How to Cite:
Obeidat, A. A. (2022). Vitamin D deficiency and the development of prediabetes in adolescent females. *International Journal of Health Sciences*, *6*(S2), 1198–1206. https://doi.org/10.53730/ijhs.v6nS2.5238

Vitamin D Deficiency and the Development of Prediabetes in Adolescent Females

Ahmad A. Obeidat
Assistant Professor of Clinical Nutrition, Head of Clinical Nutrition Department, Collage of Applied Medical Sciences, Taibah University-Yanbu, Saudi Arabia

***Abstract*---**Prediabetic teenagers have higher danger to endure diabetes mellitus in adulthood span of life. The function of calcium and Vitamin D admission in prediabetes hazard is easily proven wrong. The point of this study was to examine the relationship among calcium and Vitamin D admission and prediabetes in youths. The insightful observational study was utilized in this data analysis of approx. 200 cases, who matured a teen age and obtained from various educational institutions. Calcium and Vitamin D admission were acquired from the whole day food consumption survey for 3 exchanging days. Fasting blood glucose levels were estimated utilizing an enzymatic colorimetric strategy. Gathered information in this examination were examined utilizing the Fisher's careful and strategic relapse tests with an estimation as <0.06. Of 2.05% female youths had prediabetes. All teenagers had deficient calcium and vitamin D intakes as per the body needs. The normal of calcium and Vitamin D admissions was 232.950 ± 142.260 mg and 1.565 ± 1.785 µg, individually. Lower mean admission of calcium and Vitamin D was found in 56.5% and 63.9% teenagers, individually. Low calcium admission diminished 0.185 occasions prediabetes hazard though low Vitamin D admission could increment 2.15 occasions prediabetes hazard in spite of the fact that it didn't reach altogether (p=0.175 and p=0.520). Low Vitamin D admission, family background of DM, and low active work can expand the prediabetes hazard in female teenagers in various recognized regions.

***Keywords*---**adolescent females, glucose intakes, prediabetes, vitamin D.

Introduction

Pervasiveness of prediabetes and diabetes mellitus (DM) has expanded somewhat recently and is relied upon to increment 629 million by 2045. Prediabetes and

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
***Corresponding author**: Obeidat, A. A.; Email: aobeidat@taibahu.edu.sa*
Manuscript submitted: 09 Nov 2021, Manuscript revised: 18 Feb 2022, Accepted for publication: 25 March 2022

diabetes mellitus happen in grown-ups as well as in youths. Youths with prediabetes have 1.97 occasions hazard to endure diabetes mellitus in future. Predominance of prediabetes in overall arrives at 352.1 million. Prediabetic predominance is recognized in 5.4% Arabian and 4% in Nigerian young people while it has not revealed at this point the prediabetic commonness in Indonesian youths. Teenagers who have strange blood glucose levels (100-125 mg/dl) will more often than not have other metabolic issues, for example, dyslipidemia and hypertension by which brings about diminishing of life quality in future. Furthermore, undiscovered prediabetes can advance to DM and increment higher danger of cardiovascular illnesses (OR=2.3), disease (OR=1.25), and stroke (OR=1.21).

Stoutness is the fundamental element of prediabetes albeit many variables contribute in this problem. Dubious outcomes have been accounted for the commitment of microminerals consumption particularly calcium and vitamin D. This has been counted in 2014 that everyday admission of approx. more than 1,150 milligrams of Ca component and an approximate range of 2,100-6,100 International Units of vitamin D to the quite some time can lessen prediabetic hazard through progress of insulin responsiveness. Calcium consumption ≥ 1,250 mg each day can likewise diminish 22% the danger of diabetes mellitus. Conversely, along with such experiments, it has been counted as the people grown-ups took 1.5x500 milligrams of calcium per day as a considerable length of time didn't decrease the danger of DM. In teenagers' life, a few examinations have uncovered as the micromineral admission along with the calcium and vitamin D is lesser than that of the suggested micromineral consumption. Youths who have sporadically lunch feast will eat all the quicker food sources and less quality food varieties that comprise of the lesser of fiber also the micronutrients. Lesser the vitamin D admission increments as approximate of 4 occasions hazard of the diabetic mellitus contrasted and more of the vitamin D consumption. Such lacking admission could be meddled insulin emission along with awareness by the feeling of insulin as recipient articulation. Notwithstanding, it is observed that supplementary to the 4,000 International Units of the vitamin D in kids doesn't influence fasting glucose levels and insulin responsiveness despite the fact that they took this enhancement for a long time. Thusly, this study meant to break down the relationship among the intakes of the calcium and vitamin D also the danger to be prediabetic among the age group of approx. 12 to 20 years.

