Original Article

Prevalence of Vitamin D Deficiency and Its Correlate with Overweight and Obesity in Community-Dwelling Old Adults

Ismael Hasan Jawad, Hasan Alwan Baiee[1]

Department of Community Health Nursing, College Nursing, University of Babylon,
[1]Department of Family and Community Medicine, Hammurabi College of Medicine, University of Babylon, Hilla, Iraq

Abstract

Background: Vitamin D has different biological actions in the body. Vitamin D has the pleiotropic effects in multiple organ systems, and Vitamin D deficiency (VDD) was suggested to be associated with overweight and obesity according to previous reports. Several interventional studies have examined the effect of Vitamin D supplementation on overweight and obesity. **Objectives:** the aim of this study is to identify the prevalence of VDD and its correlate with overweight and obesity in community-dwelling old adults. **Materials and Methods:** This was a cross-sectional study that included convenient consecutive sample of elderly people who attended the office of retired employees and the elders' home in Hilla City-Babylon Province–Iraq. The period of the study started from the first of January to September 2019, and a pretested semi-structured questionnaire was used to interview the participants after obtaining their verbal consent. The sample included (300) old adults of both genders; the serum level of Vitamin D was assessed by chemoimmunoassay method. The weight was measured in kilograms by using weight measuring balanced scale for all individuals, and height was measured (in centimeters) by using a fixed board in standing position without shoes, the head in the horizontal plane. The body mass index was calculated according to weight in kg/height in m^2. **Results:** The study included 300 participants; most of the study sample had either insufficiency or deficiency of Vitamin D level. Obese and overweight elders in this study had significant low serum Vitamin D level (both deficiency and insufficiency of vitamin) as compared to the nonobese group; this difference was statistically significant $P < 0.05$. **Conclusion:** There was a significant inverse relationship between Vitamin D level and excess body weight in Iraqi old adults.

Keywords: Iraq, obesity, old adults, overweight, Vitamin D deficiency

Introduction

Since the beginning of this century, interest in Vitamin D has brought significant attention to the researchers and lay communities, and this leads to an increase in the number of researches on this issue.[1] Vitamin D, a fat-soluble vitamin that now is recognized as a prohormone that recently has an important role in reproductive health. Vitamin D deficiency (VDD) had high prevalence worldwide and was estimated to affect about 50% of the population worldwide.[2] Vitamin D is a fat-soluble vitamin highly important for skeletal health. Its deficiency is very common and a worldwide metabolic disorder.[3] VDD considered an epidemic nowadays.[4] Significant debates regarding this health problem, with lack of evidence to justify a request for mass screening,[5] low serum Vitamin D levels are associated with increased mortality and poor prognosis for a variety of chronic diseases and health-related problems.[5,6]

Obesity is a serious health problem because it is proved as a risk factor for most chronic noncommunicable diseases and leading to increase morbidity and mortality.[7-10] In older adults, epidemiological studies have been performed to establish a causal relationship between excess body weight (high body mass index [BMI]) and some chronic diseases;[10-12] all-cause mortality; and reduced life expectancy.[7,8]

The number of obese persons in 2015 alone exceeds 6 million adults worldwide.[9] Obesity during the past three decades had almost doubled among people worldwide.[5,9] Recently,

Access this article online

Quick Response Code:

Website: www.medjbabylon.org

DOI: 10.4103/MJBL.MJBL_98_19

Address for correspondence: Dr. Ismael Hasan Jawad, Department of Community Health Nursing, College Nursing, University of Babylon, Hilla, Iraq.
E-mail: ismaelalmosawy@gmail.com

Submission: 25-12-2019 **Accepted:** 31-12-2019 **Published Online:** 17-03-2020

How to cite this article: Jawad IH, Baiee HA. Prevalence of Vitamin D deficiency and its correlate with overweight and obesity in community-dwelling old adults. Med J Babylon 2020;17:36-40.

