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ORIGINAL ARTICLE

Knowledge and practice of vitamin D deficiency and risk of hair loss among adult population in Majmaah city, Saudi Arabia

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ABSTRACT

Background: Vitamin D deficiency is still epidemic and it represents a global health concern. Vitamin D deficiency is associated with several diseases, including bone diseases, multiple sclerosis, Alzheimer's disease, alopecia, and obesity. The deficiency of vitamin D is rising in Saudi Arabia. The presence of sufficient knowledge about this problem may lead to a decrease in its prevalence. The aim of the current study was to assess the knowledge and practice of adult population regarding vitamin D deficiency and risk of hair loss.

Methodology: This cross-sectional study was conducted in Majmaah city and surrounding villages, Riyadh, Saudi Arabia. Participants' socio-demographic data, skin color, knowledge and practice of vitamin D deficiency, and risk of hair loss were investigated using a pre-tested electronic questionnaire.

Results: Majority (80.5%) of the participants knew about vitamin D and the main source of knowledge was media (27.9%). Of the respondents, 17% believed that there was a relationship between vitamin D deficiency and hair loss. Among the participants, 49.6%, 49.9%, and 0.3% reported poor, fair, and good knowledge about vitamin D deficiency, respectively. While 46.9%, 47.4%, and 5.7% had poor, fair, and good practice toward vitamin D deficiency, respectively.

Conclusion: There was a lack of knowledge and poor practice regarding vitamin D deficiency.

Keywords: Knowledge, practice, vitamin D deficiency, alopecia, Majmaah.

Introduction

Vitamin D deficiency is a global health problem. With all the medical advances of the century, vitamin D deficiency is still epidemic. Over a billion people worldwide are vitamin D deficient or insufficient [1]. The prevalence of vitamin D deficiency is rising up in Saudi Arabia, according to a study done in 2014 in three regions in Saudi Arabia among students (n = 4,035) and employee (n = 2,104), the results showed that 49% of students and 44% of employee were vitamin D deficient [2]. There are many studies that discussed vitamin D deficiency in Saudi Arabia, a cross-sectional study conducted in Riyadh among first-trimester pregnant ladies in 2010, it showed that 50% of all the sample (n = 160) were vitamin D deficient [3]. In another cross-sectional study conducted among King Faisal University Medical Students in 2009, the result was 96% of the total (95 male and 103 female) students had vitamin D deficiency [4]. Vitamin D is an essential fat-soluble vitamin that is required for regulation of calcium metabolism and to maintain good health. It is obtained through either dietary sources or synthesis in the human skin by exposure to ultraviolet B (UVB) radiation [3]. In recent years, the

