A comparative Study by Gender of Vitamin D Levels In Bahrainis and Expatriates Unexposed to the Sun

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Background: Vitamin D deficiency is a matter of concern among people of the Arabian Gulf region. Duration of exposure to the sun plays a significant role in vitamin D and calcium levels. Most Bahraini employees work indoors with limited exposure to the sun.

Objective: To evaluate vitamin D levels of Bahraini and expatriate subjects by gender who have non-exposure to sunlight

Design: An Observational Cross-Sectional Study.

Setting: Arabian Gulf University, College of Medicine and Medical Sciences, Physiology Department and Middle East Hospital, Bahrain.

Method: The study was carried out on indoor, non-exposed to the sun subjects in Bahrainis (total number =138) and expatriates (total number 117). The subjects were all non-exposed to the sun and were divided into four groups: male Bahrainis (n= 65), female Bahraini (n=73), male expatriates (n=68), and female expatriates (n=49). The study was performed from 1 October 2018 to 30 September 2019. The level of vitamin D in all four groups was evaluated. A blood sample of 5ml was obtained after securing consent and approval.

Data were analyzed using SPSS version 23.0. Two independent samples and an independent t-test were used to test the significant mean differences in different groups. P-value of less than 0.05 was considered statistically significant.

Result: There was no significant difference in vitamin D levels when we compared the values obtained by gender. Vitamin D level (18.89±0.99 ng/ml) for all females from Bahraini and expatriate subjects was not significantly different when compared with vitamin D level (18.71±0.83 ng/ml) obtained for total males, Bahraini and expatriate subjects. When we compared the level of vitamin D by nationality, i.e., Bahrainis and expatriates there was also no significant difference, 19.35 ng/ml and 18.14±0.92 ng/ml, respectively. To detect if there is a difference in vitamin D levels between males and females among Bahrainis only, our results showed that vitamin D level for female Bahrainis (19.08±1.42 ng/ml) was not significantly different to vitamin level in Bahraini males (19.66±1.01ng/ml). A similar non-significant difference result was obtained between female and male expatriates; 18.61±1.26 ng/ml and 17.81±1.31ng/ml, respectively.

When comparing vitamin D levels between only female groups, we found out that vitamin D levels in female Bahrainis and female expatriates was no significantly different between the two female groups, 19.08±1.42 ng/ml and 18.61±1.26 ng/ml, respectively. Also, there was no significant difference in vitamin D levels between male Bahrainis (19.66±1.01 ng/ml) and male expatriates (17.8±1.31ng/ml).

Conclusion: Non-exposed Bahrainis had no significantly different level of vitamin D in comparison to non-exposed expatriates. Also, there was no significantly difference in vitamin D levels when comparing male and female Bahrainis and also in male and female expatriates. No significant difference was found when comparing vitamin D levels between male Bahrainis and male expatriates. Results between female groups in both Bahraini and expatriates were not significantly different, as well. The non-significant results among all non-exposed groups could be attributed to the different types of diet or different lifestyles in all groups that compensate for sun exposure.

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Vitamin D can be easily obtained from short periods of exposure to the sun, without any expense.[1-4].

In the last decade, there has been a major concern about vitamin D deficiency which affects almost 50% of the population worldwide[5]. Studies in Bahrain and other Gulf countries showed that Bahraini and Gulf Cooperation Council (GCC) citizens suffer from vitamin D deficiency[1,6,7]. Studies revealed 81% vitamin D deficiency among various age groups in Saudi Arabia[8,9]. This may be attributed to lifestyle and daily activities, such as shopping, and playing indoors. Exposure to sunlight is required for Ultraviolet-B induced vitamin D production in the skin[10].

Vitamin D is a fat-soluble vitamin that exhibits hormonal properties and has receptors in most tissues and cells in the human body[11,12]. It has two biologically inert precursors: vitamin D3 and vitamin D2[13,14]. Both precursors which can be obtained from sunlight exposure and diet are converted by a two-step hydroxylation process, first in the liver followed by the kidneys.

Vitamin D plays a significant role in the regulation of calcium and phosphorous concentration in the blood. The main source of calcium and phosphorous in the human body is bone metabolism, which maintains the homeostasis of both calcium and phosphorous in the blood [9,13,14]. Without vitamin D, only 10-15% of dietary calcium and about 60% of phosphorus are absorbed[15]. The availability of vitamin D enhances calcium absorption by 30-40% and phosphorus absorption by 80%[10,16].