the American Medical Association has classified obesity as a disease.[10] Vitamin D role goes beyond just regulation calcium and phosphorous to a possible role in obesity.[11]

Many epidemiological studies, several parameters have been investigated to identify the correlation between this hormone and overweight and obesity.[12] The elderly fatty women with high BMI had a significant lower level of serum Vitamin D.[13]

The relationship between Vitamin D low level and obesity has been identified as a significant health issue globally, and there is clear evidence that they are correlated; even though, the casualty remains controversial.[14,15] The prevalence of VDD was high in Norwegian adults with high BMI.[16]

The aim of this study was to identify the prevalence of Vitamin D among elderly people and the relationship between obesity and Vitamin D.

Materials and Methods

Study design and subjects

This was a cross-sectional study conducted on 300 consecutive Iraqi old adults (>65 years of age) who attended the office of retired employees in Babylon Province as well as the residents of the geriatric home in Hillah City, Babylon Province, Iraq.

The period of the study started from the first of January to September 2019, and a pretested semi-structured questionnaire was used to interview the participants after obtaining their verbal consents, the sample included old adults (65 years of age and more) of both genders; serum level of Vitamin D was assessed using chemoimmunoassay method. The weight was measured in kilograms by using the balanced scale for all individuals, height was measured (in centimeters) by using a fixed board in the standing position without shoes, and the head in the horizontal plane. The BMI was calculated according to weight in kg/height in m^2, then classified according to the World Health Organization (WHO) categories for adults aged >25 years and older as: underweight ≤18.9 kg/m^2, ideal (normal) 19–24.9 kg/m^2, overweight 25–29.9 kg/m^2, and obese ≥30 kg/m^2.

Statistical analysis

Data analysis was using the Statistical Package for the Social Sciences version 22 (SPSS, IBM Company, Chicago, USA). Qualitative data were described using the number and percent. Quantitative data were presented as mean and standard deviation. Chi-square test was applied for comparison of categories. $P < 0.05$ was adopted as the level of statistical significance.

Ethical consideration

The study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. It was carried out with patients' verbal and analytical approval before the sample was taken. The study protocol and the subject information and consent form were reviewed and approved by a local ethics committee (College of Nursing, University of Babylon).

Results

Table 1 shows the distribution of elders according to their age and mean age of the study groups, 65–69 years group is the dominant age group, and the overall mean age is 70.44.

Results also found that the frequency distribution of the study participants according to the means of Vitamin D level by gender the mean of Vitamin D level among females is lower than Vitamin D level among males (females: 19.5 ng/ml; males: 25.8 ng/ml).

Regarding the distribution of the elders according to age group, results found that most of the participants were in the age group 65–69 years (56%).

Table 2 shows that 72% of overweight elderly men and women have either deficient or in sufficient level of serum Vitamin D level, whereas 83.1% of the obese study group have deficient or insufficient Vitamin D level, this difference is highly statistically significant ($\chi^2 = 25.84$ $P < 0.001$).

Table 3 shows that 80.4% of old males (obese), 69.5% (overweight) and 56% (normal) have low serum Vitamin D level (<3 ng/ml) most of them with deficient or insufficient level, this table also explains a positive highly significant association between low Vitamin D and having high (BMI) among elderly males $\chi^2 = 57.99$, df = 2, $P < 0.002$, there is an inverse relationship between the two variables.

Table 4 shows that 84.1% of old females (obese), 74% (overweight) and 51.1% (normal). Low serum Vitamin D level (<30 ng/ml are significantly associated with high BMI both (overweight and obesity) among elderly women $\chi^2 = 57.99$, df = 2, $P < 0.002$, there is an inverse relationship between the two variables.