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topic of vitamin D has become a highly significant subject in the medical world as vitamin D deficiency is largely an unrecognized worldwide epidemic [5]. Vitamin D deficiency is the most common nutritional deficiency and is highly alarming in Saudi Arabia and worldwide. It has been recognized as an international public health problem due to its significant role for the most common medical conditions for the skeletal system [6]. Saudi Arabia is one of the sunniest countries, and vitamin D deficiency has long been reported as prevalent in the Saudi population [7]. Level of vitamin D should be maintained ≥30 ng/ml, the normal level is 40–60 ng/ml, the level of vitamin D is insufficient when it is 21–29 ng/ml, and deficient when it is <20 ng/ml [8]. The etiology of vitamin D deficiency in Saudi women could be related to the inadequacy of diet and sunlight exposure, as well as skin pigmentation playing a role. Inadequate exposure to sunlight is attributed by a conservative style of dress as abaya, hijab that covers most of the body surfaces when they are outdoor, which limits the skin surfaces exposure to the sun with the deficiency being partly overcome in some subjects who expose themselves to sunlight [9]. Use of sunblock, common window glass in homes or cars, and clothing, all effectively block UVB radiation, even in the summer. People who work indoors, wear extensive clothing, regularly use sunblock, are dark-skinned, obese, aged, or consciously avoid the sun, are at risk of vitamin D deficiency [1]. Vitamin D deficiency has been reported to be linked to many diseases, like cardiovascular diseases, osteoporosis, colorectal, prostate, breast cancers, multiple sclerosis, Alzheimer's disease, psoriasis, liver diseases, alopecia, and obesity [3]. Current research indicates that vitamin D deficiency plays a role in causing 17 varieties of different cancers, as well as heart disease, stroke, autoimmune diseases, birth defects, and periodontal disease. Vitamin D3 is believed to play a role in controlling the immune system (possibly reducing one's risk of cancers and autoimmune diseases), increasing neuromuscular function and improving mood, protecting the brain against toxic chemicals, and potentially reducing pain [1]. There are 2–3 million non–melanoma skin cancers and 132,000 malignant melanomas that occur globally each year due to sun exposure [10]. One of the main problems present in vitamin D deficiency is alopecia areata (AA), which is a common form of hair loss, characterized by sharply demarcated, round to oval, skin-colored patches of non-scarring alopecia. Study results support the autoimmune nature of AA, including association with other autoimmune diseases, the presence of hair follicle-specific autoantibodies, or improvement after immunosuppressive treatment. Typical histological features of AA are inflammatory infiltrate around and within hair follicles, composed mainly of Th1 cells and increased expression of interleukin-2 and interferon γ. At present, studies concentrate on finding the mediators involved in the pathogenic processes in AA, which could be a target for new therapeutic options. Literature data suggest that vitamin D, due to its immunomodulatory effect, may be involved in the pathogenesis of AA. Decreased serum 25(OH)D levels in AA in comparison to healthy subjects were reported in many studies [11,12]. Since the majority of studies were conducted on adult patients, the study by Unal et al. is of special interest. The authors demonstrated vitamin D deficiency in pediatric patients with AA and in the control group. However, they reported a significant inverse correlation between serum 25(OH)D levels and disease severity, duration, as well as the number of bald patches. The authors suggested that vitamin D deficiency may aggravate the disease and lead to severe hair loss [11,13]. The potential role of vitamin D3 receptor (VDR) in the pathogenesis of AA was also assessed. Fawzi et al. revealed significantly lower levels of tissue and serum VDR in AA than in a control group. An important negative correlation was observed between the extent of AA and tissue VDR. The results are in accordance with the study by Lim et al. The authors found significantly lower expression of VDR in hair follicles and epidermis within alopecia lesions than in healthy skin. Moreover, the VDR levels were lower in patients with a more severe form of hair loss. Reduction of VDR expression in AA was related to decreased hair cycle-related signals—Wnt/β-catenin signals. The authors suggested that reduced expression of VDR in AA might be related primarily to suppression of cell differentiation since decreased expression of involucrin and filaggrin within hair follicles and epidermis were revealed [11,14,15]. Female pattern hair loss (FPHL) is one of the most common types of alopecia in women. Clinically, it is characterized by diffuse hair shedding with the maintained frontal hairline. Recent literature data include genetic, hormonal, and environmental factors in the pathogenesis of FPHL, which suggested a possible link between serum 25-hydroxyvitamin D and FPHL since its decreased concentration was demonstrated in patients with FPHL compared to control group [11], Moneib et al. [16] reported a significantly lower serum 25(OH)D levels in patients with FPHL than in controls. The majority of patients with FPHL (96.6%) showed a vitamin D deficiency or insufficiency. Sufficient levels were observed only in 3.3% of patients. There was no significant difference between different serum 25(OH)D levels and mean disease duration or patients' age; however, a significant difference between the severity of hair loss and mean serum 25(OH)D concentration was observed. The authors suggested that the higher serum 25(OH)D concentration in patients with most severe hair loss in comparison with less severe alopecia may result from increased exposure to ultraviolet light due to more decreased scalp hair density [11]. Contrary to this, in another study, patients with mild and moderate FPHL had significantly higher mean serum levels of 25(OH)D compared to those suffering from the severe form. It cannot be excluded that conflicting results observed in both studies were determined by different patterns of sun exposure and evaluation of serum 25(OH)D level. It has also been pointed out that women with positive family