The darker the skin, the more protection a person gets against the sunlight. Therefore, people with dark skin are less efficient in producing vitamin D, which requires them to expose themselves to the sun for at least three to five times longer than lighter-skinned individuals[15,17,18]. The majority of expatriates in this study were of darker skin compared to the Bahrainis who were in general of lighter skin.

Calcium, phosphorous, and bone metabolism is highly affected by vitamin D deficiency. A decrease in vitamin D can cause a concomitant decrease in calcium and phosphorous absorption which in return increases parathyroid hormone secretion[10,19,20].

Low levels intake of calcium-phosphorus products causes demineralization of bones and may result in skeletal defects, rickets and muscle weakness in children[21-24]. In the elderly, it could result in increasing sway and more frequent falls[25,26].

Wearing sunscreen reduces vitamin D syntheses in the skin by more than 95%[27]. The significance of the role of sunscreen in reducing vitamin D synthesis is still unclear[28].

Previous studies revealed that vitamin D deficiency was 67.6% and 31.2% in females and males, respectively[11,29]. However, there are no published studies comparing vitamin D levels among foreign indoor workers and Bahraini citizens under similar conditions by gender.

Previous studies revealed that people who stay indoors for long periods, or women who cover themselves with abaya and headscarves (hijab) are prone to have lower levels of vitamin D. Also, people with certain occupations which limit their exposure to the sun are unlikely to produce the required amount of vitamin D[30-32].

The aim of this study was to evaluate vitamin D levels among non-exposed to the sun Bahrainis and expatriates workers. Also, comparisons in vitamin levels according to the gender was made among Bahrainis and expatriates under non-exposed to the sun conditions.

METHOD

The study was carried out on non-exposed Bahrainis and non-exposed expatriates working in Bahrain. The non-Bahraini expatriates are from the Asian origin, i.e., Bangladesh, India, Pakistan and Philippine. They are employees who spend most of their working hours indoor. The subjects of the study were categorized into four groups: Bahraini males, Bahraini females, expatriate males, and expatriate females. The study was performed from 1 October 2018 to 30 September 2019. The level of vitamin D in all four groups was evaluated. A blood sample of 5ml was obtained after securing the consent and approval.

Data were entered and analyzed using SPSS version 23.0. Quantitative variables were presented as Mean ± SE. Two independent samples t-test were used to test the significant differences in means of the different groups. P-value of less than 0.05 was considered statistically significant.

The ADVIA Centaur Vitamin D assay is one-pass competitive immunoassay that uses anti-fluorescein labeled (FITC) monoclonal antibody covalently bound to paramagnetic particles, one monoclonal antibody labeled with Acridium ester, and a vitamin D analog labeled with fluorescein. An inverse relationship exists between the amount of Vitamin D present in the patient sample and the amount of relative light (RLUs) measured by the system. The assay demonstrates equimolar cross-reactivity with 25(OH) D3 (100.7%) and 25(OH) D2 (104.5%). It has a broad dynamic range of 4.2 to 150 ng/ml (10.5 to 375 nmol/L). The reference procedure for the Vitamin D Standardization Program (VDSP) has been used, as was previously applied in reported research by Sempos et al and Thienpont et al[33,34].

RESULT

Table 1 shows the demographic data of all subjects in the study. The total number of non-exposed subjects for both Bahrainis and expatriates was 225, where the Bahrainis (n=138) form (54.2%) of the total subjects, and the expatriates (n=117) form (45.8%). The Bahraini male subjects (n=65) form 47.1% of the total Bahraini subjects and 25.5% of total subjects, whereas the female Bahrainis (n=73) form 52.9% of total Bahrainis and 28.6% of the total subjects. Male expatriates (n=68) group 58.1% of total expatriates and 26.7% of the total subjects, whereas the female expatriates (n=49) form 41.9% of the total expatriates and 19.2% of the total subjects. Expatriates were males and females who have lived in Bahrain for at least the last two years.