Discussion

Findings of this study depict that the prevalence of low Vitamin D serum level is higher among elderly women compared to men. The proportion of participants with insufficient and deficient Vitamin D in this study is high; this high prevalence is similar to that reported by other researchers.[17] In a survey conducted in Korea, the prevalence of VDD at the national level in both males and females is lower than the prevalence found in our study,[18] but in a similar nationwide study conducted in Thailand, the prevalence in both male and females are much lower than ours.[19]

The prevalence of VDD in this study is higher than that found in a local study conducted in Baghdad among 20 Parkinson

Table 1: Frequency distribution of the mean age of the study group

Parameter (years)	*n*	Mean of the age (years)
65-69	168	67
70-74	84	73
75-80 and more	48	78
Total	300	70.44

Iraqi patients with the mean age of 59 years (62.5%). The same study reported that the proportion of VDD was much lower in the control group (27.5%).[20] A recent cohort study carried out on Irish elderly people showed that the prevalence of VDD and insufficiency was 13.1% among Caucasian old adults.[21]

Studies found that aging is strongly associated with an increasing proportion of VDD and insufficiency.[22,23] Elder people are more liable to this deficiency because of so many reasons, not only to inadequate skin production but also due to less exposure ultraviolet sunlight exposure, very low Vitamin D in food, malabsorption, and liver and kidney impairment, which lead to decrease hydroxylation.[24,25] In the current study, the prevalence of obesity and overweight are 53% and 28%, respectively, this prevalence is higher than that documented by WHO, about 40% the population are suffering from excessive weight and 13% from obesity,[26] two millions of adults from both gender globally were overweight, with over 650 million being obese,[27] this means that obesity is a health problem of high concern worldwide[28,29] that has serious implications on both individuals and societies.[30,31] In a random sample (401 Libyan adults), the prevalence of obesity and overweight is close to the finding of the current study, this may be explained by the fact of the similarity in culture and unhealthy lifestyle in the two societies.[32] The results of this study reveals that there is a statistically high significant inverse association between high BMI (obesity and overweight) and low serum Vitamin D (VDD and insufficiency), this finding is consistent with the results of other studies, that explained a high prevalence rates of obesity and low level of Vitamin D; thus, the two health problems are related to each other and take the picture of pandemic and have serious health effects to Iraqi patients or patients worldwide.[21]

Having a normal BMI was also associated with a 20% lower risk of VDD in old adults,[33] but other studies depicted that obese patients have lower serum levels of Vitamin D.[32,34] This may be a cause or effect still uncertain. However, experimental studies have not confirmed sold advantage of Vitamin D supplementation in terms of weight loss.[35] In recent study conducted on 75 participants in Alexandria-Egypt reported that the BMI was shown to be a significant negative correlation with serum level of Vitamin D.[36] Serum Vitamin D was inversely associated with excess fat in the body. In addition, VDD was positively associated with both general and abdominal obesity.[36]

Table 2: Association between Vitamin D level and body mass index of the study group

BMI (kg/m²)	Vitamin D level				Total, *n* (%)	χ^2	P
	Deficiency (0-20 ng/ml)	Insufficiency (21-29 ng/ml)	Normal (30-100 ng/ml)	Deficient or insufficient (%)			
Normal (18.5-24.9)	19 (9.4)	11 (8.0)	26 (31.4)	33.5	56 (19)	25.84	<0.001*
Overweight (25-29.9)	23 (31.7)	37 (42.0)	23 (34.3)	72.2	83 (28)		
Obese (30 or more)	94 (58.9)	40 (50.0)	27 (34.3)	83.1	161 (53)		
Total (%)	136 (100.0)	88 (100.0)	76 (100.0)		300 (100)		

*Fisher-exact test. BMI: Body mass index

Table 3: Association between Vitamin D level and body mass index among males

Study variables BMI	Vitamin D level among males					χ^2	*P*
	Deficiency (0-20 ng/ml)	Insufficiency (21-29 ng/ml)	Normal (30-100 ng/ml)	Total	Deficiency or insufficient, %		
Normal (18.5-24.9)	6 (15.4)	8 (25.8)	11 (37.9)	25 (25.3)	56	57.99	<0.002
Over weight (25-29.9)	8 (20.5)	15 (48.4)	10 (34.5)	33.3 (33)	69.50		
Obese (30 or more)	25 (64.1)	8 (28.8)	8 (27.6)	41 (41.4)	80.40		
Total (%)	39 (100.0)	31 (100.0)	29 (100.0)	99 (100)			