history of FPHL and vitamin D deficiency or insufficiency are more prone to develop FPHL in comparison with women with sufficient serum 25(OH)D levels. Contrary to this, Banihashemi et al. [17–19] did not find any significant correlation between serum 25(OH)D concentration and positive family history of FPHL. Although a decreased serum 25(OH)D concentration was demonstrated in FPHL, the role of VDR in FPHL was assessed in a single study. Fawzi et al. [14] reported significantly decreased concentrations of both serum and tissue VDR in androgenic alopecia in comparison with healthy controls. No correlation was observed between serum or tissue VDR concentration and disease severity. Interestingly, female patients had higher levels of both serum and tissue VDR than male patients. This could be explained by the interaction of 17β-estradiol and 1,25(OH)2D, which results in enhancement of VDR gene expression [11]. At present, there are no studies evaluating the oral supplementation of vitamin D or its topical application in patients with FPHL. The results described above suggest a possible involvement of vitamin D in the pathogenesis of FPHL. However, the studies were limited by the small number of enrolled patients and different inclusion criteria. To elucidate the role of vitamin D in FPHL, further large-scale studies are required [11]. Exposure to sunshine each day helps the human body to manufacture the required amount of vitamin D. However, due to fear of developing skin cancer, most people avoid the sun exposure. To prevent vitamin D deficiency, one should spend 15–20 minutes daily in the sunshine with 40% of the skin surface exposed. High concentration of melanin in the skin slows the production of vitamin D; similarly, aging greatly reduces skin production of vitamin D [1]. Unfortunately, without UVB exposure, dietary intake of vitamin D from food is unlikely to be sufficient to meet adult needs [10]. Serum 25(OH)D concentration is the parameter of choice for the assessment of vitamin D status. The Institute of Medicine recommended that all children and adults up to the age of 50 require 200 IU vitamin D/day and adults aged 51–70 and 71 years need 400 and 600 IU vitamin D/day. The National Osteoporosis Foundation recently recommended that all postmenopausal women take 800–1,000 IU vitamin D/day 20. The best way to prevent or treat vitamin D deficiency is sun exposure and dietary resources which contain vitamin D; if those fails, supplements are a choice. Sun exposure is the best but it has many dangerous effect like, there are 2–3 million non–melanoma skin cancers and 132,000 malignant melanomas occur globally each year [10].

Materials and Methods

This was a cross-sectional study conducted in Majmaah city and surrounding villages in Saudi Arabia in 2018; to assess the knowledge and practice of vitamin D deficiency and risk of hair loss among the adult population. Data were collected based on a pre-tested questionnaire which includes questions about socio-demographic data (age, gender, residency, and nationality), skin color, knowledge and practice of Vitamin D deficiency, and risk of hair loss. The questionnaire includes seven questions about knowledge of vitamin D and risk of hair loss and six questions about the practice; based on these questions, we classified the knowledge into poor when the participant answered only two questions and fair when he/she answered four and good knowledge when he/she answered seven questions. The same concept also was done with the practice score, 2 for poor, 4 for fair, and 6 for good practice.

Ethical approval was obtained from the ethical committee of the Basic Health Research Centre of Majmaah University, Riyadh, Saudi Arabia.

Results

The present study included 369 individuals; the majority were males representing 298 (80.8%), while females were 71 (19.2%) only. Individuals with an age range of 26–35 years old were more dominant 140 (37.9%), followed by those in the age range of 18–25 years at 90 (24.4%). The majority of participants were married representing 242 (65.6%), Saudi individuals were the most dominant

Table 1. *Baseline characteristics of the study participants.*

Characteristics	Number (369)	Percentage
Age (years)		
18–25	90	24.4
26–35	140	37.9
36–45	82	22.2
46–55	45	12.2
≥56	12	3.3
Sex		
Male	298	80.8
Female	71	19.2
Marital status		
Single	121	32.8
Married	242	65.6
Divorced	6	1.6
Residency		
Almajmaah	151	40.9
Hawtah Sugair	16	4.3
Rwdat Sudair	6	1.6
Others	196	53.1
Nationality		
Saudi	359	97.6
Non-Saudi	10	2.7
Skin color		
White	109	29.5
Light brown	217	58.8
Dark brown	35	9.5
Black	8	2.2