Table 1: Demographic Characteristics of the Participants of Non-Exposed Bahrainis and Non-Exposed Expatriates

		Gender				Total
		Female		Male		
		no.	%	No.	%	
Nationality	Bahraini	73	52.9	65	47.1	138
	Expatriates	49	41.9	68	58.1	117
Total		**122**		**133**		**255**

Table 2 shows the levels of vitamin D by gender and nationality. There was no significant difference in vitamin D levels when we compared the values obtained by gender. Vitamin D level (18.89±0.99 ng/ml) for all females from both Bahraini and expatriate subjects (n=122)

was not significantly different when compared with vitamin D level (18.71±0.83 ng/ml) obtained for total males; Bahraini and expatriate subjects (n=133) P=0.88. And when we compared the level of vitamin D by nationality, i.e. Bahrainis (n=138) and expatriates (n=117) there was also no significant difference, 19.35± 0.89ng/ml and 18.14±0.92ng/ml, respectively, P=0.347.

Table 2: Comparison of Vitamin D Levels by Gender and Nationality

		no.	Mean	SD	SE	P-Value
Gender	Female	122	18.89	10.9	0.99	0.888
	Male	133	18.71	9.62	0.83	
Nationality	Bahraini	138	19.35	10.43	0.89	0.347
	Expatriates	117	18.14	10	0.92	

To detect if there is a difference in vitamin D levels between males and females among Bahrainis, we carried out an analysis between the two groups. Our results showed that vitamin D level for female Bahrainis (19.08±1.42 ng/ml, n=73) was not significantly different to vitamin level in Bahraini males (19.66±1.01ng/ml, n=65) (P=0.746). Same non-significant difference was obtained between female (n=49) and male (n=68) expatriates; 18.61±1.26 ng/ml and 17.81±1.31ng/ml, respectively, (p=0.670). **Table 3**

Table 3: Comparison of Vitamin D Levels by Gender according to Nationality

		no.	Mean	SD	SE	P-Value
Bahraini	Female	73	19.08	12.15	1.42	0.746
	Male	65	19.66	8.16	1.01	
Expatriates	Female	49	18.61	8.82	1.26	0.67
	Male	68	17.81	10.82	1.31	

Table 4 illustrates vitamin D levels in female Bahrainis (n=73) and female expatriates (n=49). There was no significant difference between the two female groups, 19.08±1.42 ng/ml and 18.61±1.26 ng/ml, respectively, (P=0.815). Also, there was no significant difference in vitamin D levels between male Bahrainis (19.66±1.01 ng/ml, n=65) and male expatriates (17.8±1.31ng/ml, n=68).

Table 4: Comparison of Vitamin D Levels by Nationality according to Gender

		no.	Mean	SD	SE	P-Value
Female	Bahraini	73	19.08	12.15	1.42	0.815
	Expatriates	49	18.61	8.82	1.26	
Male	Bahraini	65	19.66	8.16	1.01	0.268
	Expatriates	68	17.8	10.82	1.31	

Our results showed that two independent samples t-test indicates that there are no differences in Vitamin D levels with respect to gender or nationality for the non-exposed participants in this study.

DISCUSSION

Sizar et al classified the severity of vitamin D deficiency into three categories, depending on the concentration of vitamin D: mild (20 ng/ml), moderate (10 ng/ml) and severe (5 ng/ml)[35]. Therefore, the level of vitamin D obtained in our study ranges between 19.66 ng/ml in exposed male Bahrainis and 17.80 ng/ml in exposed male expatriates is mildly deficient.

Previous studies revealed that the use of the veil was found to contribute significantly to a lower vitamin D level in women[11, 35,36]. Other studies revealed that the type of dress did not play a significant role in vitamin D level between covered and uncovered females[36]. We have not paid any emphasis in this study to the type of dress for both groups. Even though most of the Bahraini female subjects in our study cover their bodies, we could not find any significantly difference between Bahraini female and expatriate females which contradicts with previous findings[11,35].

All non-exposed groups in our study showed nonsignificant differences in vitamin D levels when we compared Bahrainis with expatriates. Also, there was no significant difference between total males with total female subjects, male Bahrainis with female Bahrainis, and male expatriates with female expatriates. Also, our results revealed that vitamin D level was not significantly different among females in Bahrainis and expatriate groups and between males in both Bahrainis and expatriates. The non-difference between the non-exposed Bahrainis and non-exposed expatriates could be attributed to the type of food these two groups are consuming which supplies them with the same amount of vitamin D. In other words, the diet in both groups could be attributed to the non-different level of vitamin D in both Bahrainis and expatriates. It could also be attributed to the fact that the time of exposure for all groups outside their offices is sufficient to supply them with the needful amount of vitamin D.

As our results did not show any significant differences in vitamin D according to nationality or gender, it is, therefore, recommended to carry out other future studies in which a comparison of vitamin D and calcium levels among exposed and non-exposed employees in both Bahraini and expatriate subjects.

