistic regression. **Results:** Serum 25(OH)D was significantly associated with FVC and FEV1 (P <0.001). When data were stratified based on sex and smoking status, we found similar associations between serum 25(OH)D and lung function markers. No relation was found between serum 25(OH)D and prevalence of asthma, chronic bronchitis, and emphysema. **Conclusions:** Serum 25(OH)D is significantly associated with improved lung function markers. Controlled studies are needed to determine if improved serum 25(OH)D will improve the lung function in adults.

INTRODUCTION

- Vitamin D is a lipophilic vitamin. Suboptimal vitamin D status is a global health problem
- 25(OH)D is a major circulatory form of vitamin D.
- Vitamin D classical function is to maintain calcium homeostasis.
- Recent evidence supports a role for vitamin D in non-bone diseases such as heart diseases, cancer, and neuro-muscular diseases.
- Asthma is a chronic inflammation of the airways resulting in wheezing, shortness of breath, cough and chest pains. while high concentrations helped to decrease severity and number of asthma attacks to half, in mild to moderate cases of asthma.
- Objective was to investigate the relation between serum 25(OH)D and lung function markers and lung diseases in adults.

METHODOLOGY

- Data from >19 years and older participants from 3 NHANES cycles (2007-2008, 2009-2010, and 2011-2012) were used (n=11983). These 3 cycles were combined into one analytic file, NHANES 2007-2012.
- Liquid chromatography-tandem mass spectrometry was used to measure the serum 25(OH)D.
- FVC and FEV1 are available only in NHANES 2007-2012 cycles.
- Asthma, chronic bronchitis, and emphysema were self-reported by participants during the personal interview.
- Serum 25(OH)D concentrations were stratified into quartiles.
- Data analysis was performed with STATA software.
- Relation between serum 25(OH)D concentrations and lung function makers was assessed using the multivariate linear regression.
- Relation between serum 25(OH)D and prevalence of asthma, chronic bronchitis, and emphysema was assessed with multivariate-adjusted logistic regression
- Analysis was adjusted for age, sex, race-ethnicity, physical activity-sedentary, poverty income ratio, smoking, alcohol consumption, vitamin D supplements use, season of examination, and BMI).
- P<0.05 is considered as statistically significant.

Table1: Subject characteristics of study population (n=11983): National Health and Nutrition Examination Surveys (NHANES) 2007-2012

	Serum 25 (OH) D				P-value
	Q1	Q2	Q3	Q4	
	(n=2995)	(n=2996)	(n=2996)	(n=2996)	
Serum 25(OH)D, nmol/L	32.3±7.7	52.5±4.9	68.8±5.0	97.0±19.1	<0.001
Age, y	43.9±15.8	45.2±15.9	47.6±16.1	50.8±16.4	<0.001
BMI, kg/m ²	30.8±8.1	29.5±6.5	28.6±6.1	27.4±5.8	<0.001
Winter	1826 (61%)	1507 (50%)	1232 (41%)	964 (32%)	
Summer	1169 (39%)	1489 (50%)	1764 (59%)	2032 (68%)	
Supplement use					<0.001
No	2579 (86%)	2236 (75%)	1815 (61%)	1275 (43%)	
Yes	416 (14%)	760 (25%)	1181 (39%)	1721 (57%)	

¹P- for trend for the effect of variable in the regression analysis. Participants who took supplements 1 month before the survey was conducted. Data were collected during 1 May–31 October in the North (summer) and 1 November–30 April in the South (winter).

RESULTS

- In the multivariate adjusted models, serum 25(OH)D concentrations were significantly, positively associated with lung function markers, i.e., FVC and FEV1 (P for trend <0.001).
- No relationship was observed between serum 25(OH)D concentrations and the prevalence of asthma emphysema, and chronic bronchitis in both unadjusted and multivariate adjusted analysis.

Table2: Association between serum 25(OH)D and markers of lung function in US adults¹

		Serum25 (OH)D				P-value
		Q1 (n=2995)	Q2 (n=2996)	Q3 (n=2996)	Q4 (n=2996)	
FVC, mL	Unadjusted	3004±23 ^a	3304±121	3313±26	3181±29	0.005
	Multivariate adjusted	3108±17	3199±178	3236±16	3259±17	<0.001
FEV1, mL	Unadjusted	3801±32	4182±132	4257±27	4145±30	<0.001
	Multivariate adjusted	4007±22	4087±192	4144±18	4190±19	<0.001

¹Relation between serum 25(OH)D and lung function makers was assessed with the multivariate regression. FCV & FEV1 are adjusted for age, sex, race-ethnicity, physical activity-sedentary, poverty income ratio, smoking, alcohol consumption, vitamin D supplements use, season of examination, BMI.