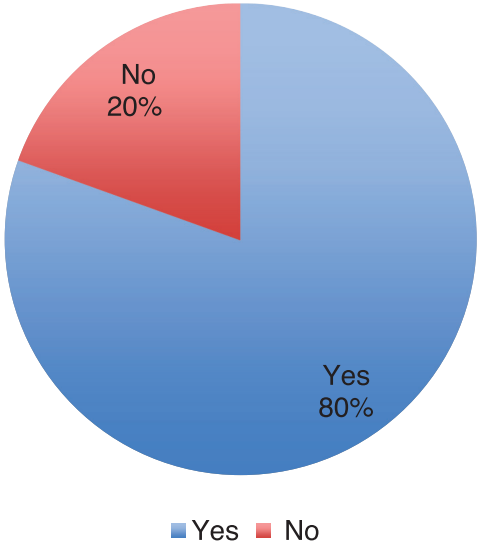

Figure 1. *Percentage of participants knowing about vitamin D.*

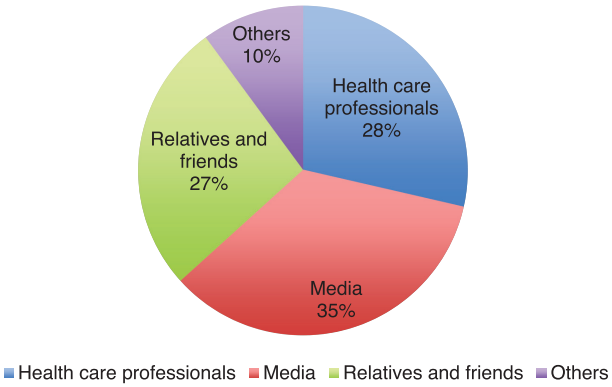

Figure 2. *Percentage of sources of participants' information about vitamin D.*

at 359 (97.3%), while non-Saudi individuals were 10 (2.7%) only. Most of participants 217 (58.8%) were of light brown skin color, followed by those with white 109 (29.5%), dark 35 (9.5%), and black color 8 (2.2%). Baseline characteristics of the participants are shown in Table 1.

There were 297 (80.5%) of individuals who knew about vitamin D, only 72 (19.5%) did not know about it, as shown in Figure 1. The most common source of individuals' information about vitamin D was media representing 103 (27.9%), followed by health care professionals 85 (23%), then relatives and friends 79 (21.4%) and other different sources 30 (8.1%) (Figure 2).

Regarding practice toward vitamin D deficiency, there were 148 (40.1%) participants who reported that they perform the physical activity as individuals with the same age, while 153 (41.5%) reported less activity and 68 (18.4%) only reported more activity. There were 150 (40.7%) participants who reported that they expose themselves to sunlight, and 253 (68.6%)

Table 2. *Frequency distribution of the study participants' practice about vitamin D.*

Item	Number	Percentage
Physical activity compared to other people of the same age		
More active	68	18.4
Less active	153	41.5
About as active	148	40.1
Sunlight exposure		
Yes	150	40.7
No	89	24.1
Sometimes	130	35.2
Duration of exposure		
<20 minutes	253	68.6
>20 minutes	116	31.4
Sunscreen product usage		
Usually	16	4.3
Sometimes	49	13.3
Rarely	54	14.6
Never	250	67.8
Eating food containing vitamin D		
Usually	167	45.3
Sometimes	163	44.2