BMI: Body mass index

Table 4: Association between Vitamin D level and body mass index among females

Study variables BMI	Vitamin D level among females					χ^2	*P*
	Deficiency (0-20 ng/ml)	Insufficiency (21-29 ng/ml)	Normal (30-100 ng/ml)	Total	Deficient and insufficient, %		
Normal (18.5-24.9)	13 (13.4)	3 (5.3)	15 (31.9)	31 (15.4)	51.10	57.99	<0.002*
Over weight (25-29.9)	15 (15.5)	22 (38.5)	13 (27.7)	50 (24.9)	74		
Obese (30 or more)	69 (71)	32 (56.2)	19 (40.4)	120 (59.7)	84.10		
Total (%)	97 (100.0)	57 (100.0)	47 (100.0)	201 (100)			

*Fisher-exact test. BMI: Body mass index

Many studies reported that VDD was associated with obesity irrespective of age.[37] A recent study revealed that after taking 50,000 international units per week of Vitamin D supplementation for 6 weeks, weight, waist circumference, and BMI were decreased significantly and serum Vitamin D increased compared to the control group.[38] Contrary to our study, there is no significant statistical association between VDD and obesity,[39,40] other study reported that increasing BMI was associated with higher Vitamin D levels.[41] These results require the serious attention of the health-care providers to put an effective and efficient intervention plan to prevent and control these widely spread health problems to avoid serious health-related preventable consequences.

Conclusion

We can conclude from the findings of the present study that there was a significant inverse relationship between Vitamin D level and excess body weight in Iraqi old adults.

Limitations

Data were not collected regarding dietary source of Vitamin D intake; the study had not included the measurement of parathyroid hormone which would give information about the association between Vitamin D and the hormone because of its high cost in most laboratories, this cross-sectional study does not prove the casualty and cannot exclude the possibility of reverse causality**,** in addition to the relatively small sample size which may affect the generalization of the results.