Concentrate on design and subjects

This observation is directed as per few schools in a quarter time of year 2019. Research subjects were chosen utilizing delineated arbitrary examining and met the consideration rules: matured teen age, learned in the standards of 11^{th} and 12^{th}, and didn't consume any of the medication, that can cause of the increment or diminish the ranges of the glucose components in blood. Such exploration convention has been endorsed by few faculty members of medical universities.

Information gatherings

Age, sex, and family background of DM is gathered utilizing own-revealed surveys. Information gathered about the calcium and vitamin D admission are gotten

among considered day by day admission of young people like drinks and enhancements. Research subjects were talked with utilizing 1x24 hour review poll for three rotating days. Gathered information were classified into deficient (<80%) and adequate (≥80%) admission as indicated by suggested dietary stipend (RDA). Actual work information was gathered involving as a Global Level considered Human Discussion for Adolescent (GLHD-A) and have been segmented into min (<650MET. min per week), moderate (620-3250 ET. min per week) and maximum (>3250 MET. min per week) GLHD results.

Prediabetics conclusion is resolved utilizing the American Diabetes Association (ADA) rule. Tastings of three ml of venous blood has been filled for observations from lower arms of subjects by an expert wellbeing laborer. The ranges of the glucose in the blood samples have been estimated utilizing as a process of enzymatic colorimetric.

Measurable process

Attributes to the exploration parameters have been introduced as a recurrence, rate, and mean. Relationships of the calcium and vitamin D intakes as prediabetics have been resolved utilizing Fisher's accurate also calculated relapse observations together the level of importance as an approximation of <0.06.

Observations

An aggregate of 193 young people was remembered for this examination that female extent was higher than male extent. Table 1 showed that the young people matured 17 years aged and had 82 mg/dl glucose standards in the blood. Youths had no family background of DM (75%), low active work (53.9%), calcium admission (235 mg), and vitamin D (2 µg). This food admission was a lot of lower than the suggested calcium and vitamin D admission in young generation.

Since the young generation had inadequate admission of calcium and vitamin D, the class was adjusted to turn out to be less or more than mean qualities. Shockingly, most of teenagers actually had low calcium and vitamin D admission (as per table 1). Lower calcium and vitamin D admission was seen in 60% and 70% youths, individually. Pervasiveness of prediabetes was found in 2.5% young people and just in female youths.

As per Table 2, there were contrast relationship between micromineral admission and blood glucose levels in youths. Calcium consumption (OR=0.245; 95%CI=0.025-2.395) and family background of DM (OR=0.28; 95% CI=0.04-2.09) were feebly connected with blood glucose levels while moderate affiliation was seen in vitamin D admission (OR=1.7-95% CI=0.176-16.9). Everything affiliations didn't reach measurably importance (p=0.4 and p=1.1, separately).

Table 3 indicates relationship among micromineral consumption also prediabetes later changed with frustrating variables like family background of DM and low actual work. Lesser calcium admission diminished 0.195 multiple prediabetes hazard, contrasted and high calcium consumption while low vitamin D admission

expanded 2 times prediabetes hazard, contrasted and higher vitamin D admission after adjustment with family background of DM and actual work.

Table 1
Essential characteristics of adolescents

	M		F		SUM		GENERAL	MEAN
	x	Ratio	y	Ratio	N	Ratio	COUNTS	
Male					44	23		
Female					160	78		
Height (centimeters)								155
Weight (Kilograms)								55
Age (in years)								
16					24	12		
17					128	66		
18					40	21		
19					5	2.5		17
Family History of Diabetes	14	31	32	21	45	23		
Yes	31	70	120	79.8	150	77.5		
No								
Health Workout								
Min					105	53.5		
Mid					60	31		
Max					31	16		157
Early Morning Glucose (mg/dl)	44	101	147	97.5	190	98	75-95	
Normal	00	0	4.5	2.8	4.1	2.2		
Prediabitic								82
Consumption of Calcium(in mg)					0	0	1250	
Suitable					194	102		
Unsuitable								235
Consumption of Vitamin (in µg)					0	0	16	
Suitable					194	102		
Unsuitable								2
Calcium Consumption (in mg)					112	58	1210	
< mean					84	44		
≥mean								
Calcium Consumption (in µg)					125	64	18	
< mean					75	38		
≥mean								