The limitation of the study: All the expatriate groups are from Asian origin (India, Bangladesh, Pakistan, and Philippines) with different ethnic backgrounds and different nutritional diets, a fact that could affect the levels of vitamin D in these groups.

CONCLUSION

Non-exposed Bahrainis had no significantly different level of vitamin D in comparison to non-exposed expatriates. Also, there was not significant difference in vitamin D levels when comparing male and female Bahrainis and also in male and female expatriates. Also, not significantly difference was found when comparing vitamin D levels between male Bahrainis and male expatriates. Results between female groups in both Bahraini and expatriates were not significantly different, as well. The non-significant results among all non-exposed groups could be attributed to the different types of diet or different lifestyles in all groups that compensate for sun exposure.

We recommend, due to the low level of vitamin D, more exposure to the sun in the early morning and vitamin D-rich-diet or vitamin D supplementation of 1000 IU in case of vitamin D deficiency. Another study is recommended to evaluate the calcium level in these subjects, which will be our other future research.

Authorship Contribution: The corresponding author made the whole effort contribution towards (1) conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content, and (3) final approval of the manuscript version to be published. Yes.

Potential Conflict of Interest: None.

Competing Interest: None.

Sponsorship: None.

Acceptance Date: 29 December 2020

Ethical Approval: Approved by the Arabian Gulf University, College of Medicine and Medical Sciences, Research and Ethics Committee (Reference No E011-PI-04/17).