Table 3: Association between serum 25-hydroxyvitamin D [25(OH)D] and markers of lung function by sex and smoking status in US adults¹

		Serum 25 (OH)D				P-value
		Q1 (n=2995)	Q2 (n=2996)	Q3 (n=299)	Q4 (n=299)	
FVC, mL						0.041
Smoking status	Non smoker	4012±23 ^a	4084±167 ^b	4143±18 ^{b,c}	4214±22 ^c	
	Smoker	4047±34 ^a	4144±117 ^{a,b}	4187±35 ^b	4152±28 ^{a,b}	
Sex	Men	4622±40 ^a	4767±141 ^{a,b}	4852±28 ^{b,c}	4955±32 ^c	<0.001
	Women	3425±21 ^a	3455±169 ^{a,b}	3463±20 ^{a,b}	3458±17 ^b	
FEV1, mL	Non smoker	3129±20 ^a	3214±152 ^b	3280±14 ^{b,c}	3321±18 ^{c,d}	0.002
	Smoker	3079±29 ^a	3192±107 ^b	3171±32 ^{a,b}	3133±28 ^{a,b}	
Sex	Men	3550±34 ^a	3701±123 ^b	3760±23 ^b	3798±27 ^b	0.009
	Women	2685±20 ^a	2724±138 ^{a,b}	2737±15 ^{a,b}	2746±17 ^{b,c}	

¹Association between serum 25(OH)D and lung function markers by sex and smoking was assessed using multivariate regression analysis. Bonferroni correction was used for pair-wise comparison of FVC and FEV1 values between serum 25(OH)D quartiles mean values sharing common superscripts are not significantly different within row.

Table 4: Relationship between serum 25(OH)D and prevalence of asthma, emphysema, and chronic bronchitis¹

	Serum25(OH)D				P-value	
	Q1	Q2	Q3	Q4		
Asthma	n	2994	2994	2991	2993	
	Cases	446	399	385	403	
	Unadjusted OR (95% CI)	1.23 (0.98-1.55)	1.10 (0.86-1.42)	0.98 (0.79-1.22)	1.0 ⁴	0.09 ⁵
Emphysema	n	2993	2993	2991	2995	
	Cases	39	29	34	54	
	Unadjusted OR (95% CI)	1.19 (0.76-1.88)	0.62 (0.36-1.06)	0.95 (0.58-1.54)	1.0 ⁴	0.99 ⁵
Chronic bronchitis	n	2993	2991	2989	2990	
	Cases	147	115	142	176	
	Unadjusted OR (95% CI)	0.99 (0.71-1.37)	0.82 (0.57-1.17)	0.89 (0.61-1.31)	1.0 ⁴	<0.67 ⁵
Multivariable-adjusted OR (95% CI)		1.19 (0.95-1.51)	1.13 (0.87-1.46)	1.01 (0.80-1.28)	1.0 ⁴	0.14 ⁶
		1.11 (0.66-1.87)	0.69 (0.36-1.31)	0.60 (0.36-0.99)	1.0 ⁴	0.89 ⁶
		1.06 (0.71-1.57)	0.98 (0.64-1.49)	0.95 (0.65-1.39)	1.0 ⁴	<0.84 ⁶

¹Relation between serum 25(OH)D and prevalence of lung diseases were assessed with multivariate-adjusted logistic regression. Odds ratios (OR) and 95% CI were calculated for the presence of lung diseases using the χ^2 test. Analysis was adjusted age, sex, race-ethnicity, physical activity-sedentary, poverty income ratio, smoking, alcohol consumption, vitamin D supplements use, season of examination, and BMI.

CONCLUSION

- Serum 25(OH)D is significantly, directly associated with lung function markers such as FVC and FEV1.
- Serum25(OH)D was not associated with prevalence of asthma, emphysema and chronic bronchitis.
- Controlled studies are needed to determine if improved serum 25(OH)D will improve the lung function in adults.

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