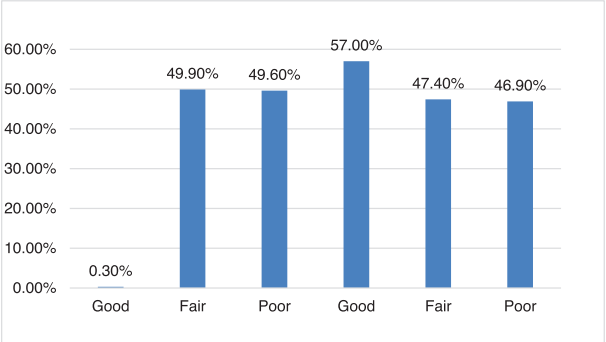

Figure 3. *Knowledge and practice of vitamin deficiency among participants (percentage %).*

reported exposure duration of less than 20 minutes. The majority of participants 250 (67.8%) reported that they never used sunscreen, 167 (45.3%) said that they usually eat food containing vitamin D, and there were 93 (25.2%) participants who were administrating vitamin D supplements. Details of the participants' practice are shown in Table 2.

The overall knowledge and practice is shown in Figure 3, regarding knowledge, only 1 (0.3%) had good knowledge about vitamin D deficiency, whereas 183 (49.6%) and 184 (49.9%) had poor and fair knowledge, respectively. Regarding practice, also there were 21 (5.7%) participants who only reported good practice, while 173 (46.9%)

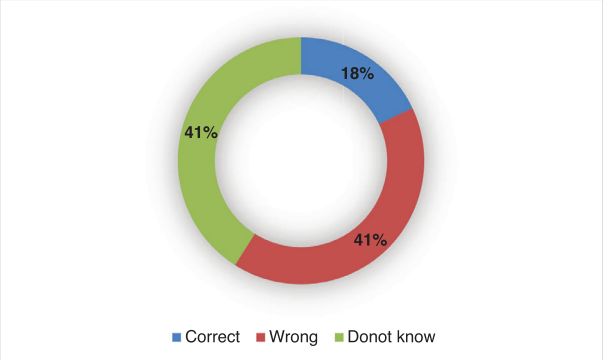

Figure 4. *Knowing the relation between vitamin D deficiency and hair loss.*

and 175 (47.4%) participants had poor and fair practice, respectively.

Only 53 (17.8%) had correct knowledge about the relationship between vitamin D deficiency and hair loss, while most of them 244 (82.1%) either did not know or they gave wrong answers (Figure 4).

The correlations investigated showed that there was no correlation between age with total knowledge (p-value = 0.3) or total practice (p-value = 0.9). Also, there was no association between total knowledge and total practice (p-value = 0.9).

