Vitamin D deficiency and risk of hair loss: Knowledge and practice of adult female population in Saudi Arabia, 2020

Abstract

Background: Vitamin D deficiency is a global problem related to public health causing multiple disorders, for example rickets, osteoporosis (weak bones) and osteomalacia. Lack of information, education and perception about the normal requirements of vitamin D is leading to emergence of many diseases in Saudi population. We aimed to assess Knowledge and practice of vitamin D deficiency and risk of hair loss among adult female population in Saudi Arabia.

Method: We performed a cross sectional study in adult females older than 16 years who are residing in Saudi Arabia. We excluded female healthcare workers. Knowledge and practice of vitamin D deficiency and risk of hair loss were measured among included female. Data were analyzed using SPSS.

Results: A total of 810 female were included. Most of participants were between 18-25 (41.6%) and 26-35 (39.5%) years old. 42.6% of total participant were single. 96% of them heard about vitamin D. The main source of information were Relatives & friends (55.8%) followed by health care professional (50.75%). 503 (62.1%) of the participating females correctly knew that there is a relationship between vitamin D deficiency and hair loss, 188 (23.2%) thought that there is no relationship while 119 (14.7%) did not know or did not have any opinion. Regarding practice, about 216 (26.7%) participants exposed themselves to sunlight, and 40% were taking Vitamin D supplement. The overall knowledge score was 9.4 ±2.80 out of 18. A significant difference in knowledge score was found according to age, nationality, residence and marital status.

Conclusions : The overall knowledge score was average among participants, and majority of them heard about vitamin D. About two third of the participants knew that there is a relationship between vitamin D deficiency and hair loss. There is a need to increase the taking of vitamin D supplement among female for prevention from diseases.

Key words: Vitamin D; Female; Knowledge; Practice; Hair loss; Saudi Arabia.

Background:

Hair loss is a common problem that can be treated with vitamins and minerals. Vitamins and minerals are essential for growth of normal cell and performing their function and in case of its deficiency, it may contribute to hair loss. Although supplements are relatively affordable and easily accessible, it is important to have the knowledge about which vitamins and minerals are useful in treating hair loss [1].

Vitamin D is a fat-soluble vitamin that regulates the metabolism of calcium and phosphorous [2]. There are two types of vitamin D; cholecalciferol (vitamin D3) and ergocalciferol (vitamin D2) [3]. Sun exposure is the main source of vitamin D [4]. There are few sources of vitamin D, including fatty fish, such as sardines, tuna, mackerel, and salmon. cod liver oil; yolk; And mushrooms. It is rarely found in vegetables, grains, and fruits [5].In human body, the major function of vitamin D is its contribution in detachment of phosphorus and calcium homoeostasis by enhancing the intestinal absorption of calcium and phosphorus from ingested food sources. The absorbed calcium and phosphorous are required for proper transduction signaling, skeletal mineralization, neuromuscular function, and metabolism processes. Numerous studies have reported sunlight to be the most important source of vitamin D production within human body [6,7]. Vitamin D deficiency is one of the commonest global health conditions however the all available of the medical advances of the century where there are over billion of people worldwide who are vitamin D deficient or insufficient [8].This deficiency disorder has been reported as a global problem related to public health considering its primary involvement in pathogenesis of the most widespread medical conditions of the skeletal system [9,10].According to a study conducted in 2014 among students (n = 4,035) and staff (n = 2,104) in three regions of Saudi Arabia, the study found that 49% of students and 44% of employee are vitamin D deficient indicating that vitamin D deficiency is rising in Saudi Arabia [11]. There are many studies on vitamin D deficiency in Saudi Arabia, where a study conducted in Riyadh among pregnant women in the first half of 2010 showed that 50% of all samples (n = 160) were vitamin D deficient [12]. Another short-term study of medical students at King Fasil University in 2009 found that 96% of 95 students (95 males and 103 females) were deficient in vitamin D [13].

Numerous research reports have revealed a consistent relationship between vitamin D deficiency and prognosis of several disorders including multiple types of cancers, coronary

Comment [SA1]: refrase for better understanding

Comment [SA2]: Should be included in discussion not introduction

heart disease, diabetes [14–17], hypertension, Alzheimer and multiple sclerosis [18]. Although the synthesis of vitamin D in human body is significantly dependent on sunlight exposure, yet a number of global regions with best sunlight exposure have shown highest rates of vitamin D deficiency [19].About 2-3 million cases of non-melanoma skin cancer and 132,000 malignant skin cancers occur worldwide each year due to exposure to sunlight [20]. Alopecia areata (AA) is one of the main problems of vitamin D deficiency. AA is a common form of hair loss that is characterized with sharply demarcated, skin-colored patches of non-scarring alopecia. Study results support immune nature AA, including presence of other autoimmune diseases, presence of hair follicle-specific autoantibodies, or improvement after immunotherapy [8].