Acknowledgments

We would like to express our deep appreciation and thanks to all participants who participated voluntarily in this work; without their full cooperation and patience, this work could not be completed. Thanks are due to the entire health-care providers and academic staff who and supported us during this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Cashman KD, Dowling KG, Škrabáková Z, Gonzalez-Gross M, Valtueña J, De Henauw S, *et al*. Vitamin D deficiency in Europe: Pandemic? Am J Clin Nutr 2016;103:1033-44.
2. Hantoosh HA, Mahdi MH, Imran BW, Yahya AA. Prevalence of Vitamin D deficiency in Iraqi female at reproductive age. Med J Babylon 2019;16:119-22.
3. Al-Hilali KA. Prevalence of hypovitaminosis D in adult Iraqi people including postmenopausal women. Sci Res J 2016;4:53.
4. Palacios C, Gonzalez L. Is Vitamin D deficiency a major global public health problem? J Steroid Biochem Mol Biol 2014;144:138-45.
5. Scott D, Ebeling PR. Vitamin D and public health. Int J Environ Res Public Health 2019;16:848.
6. Heath AK, Kim IY, Hodge AM, English DR, Muller DC. Vitamin D status and mortality: A systematic review of observational studies. Int J Environ Res Public Health 2019;16:E383.
7. Lung T, Jan S, Tan EJ, Killedar A, Hayes A. Impact of overweight, obesity and severe obesity on life expectancy of Australian adults. Int J Obes (Lond) 2019;43:782-9.
8. Peeters A, Barendregt JJ, Willekens F, Mackenbach JP, Al Mamun A, Bonneux L, *et al*. Obesity in adulthood and its consequences for life expectancy: A life-table analysis. Ann Intern Med 2003;138:24-32.
9. Lartey ST, Magnussen CG, Si L, Boateng GO, de Graaff B, Biritwum RB, *et al*. Rapidly increasing prevalence of overweight and obesity in older Ghanaian adults from 2007-2015: Evidence from WHO-SAGE waves 1 and 2. PLoS One 2019;14:e0215045.
10. Matthew W. The Facts About Obesity. H and HN. American Hospital Association. Available from: https://www.aha.org/. [Last accessed on 2013 Jun 24].
11. Christakos S, Dhawan P, Verstuyf A, Verlinden L, Carmeliet G. Vitamin D: Metabolism, molecular mechanism of action, and pleiotropic effects. Physiol Rev 2016;96:365-408.
12. Daniele G, Winnier D, Mari A, Bruder J, Fourcaudot M, Pengou Z, *et al*. Sclerostin and insulin resistance in prediabetes: Evidence of a cross talk between bone and glucose metabolism. Diabetes Care 2015;38:1509-17.
13. Ong MW, Tan CH, Cheng AKS. Prevalence and determinants of Vitamin D deficiency among the overweight and obese Singaporeans seeking weight management including bariatric surgery: A relationship with bone health. Obes Surg 2018;28:2305-12.
14. Earthman CP, Beckman LM, Masodkar K, Sibley SD. The link between obesity and low circulating 25-hydroxyvitamin D concentrations: Considerations and implications. Int J Obes (Lond) 2012;36:387-96.
15. Zakharova I, Klimov L, Kuryaninova V, Nikitina I, Malyavskaya S, Dolbnya S, *et al*. Vitamin D Insufficiency in overweight and obese children and adolescents. Front Endocrinol (Lausanne) 2019;10:103.
16. Larose TL, Chen Y, Camargo CA Jr., Langhammer A, Romundstad P, Mai XM. Factors associated with Vitamin D deficiency in a Norwegian population: The HUNT study. J Epidemiol Community Health 2014;68:165-70.
17. Kar A, Datta S. A study of serum Vitamin D level and its association with hypertension. J Family Med Prim Care 2018;7:546-50.
18. Choi HS, Oh HJ, Choi H, Choi WH, Kim JG, Kim KM, *et al*. Vitamin D insufficiency in Korea a greater threat to younger generation: The Korea national health and nutrition examination survey (KNHANES) 2008. J Clin Endocrinol Metab 2011;96:643-51.
19. Chailurkit LO, Aekplakorn W, Ongphiphadhanakul B. Regional variation and determinants of Vitamin D status in sunshine-abundant Thailand. BMC Public Health 2011;11:853.
20. Hatem AK, Lateef HF. The state of Vitamin D in Iraqi patients with Parkinson disease. Al-Kindy College Med J 2017;13:137-41.
21. Laird E, O'Halloran AM, Carey D, Healy M, O'Connor D, Moore P, *et al*. The Prevalence of Vitamin D deficiency and the determinants of 25(OH) D concentration in older Irish adults: Data from the Irish longitudinal study on ageing (TILDA). J Gerontol A Biol Sci Med Sci 2018;73:519-25.
22. Daly RM, Gagnon C, Lu ZX, Magliano DJ, Dunstan DW, Sikaris KA, *et al*. Prevalence of Vitamin D deficiency and its determinants in Australian adults aged 25 years and older: A national, population-based study. Clin Endocrinol (Oxf) 2012;77:26-35.
23. Ramason R, Selvaganapathi N, Ismail NH, Wong WC, Rajamoney GN, Chong MS. Prevalence of Vitamin D deficiency in patients with hip fracture seen in an orthogeriatric service in sunny Singapore. Geriatr Orthop Surg Rehabil 2014;5:82-6.
24. Dayyih HW, Mallah E, Hamad M, Mima M, Awad R, Arafat T, *et al*. Nationality, gender, age, and body mass index influences on Vitamin D concentration among elderly patients and young Iraqi and Jordanian in Jordan. Biochem Res Int 2016;2016:1-8.
25. Al-Mogbel ES. Vitamin D status among adult Saudi females visiting primary health care clinics. Int J Health Sci (Qassim) 2012;6:116-26.
26. de Onis M, Blössner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. Am J Clin Nutr 2010;92:1257-64.
27. World Health Organization. Obesity and Overweight, Fact Sheet No. 311. World Health Organization; 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. [Last accessed on 2019 Mar 22].
28. Medvedyuk S, Ali A, Raphael D. Ideology, obesity and the social