Table 2
Relationship between calcium and vitamin intakes and prediabetic

		Blood Glucose Level				OR	95%CI	P
		General		Prediabetics				
		p	ratio	p	ratio			
Consumption of Calcium	Upper	82	97	4	4	.25	.026	.4
	Lower	110	100	1.2	1			
Consumption of Vitamin D	Upper	70	98.5	1.2	1.5	1.8	.18	1.1
	Lower	122	98	3.5	2.5			
Consumption of Vitamin D	No	150	1.5	2.1	99	.3	.05	.3
	Yes	44	5	2.1	96			

Table 3
Strategic regression analysis: relation among calcium and vitamin d consumptions and prediabetic cases

	OR	95%CI	P	Ratio of neglected factor
Diabitic mellitus family background	3.9	.3	.2	13
Physically Challanged	2.9	.28	.38	
Min Calcium Consumption	.2	.02	.18	
Min Vitamin Consumption	2.1	.2	.6	

Discussion

Here, we have first and foremost recorded as pervasiveness of prediabetes among the female youths has been observed as approximate of 2.2%. A pair of detected prediabetes teenagers were observed as family background of DM. Moreover, around a portion of young people had low active work. Shockingly, all young people which are detected have insufficient vitamin-D and calcium admission. Minimum of vitamin D admission expanded though as a minimum of calcium consumption diminished as prediabetic hazard not withstanding of the family background of DM also the actual work. Every outcome recommend that family background of DM, active work and vitamin D admission have been main variables influencing prediabetic predominance in young people.

Curiously, our outcomes show as the prediabetic person was just detected as a young female. A pervasiveness of such observation has been approx 3 folds lesser as compare of worldwide predominance which grown-up as prediabetic (approx the age group of 25-75 years). Different examinations are conducted worldwide in different areas and it is found in Middle East Asia and detected prediabetic predominance in Saudi Arabia and Qatar is approximate of 6% and 5% separately. Maybe, the inconsistency of this predominance is brought about by age range. One more explanation is more probable connected with hereditary, economics, and ecological variables.

There are three potential justifications for the female teenagers may be at the upper level of danger to be prediabetic. As the starting time, a serious awareness about the insulin intakes for the teenage of female (12 years of age) hypothetically diminishes at leather treater 1 and ascends at leather treater 5 by 15 years of age. Nonetheless, our review displayed inverse outcomes and the prediabetic teenagers might have diminished insulin awareness, contrasted and typical female young people. Besides, half prediabetic female youths have family background of DM despite the fact that we don't recognize whether their dad, mother or family members endures DM. In some of the areas, family background as per the DM increments approximate of 12-time hazard of being prediabetic among all youths albeit the scientists don't consider the sex factor. As per the observations most of female teenagers invest more energy to do schoolwork at home and to sit in front of the TV.

In our investigation, it is found that most teenagers polished off more shoddy nourishments also lack of intakes of fruits and green veggies, natural products, also the main factor of calcium like fish and milk and vitamin D sources. Notwithstanding observations, decrease of micronutrient admission is normal in young people who eat with high quick food varieties and less good food sources. Ideally, sufficient admission of vitamin D aides insulin discharge and responsiveness of the beta cells for the pancreas. As a covered component of vitamin D activities by immediate and roundabout ways. A functioning type as vitamin D (1.25-(OH)D) communicates along with the vitamin D receptor in the beta cells of pancreas, it brings about enactment of the insulin advertiser quality. At the same moment, the circuitous process is joined in the togetherness of calcium divert of the beta cells in pancreas however atomic instrument of this process stays obscure. In this manner lack of vitamin D can upset insulin quality record and calcium channel action, prompting decrease of insulin discharge and responsiveness.