REFERENCES

1. Arabi A, El Rassi R, El-Hajj FG. Hypovitaminosis D in developing countries-prevalence, risk factors and outcomes. Nat Rev Endocrinol 2010; 6(10):550-61.
2. Dawodu A, Kochiyil J, Altaye N. Pilot study of sunlight exposure and vitamin D status in Arab women of childbearing age. East Mediterr Health J 2011; 17(7):570-4.
3. Lund B, Sorensen OH. Measurement of 25-hydroxyvitamin D in serum and its relation to sunshine, age and vitamin D intake in the Danish population. Scand J Clin Lab Invest 1979; 39(1):23-30.
4. Matsuoka LY, Wortsman J, Dannenberg MJ, et al. Clothing prevents ultraviolet-B radiation-dependent photosynthesis of vitamin D3. J Clin Endocrinol Metab 1992;75(4):1099-103.
5. Holick MF. Vitamin D deficiency. N Engl J Med 2007;357(3):266-81.
6. Al-Turki HA, Sadat-Ali M, Al-Elq AH, et al. 25-Hydoxyvitamin D levels among healthy Saudi Arabian women. Saudi Med J 2008;29(12):1765-8.
7. Elsammak MY, Al-Wosaibi AA, Al-Howeish A, et al. Vitamin d deficiency in Saudi Arabs. Horm Metab Res 2010;42(5):364-8.
8. Alshamsan FM, Bin-Abbas BS. Knowledge, awareness, attitudes and sources of vitamin D deficiency and sufficiency in Saudi children. Saudi Med J 2016;37(5):579-83.
9. Al-Daghri NM. Vitamin D in Saudi Arabia: Prevalence,distribution and disease associations. J Steroid Biochem Mol Biol 2018; 175:102-7.
10. Lips P, Hosking D, Lippuner K, et al. The prevalence of vitamin D inadequacy amongst women with osteoporosis: an international epidemiological investigation. J Intern Med 2006;260(3):245-54.
11. Alhaddad FA, AlMahroos FT, AlSahlawi HS, et al. The Impact of Dietary Intake and Sun Exposue on Vitamin D Deficiency among Couples. Bahrain Medical Bulletin 2014; 36(1):33-37.
12. Chlebowski RT, Johnson KC, Kooperberg C, et al. Calcium plus vitamin D supplementation and the risk of breast cancer. J Natl Cancer Inst 2008;100(22):1581-91.
13. Alamoudi LH, Almuteeri RZ, Al-Otaibi ME, et al. Awareness of Vitamin D Deficiency among the General Population in Jeddah, Saudi Arabia. J Nutr Metab 2019; 2019:4138187.
14. Zhang R, Ran HH, Gao YL, et al. Differential vascular cell adhesion molecule-1 expression and superoxide production in simulated microgravity rat vasculature. EXCLI J 2010; 9:195-204.
15. Nair R, Maseeh A. Vitamin D: The “sunshine” vitamin. J Pharmacol Pharmacother 2012;3(2):118-26.
16. Lappe JM, Travers-Gustafson D, Davies KM, et al. Vitamin D and calcium supplementation reduces cancer risk: results of a randomized trial. Am J Clin Nutr 2007; 85(6):1586-91.
17. Clemens TL, Adams JS, Henderson SL, et al. Increased skin pigment reduces the capacity of skin to synthesise vitamin D3. Lancet 1982;1(8263):74-6.
18. Hintzpeter B, Scheidt-Nave C, Muller MJ, et al. Higher prevalence of vitamin D deficiency is associated with immigrant background among children and adolescents in Germany. J Nutr 2008;138(8):1482-90.
19. Heaney RP. Functional indices of vitamin D status and ramifications of vitamin D deficiency. Am J Clin Nutr 2004;80(6):1706S-9S.
20. Holick MF, Siris ES, Binkley N, et al. Prevalence of Vitamin D inadequacy among postmenopausal North American women receiving osteoporosis therapy. J Clin Endocrinol Metab 2005;90(6):3215-24.
21. Aaron JE, Gallagher JC, Anderson J, et al. Frequency of osteomalacia and osteoporosis in fractures of the proximal femur. Lancet 1974;1(7851):229-33.
22. Gordon CM, Williams AL, Feldman HA, et al. Treatment of hypovitaminosis D in infants and toddlers. J Clin Endocrinol Metab 2008;93(7):2716-21.
23. Holick MF. High prevalence of vitamin D inadequacy and implications for health. Mayo Clinic proceedings 2006;81(3):353-73.
24. Holick MF. Resurrection of vitamin D deficiency and rickets. The Journal of clinical investigation 2006; 116(8):2062-72.
25. Bischoff-Ferrari HA, Dawson-Hughes B, Staehelin HB, et al. Fall prevention with supplemental and active forms of vitamin D: a meta-analysis of randomized controlled trials. BMJ 2009; 339: b3692.
26. Bischoff-Ferrari HA, Willett WC, Wong JB, et al. Fracture prevention with vitamin D supplementation: a meta-analysis of randomized controlled trials. JAMA 2005; 293(18):2257-64.
27. Matsuoka LY, Ide L, Wortsman J, et al. Sunscreens suppress cutaneous vitamin D3 synthesis. J Clin Endocrinol Metab 1987; 64(6):1165-8.
28. Ross AC, Taylor CL, Yaktine AL, Del Valle HB, editors. Dietary Reference Intakes for Calcium and Vitamin D. Washington (DC) 2011.
29. Golbahar J, Al-Saffar N, Diab AD, et al. Vitamin Status in Adults: A cross Sectional Study. Bahrain Medical Bulletin 2013;35(1):17-23.
30. Al-Yatama FI, AlOtaibi F, Al-Bader MD, et al. The Effect of Clothing on Vitamin D Status, Bone Turnover Markers, and Bone Mineral Density in Young Kuwaiti Females. Int J o Endocrinol 2019; 2019:6794837.
31. Webb AR, Kline L, Holick MF. Influence of season and latitude on the cutaneous synthesis of vitamin D3: exposure to winter sunlight in Boston and Edmonton will not promote vitamin D3 synthesis in human skin. J Clin Endocrinol Metab 1988;67(2):373-8.
32. Webb AR, Pilbeam C, Hanafin N, et al. An evaluation of the relative contributions of exposure to sunlight and of diet to the circulating concentrations of 25-hydroxyvitamin D in an elderly nursing home population in Boston. Am J Clin Nutr 1990;51(6):1075-81.
33. Sempos CT, Vesper HW, Phinney KW, et al. Vitamin D Standardization Program (VDSP.) Vitamin D status as an international issue: National surveys and the problem of standardization. Scand J Clin Lab Invest 2012;72(243):32-40.
34. Thienpont L, Stepman HCM, Vesper HW. Standardization of measurements of 25-Hydroxyvitamin D3 and D2. Scand J Clin Lab Invest 2012; 72(243):41-9.
35. Sizar O, Khare S, Goyal A, et al. Vitamin D Deficiency. StatPearls. Treasure Island (FL) 2020. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2020.
36. Hobbs RD, Habib Z, Alromaihi D, et al. Severe vitamin D deficiency in Arab-American women living in Dearborn, Michigan. Endocr Pract 2009; 15(1):35-40.