determinants of health: A critical analysis of the obesity and health relationship. Crit Public Health 2017;28:573-85.
29. Nyberg ST, Batty GD, Pentti J, Virtanen M, Alfredsson L, Fransson EI, *et al*. Obesity and loss of disease-free years owing to major non-communicable diseases: A multicohort study. Lancet Public Health 2018;3:e490-7.
30. GBD 2015 Obesity Collaborators, Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, *et al*. Health effects of overweight and obesity in 195 countries over 25 years. N Engl J Med 2017;377:13-27.
31. Romain AJ, Marleau J, Baillot A. Impact of obesity and mood disorders on physical comorbidities, psychological well-being, health behaviours and use of health services. J Affect Disord 2018;225:381-8.
32. Lemamsha H, Randhawa G, Papadopoulos C. Prevalence of overweight and obesity among Libyan men and women. Biomed Res Int 2019;2019:8531360.
33. McCarroll K, Beirne A, Casey M, McNulty H, Ward M, Hoey L, *et al*. Determinants of 25-hydroxyvitamin D in older Irish adults. Age Ageing 2015;44:847-53.
34. Alloubani A, Akhu-Zaheya L, Samara R, Abdulhafiz I, Saleh A, Altowijri A. Relationship between Vitamin D deficiency, diabetes, and obesity. Diabetes Metab Syndr 2019;13:1457-61.
35. Landrier JF, Karkeni E, Marcotorchino J, Bonnet L, Tourniaire F. Vitamin D modulates adipose tissue biology: Possible consequences for obesity? Proc Nutr Soc 2016;75:38-46.
36. Masoume M, Miri M, Varmaghani M, Abbasi R, Taha P, Ramezani S, *et al*. Vitamin D deficiency in relation to general and abdominal obesity among high educated. Eat Weight Disord 2019;24:83-90.
37. Pereira-Santos M, Costa PR, Assis AM, Santos CA, Santos DB. Obesity and Vitamin D deficiency: A systematic review and meta-analysis. Obes Rev 2015;16:341-9.
38. Khosravi ZS, Kafeshani M, Tavasoli P, Zadeh AH, Entezari MH. Effect of Vitamin D supplementation on weight loss, glycemic indices, and lipid profile in obese and overweight women: A clinical trial study. Int J Prev Med 2018;9:63.
39. Forsythe LK, Livingstone MB, Barnes MS, Horigan G, McSorley EM, Bonham MP, *et al*. Effect of adiposity on Vitamin D status and the 25-hydroxycholecalciferol response to supplementation in healthy young and older Irish adults. Br J Nutr 2012;107:126-34.
40. Jalali G, Hami M, Namaee N, Salehi M, Mojahedi MJ, Hasanzamani B, *et al*. Relationship between Vitamin D deficiency and metabolic syndrome in renal transplant patients in Mashhad, Iran. Shiraz E Med J 2017;18:e40985.
41. Chutterpaul P, Paruk F, Cassim B. Prevalence of Vitamin D deficiency in older South Africans with and without hip fractures and the effects of age, body weight, ethnicity and functional status. J Endocrinol Metab Diabet of South Afr 2019;24:10-5.