Secondary effects and dangers

The typically suggested dosages of Vitamin D3 are 420 or 820 International Units in a day. These portions have been protected; also, incidental effects are not existing experimentally. The resilience has been counted at its higher level on the grounds that the change approx 1,3-(OH)2D3 is under close criticism controlling. Upper portions only from time to time are important, however approx lacks of International Units as consumptions or per infusion are approximately utilized annually in light of the simplicity of organization, deterring the need of actually looking at consistence. In these investigations, hypercalcemia was not noticed. Be that as it may, hypercalcemia has been seen in a more seasoned ill persons along with a portion of 2100 International Units in a day and in an isolated single ill person. Liquid consumable portion of approx six lacks International Units. Upper portions could not be pretty much as protected as lower portions. Likewise, profound intramuscular infusions convey some draining danger particularly in mix with coumarin or acetyl salicylic corrosive treatment.

Vitamin D supplementary to 450 to 850 International Units a day doesn't impact renal capacity or antibody cholesterol focus, furthermore hyper-boles are not accounted for. Heavy dosages at the point when given every day or week by week

might cause vitamin D inebriation prompting bone resorption, bone misfortune, hypercalcemia, hypercalciuria, and renal practical disability. In any case, oral dosing of Vitamin D3 approx 52,000 International Units in a day for approx 2 months didn't result hypercalcemia. The event of vitamin D inebriation is somewhat erratic, also this might happen later. Vitamin D inebriation might be likewise cause from over-the-counter diet enhancements this might be having a few a large number of units vitamin D per day-by-day portion. In vitamin D inebriation, the culpable metabolite most likely seems as 25(OH)D, it might be binding to the VDR.

On the other hand, the antibody 1,25-(OH)2D fixation must expand, results expanded bone resorption which might be obstructed by bisphosphonate imbuement. The free antibody of 1,25-(OH)2D could be similarly expanded as per the base that the high amount of 25(OH)D might dislodge 1,25-(OH)2D with vitamin D restricting to the protein, consequently expanding its free fixation. One more intriguing issue is an expanded transformation of 25(OH)D to 1,25-(OH)2D, which might happen in granulomatous sicknesses like sarcoidosis, tuberculosis, or threatening lymphoma. Vitamin D supplemented can result growing of serum 1,25-(OH)2D and hypercalcemia in such situations.

Conclusions

Low vitamin D admission can cause the increment of the prediabetics hazard of female youths related to family background of DM and reduced active work. Next examination of serum vitamin D effects segments and glucose part in blood after glucose in liquid consumable form stacking is needed to confirm the level of prediabetes among the adult females. For avoidance, consideration should be centered around hazard gatherings especially young females, e.g., the systematized and a few topographical areas. General wellbeing measures ought to incorporate stronghold of food varieties, for example, milk and Vitamin D3, nutrient of vitamin D3 segmentation to heavy chance gatherings, and calcium segmentation when calcium admission is minimum. So, in next examinations ought to explore the job of moderate lack of vitamin D is not favorable. Also impact of vitamin D and calcium supplementary to forestalling breaks ought to be affirmed by different examinations.

References

1. DeLuca HF (1983) The cardinal role of 1,25-dihydroxyvitamin D3 in mineral homeostasis. In: Frame B, Potts JT Jr (eds) Clinical disorders of bone and mineral metabolism. Excerpta Medica, Amsterdam.
2. Adami S, Romagnoli E, Carnevale V, Scillitani A, Giusti A, Rossini M, Gatti D, Nuti R, Minisola S (2011) Guidelines on prevention and treatment of vitamin D deficiency. Reumatismo 63(3):129–147.
3. Pittas AG, Nelson J, Mitri J, Hillmann W, Garganta C, Nathan DM,et al. Plasma 25-hydroxyvitamin D and progression to diabetes in patients at risk for diabetes: An ancillary analysis in the Diabetes Prevention Program. Diabetes Care 2012;35:565-73.