Discussion

In the current study, the large majority of participants (80.5%) knew about vitamin D and the most common source of their knowledge was media (27.9%), followed by health care professional, and relatives and friends (21.4%), the other sources represented 8.1% only. A previous Saudi study [9] showed that 25.6% had knowledge about vitamin D and the doctor was the main source of information (37.4%), followed by TV programs (34.8%) and Internet (32.3%), while friend represented 18.7%. Another study in Saudi Arabia [8] showed that individuals had limited knowledge about vitamin D and its deficiency. A lack of knowledge was reported in a study by Vu et al. [20]. A study from Riyadh demonstrated that the most common source of information was health care professional (44%), followed by relatives and friends (29.8%) and then media (26.2%) [10]. A study from Saudi Arabia conducted on adults with and without coronary heart disease showed that there was a low level of knowledge about vitamin D and low consumption of vitamin D supplements [21]. A study from Jeddah reported that 89.6% of participants heard about vitamin D deficiency and the main source of knowledge was friends (75.8%), followed by family (70.6%), then doctors (48.1%) and media (35.8%) [22]. A study by Bathi et al. [23] demonstrated that the main source of knowledge was doctor (40.5%), followed by relatives and friends (29%), then media (12.5%) and journals (9.5%). Regarding practice toward vitamin D deficiency in this study, there were 41.5% who reported that they were less active compared to the other people of the same age. Only 40.7% reported being exposed to sunlight and 68.6% reported the duration of exposure less than 20 minutes. The majority of individuals never used sunscreen (67.8%). The majority (74.8%) did not take vitamin D supplements. In Saudi study conducted on females [9], it was found that 46.5% were exposed to sunlight and the majority (51.2%) exposed themselves for 10–29 minutes, higher percent than ours reported using sunscreen (43.9%). Another Saudi study showed that 46.4% of participants were going in the sun and 21% only were using sunscreen [6]. In this study, the overall knowledge and practice of vitamin D deficiency were not good, only 0.3% had good knowledge. Also, 5.7% only had a good practice. There was no correlation found between age with knowledge or practice, also there was no association between knowledge and practice. Similar findings were reported in a previous Saudi study, where the poor knowledge and practice was prevalent in 23.2% and 37.4%, respectively and fair knowledge and practice represented 62.6% and 56.1% of individuals, respectively, the good knowledge was more prevalent than in our study where 14.2% of participants had good knowledge, whereas good practice represented 6.5% similar to our findings [9]. The previous study was in contrast to ours as there were correlations found between age and knowledge and between age and practice [9]. Inadequate knowledge and poor practice were reported by a Saudi study conducted in Riyadh [6]. Lack of knowledge and poor practice seem to be very common in Saudi Arabia regarding vitamin D deficiency, increasing awareness is very important, the most common source of information reported in the present study and the previous studies include doctors and media, so doctors should educate their patients about vitamin D deficiency, articles should be published on media, as well as announcement to increase the knowledge of population about this problem to avoid the diseases resulted from vitamin D deficiency. Then further studies should be established to evaluate the knowledge and practice level to find out whether the efforts were beneficial or not and to correct the mistakes performed in increasing knowledge.

Conclusion

There was a deficiency in knowledge and poor practice among the studied population regarding vitamin D deficiency.

List of Abbreviations

25(OH)D	25-hydroxyvitamin D
AA	Alopecia Areata
FPHL	Female pattern hair loss
UVB	Ultraviolet B
VDR	Vitamin D3 receptor

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication
Informed consent was obtained from the participants.

Ethical approval
The research was approved by the Institutional Review Board of Al Majmaah University, Approval No. MUREC-Dec.25 ICOM-2018/14.