4. Bischoff-Ferrari HA, Willett WC, Wong JB et al (2009) Prevention of nonvertebral fractures with oral vitamin D and dose dependency. Arch Intern Med 169:551–561
5. Holick MF 1994 McCollum award lecture 1994. Vitamin D: new horizons for the 21st century. Am J Clin Nutr 60:619–630
6. Holick MF 1995 Environmental factors that influence the cutaneous production of vitamin D. Am J Clin Nutr 61(Suppl 3):638S–645S
7. Frame B and Parfitt AM 1978 Osteomalacia: current concepts. Ann Intern Med 89:966–982
8. Sniadecki J 1939 Cited by W. Mozolowski. Jerdrzej Sniadecki (1768–1883) on the cure of rickets. Nature 143:121–124
9. Hess AF, Unger LF 1921 Cure of infantile rickets by sunlight. JAMA 39:77–82
10. Chalmers J, Conacher WDH, Gardner DL, Scott PJ 1967 Osteomalacia, a common disease in elderly women. J Bone Joint Surg 49B:403–423
11. Chalmers J, Barclay A, Davison AM, Macleod DAD, Williams DA 1969 Quantitative measurements of osteoid in health and disease. Clin Orthop 63:196–209
12. Parfitt AM, Gallagher JC, Heaney RP, Johnston CC, Neer R, Whedon CG 1982 Vitamin D and bone health in the elderly. Am J Clin Nutr 36:1014–1031.
13. Gillespie WJ, Henry DA, O 'Connell DL, Robertson J 2000 Vitamin D and vitamin D analogues for preventing fractures associated with involutional and post-menopausal osteoporosis (Cochrane Review). Oxford: The Cochrane Library 3. updated software
14. Davies M, Mawer EB, Hann JT, Stephens WP, Taylor JL 1985 Vitamin D prophylaxis in the elderly: a simple, effective method suitable for large populations. Age Ageing 14:349–354
15. Weisman Y, Schen RJ, Eisenberg Z, Amarilio N, Graff E, Edelstein-Singer M, Goldray D, Harell A 1986 Single oral high-dose vitamin D3 prophylaxis in the elderly. J Am Geriatr Soc 34:515–518 Johnson KR, Jobber J, Stonawski BJ 1980 Prophylactic vitamin D
16. Sebert JL, Fardellone P, Ruiz JC, Perdu V, Bellony R, Liu SY, Defrance D 1987 Vitamin D deficiency and supplementation in elderly institutionalized women. In: Christiansen C, Johansen JS, Riis BJ, eds. Osteoporosis 1987. Copenhagen: Osteopress ApS; 592–594
17. Barger-Lux MJ, Heaney RP, Dowell S, Chen TC, Holick MF 1998 Vitamin D and its major metabolites: serum levels after graded oral dosing in healthy men. Osteoporos Int 8:222–230
18. Adams JS, Lee G 1997 Gains in bone mineral density with resolution of vitamin D intoxication. Ann Intern Med 127:203–206
19. Davies M 1989 High-dose vitamin D therapy: indications, benefits and hazards. Int J Vitam Nutr Res 30(Suppl):81–86
20. Jacobus CH, Holick MF, Shao Q, Chen TC, Holm IA, Kolodny JM, Fuleihan GE, Seely EW 1992 Hypervitaminosis D associated with drinking milk. N Engl J Med 326:1173–1177
21. Selby PL, Davies M, Marks JS, Mawer EB 1995 Vitamin D intoxication causes hypercalcaemia by increased bone resorption which responds to pamidronate. Clin Endocrinol (Oxf) 43:531–536

22. Pettifor JM, Bikle DD, Cavaleros M, Zachen D, Kamdar MC, Ross FP 1995 Serum levels of free 1,25-dihydroxyvitamin D in vitamin D toxicity. Ann Intern Med 122:511–513
23. Mason RS, Frankel T, Chan YL, Lissner D, Posen S 1984 Vitamin D conversion by sarcoid lymph node homogenate. Ann Intern Med 100:59–61
24. Clements MR, Davies M, Hayes ME, Hickey CD, Lumb GA, Mawer EB, Adams PH 1992 The role of 1,25-dihydroxyvitamin D in the mechanism of acquired vitamin D deficiency. Clin Endocrinol (Oxf) 37:17–22
25. Corless D, Gupta SP, Switala S, Boucher BJ, Barragry JM, Cohen RD, Diffey BL 1978 Response of plasma 25-hydroxyvitamin D to ultraviolet irradiation in long-stay geriatric patients. Lancet 2: 649–651
26. Khaw KT, Scragg R, Murphy S 1994 Single-dose cholecalciferol suppresses the winter increase in parathyroid hormone concentrations in healthy older men and women. Am J Clin Nutr 59: 1040–1044
27. Dawson-Hughes B, Harris SS, Krall EA, Dallal GE 1997 Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age and older. N Engl J Med 337:670–676
28. Lips P 1996 Vitamin D deficiency and osteoporosis: the role of vitamin D deficiency and treatment with vitamin D and analogues in the prevention of osteoporosis-related fractures. Eur J Clin Invest 26:436–442.