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References

1. Naeem Z. Vitamin D deficiency—an ignored epidemic. Int J Health Sci (Qassim). 2010;4(1):5–6.
2. Kaddam IM, Al-Shaikh AM, Abaalkhail BA, Asseri KS, Al-Saleh YM, Al-Qarni AA, et al. Prevalence of vitamin D deficiency and its associated factors in three regions of Saudi Arabia. Saudi Med J. 2017;38(4):381–90. https://doi.org/10.15537/smj.2017.4.18753
3. Al-Faris NA. High prevalence of vitamin D deficiency among pregnant Saudi women. Nutrients. 2016;8(2):77. https://doi.org/10.3390/nu8020077
4. Babli AI, AlDawood KM, Khamis AH. Knowledge, attitude, and practice of general practitioners in Dammam, Saudi Arabia towards vitamin D supplementation to infants. J Fam Commun Med. 2015;22(3):135. https://doi.org/10.4103/2230-8229.163025
5. Christie FTE, Mason L. Knowledge, attitude and practice regarding vitamin D deficiency among female students in Saudi Arabia: a qualitative exploration. Int J Rheum Dis. 2011;14(3):e22–29. https://doi.org/10.1111/j.1756-185X.2011.01624.x
6. Babelghaith SD, Wajid S, Al-Zaaqi MA, Al-Malki AS, Al-Amri FD, Alfadly S, et al. Knowledge and practice of vitamin D deficiency among people lives in Riyadh, Saudi Arabia—a cross-sectional study. Biomed Res. 2017;28(7):3114–8.
7. Al-Elq AH. The status of vitamin D in medical students in the preclerkship years of a Saudi medical school. J Fam Community Med. 2012;19(2):100–4. https://doi.org/10.4103/2230-8229.98293
8. Hoel DG, Berwick M, de Gruijl FR, Holick MF. The risks and benefits of sun exposure 2016. Dermatoendocrinol. 2016;8(1):e1248325. https://doi.org/10.1080/19381980.2016.1248325
9. Habib FM, Almotairi WA, Almutairi WM. Vitamin D deficiency: knowledge and practice among adult Saudi females. Glo Adv Res J Med Med Sci. 2014;3:095–101.
10. Lucock M, Jones P, Martin C, Beckett E, Yates Z, Furst J, et al. Vitamin D: beyond metabolism. J Evid Based Complementary Altern Med. 2015;20(4):310–22. https://doi.org/10.1177/2156587215580491
11. Gerkowicz A, Chyl-Surdacka K, Krasowska D, Chodorowska G. The role of vitamin D in non-scarring alopecia. Int J Mol Sci. 2017;18(12):6–8. https://doi.org/10.3390/ijms18122653
12. Mahamid M, Abu-Elhija O, Samamra M, Mahamid A, Nseir W. Association between vitamin D levels and alopecia areata. Isr Med Assoc J. 2014;16(6):367–70. p. 80.
13. Unal M, Gonulalan G. Serum vitamin D level is related to disease severity in pediatric alopecia areata. J Cosmet Dermatol. 2018;17(1):101–4. https://doi.org/10.1111/jocd.12352
14. Fawzi MMT, Mahmoud SB, Ahmed SF, Shaker OG. Assessment of vitamin D receptors in alopecia areata and androgenetic alopecia. J Cosmet Dermatol. 2016;15(4):318–23. https://doi.org/10.1111/jocd.12224
15. Lim YY, Kim SY, Kim HM, Li KS, Kim MN, Park K-C, et al. Potential relationship between the canonical Wnt signalling pathway and expression of the vitamin D receptor in alopecia. Clin Exp Dermatol. 2014;39(3):368–75. https://doi.org/10.1111/ced.12241
16. Moneib H, Fathy G, Ouda A. Possible association of female-pattern hair loss with alteration in serum 25-hydroxyvitamin D levels. Egypt J Dermatol Venerol 2014;34:15–20. https://doi.org/10.4103/1110-6530.137254
17. Rasheed H, Mahgoub D, Hegazy R, El-Komy M, Abdel Hay R, Hamid MA, et al. Serum ferritin and vitamin d in female hair loss: do they play a role? Sk in Pharmacol Physiol. 2013;26(2):101–7. https://doi.org/10.1159/000346698
18. Banihashemi M, Nahidi Y, Meibodi NT, Jarahi L, Dolatkhah M. Serum vitamin D3 level in patients with female pattern hair loss. Int J Trichol. 2016;8(3):116–20. https://doi.org/10.4103/0974-7753.188965
19. Holick MF, Chen TC. Vitamin D deficiency: a worldwide problem with health consequences. Am J Clin Nutr. 2008;87(4):1080S–6S. https://doi.org/10.1093/ajcn/87.4.1080S
20. Vu LH, van der Pols JC, Whiteman DC, Kimlin MG, Neale RE. Knowledge and attitudes about Vitamin D and impact on sun protection practices among urban office workers in Brisbane, Australia. Cancer Epidemiol Biomarkers Prev. 2010;19(7):1784–9. https://doi.org/10.1158/1055-9965.EPI-10-0127
21. Aljefree N, Lee P, Ahmed F. Exploring knowledge and attitudes about vitamin D among adults in Saudi Arabia: a qualitative study. Healthcare (Basel). 2017;5(4).
22. Al-Agha AE, Alorabi SH, NoorSaeed SM, Shalabi NM. Awareness of vitamin D and its deficiency in Jeddah population, Saudi Arabia. J Comm Pub Health Nurs. 2016;2(120):2.
23. Bathi BA, Zayed KA, Qenai MA, Makboul G, El-Shazly MK. Knowledge, attitude and practice of patients attending primary care centers toward vitamin D in Kuwait. Alexandria J Med. 2012;48(3):277–82. https://doi.org/10.1016/j.ajme.2012.02.003