Saudi Arabia is one of the brightest countries in the world, and vitamin D deficiency has been widely reported in Saudi Arabia [21]. Level of vitamin D should be sustained ≥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 [22]. The etiology of vitamin D deficiency in Saudi women could be related to number of factors including residents of Saudi Arabia mostly practice indoor lifestyle due to very hot climate with scorching temperature. Moreover, direct exposure of sunlight to most body parts are restricted in Saudi population due to religious/cultural habits, as Muslims tend to keep their bodies covered in public. Additionally, in another study, almost 19% of Saudi girls were found to have no direct sun exposure, 67% were observed to have the direct sun exposure while 75% were reported to have an indirect exposure to sunlight [19]. Moreover, direct sun exposure to human body in Saudi female population was previously found to be limited because women tend to hide their entire bodies by wearing a special dress known as ”abaya” that covers from head to toe [19,23].

Comment [SA3]: Again, keep in discussion

1.1 Rationale of study

Vitamin D performs a crucial role in sustaining the homeostasis of different biological systems in the human body. One of the main roles of vitamin D is its involvement in uptake and use of minerals such as calcium and phosphorus. Another key role played by vitamin D is its function in development of skin and adnexa. Other vitamin D functions are involved in epidermal differentiation and, especially, in protection of hair follicle integrity [24,25].

However, lack of information, education and perception about the normal requirements of vitamin D by human body, enriched intake and supplementation practice towards vitamin D is leading to emergence of many diseases in Saudi population. Only a few studies have been conducted on the awareness of the vitamin D deficiency [24]. Therefore, it is need of time to perform a detailed study on the awareness of vitamin D deficiency and possible peril of hair loss amongst young female residents in Saudi Arabia.

1.Literature review

The role of the vitamin D3 receptor (VDR) in AA pathogens has also been evaluated. Fawzi et al showed tissue and serum VDR in AA significantly lower levels compared to the control group. A significant negative correlation was observed between AA and tissue VDR volume. The results are based on lime and others. The authors found that VDR expression was significantly lower than in intact skin in hair follicles and in Alzheimer's disease. Furthermore, VDR levels were lower in patients with severe hair loss. Decreased VDR expression in AA correlates with a decrease in hair follicle symptoms and N/β-catenin. The authors suggest that the decrease in VDR expression may be mainly related to the suppression of cell differentiation because the expression of sputum and sputum in hair follicles and epidermis is decreased [26–28].Since most of the studies were in adult patients, Unal et al. He has a special interest. The authors demonstrated vitamin D deficiency in pediatric patients in the AA and follow-up group. However, they reported significant relapses between serum 25(OH)D levels, disease severity and duration, and obesity. The authors note that vitamin D deficiency can exacerbate the disease and lead to severe hair loss [26].

Previously, Babelghaith et al. investigated the relationship among the knowledge, approach and exercise towards the management of vitamin D deficiency found among Saudi population [29]. They collected the cross-sectional data by conducting an online survey and applied descriptive statistics to analyze the collected data. It was found that about 98.4 percent of sampled population had perceived about vitamin D whereas most of the participants (91.0%) knew about the sun exposure being a significant source for vitamin D production. However, only 46.4 percent of participants showed interest in going out to sun for sunlight exposure and only a few participants thought to have sufficient sun exposure. Hence, it was concluded that insufficient information about vitamin D and less practice to get

vitamin D is main cause of the vitamin D deficiency. Thus, more efforts are required to establish public response for improvement of public knowledge and attitude in management of vitamin D deficiency.

In another study, Al-Faris reported vitamin D deficiency being a global nature of health condition, prevailing in the Middle East with female population being more affected [30]. Cross-sectional analysis was performed to establish relationship of vitamin D deficiency with predisposition elements in females living in Riyadh, Saudi Arabia. The parameters of the study were socio-demographic features, characteristics related to health and life style, selected intake of dietary supplements, weight and height. Descriptive statistical test was applied on the data that found that women with age 65 are more affected with vitamin D deficiency as compared to the younger females. It was also observed that old age females were taking the vitamin D supplements and multi-vitamins/calcium supplements were acknowledged as factors related to lower risk of hypovitaminosis D. This study recommended that a national strategy is essential to control a prospective hypovitaminosis D disaster in Saudi Arabia. Further, this study also elaborated that vitamin D deficiency risks factors in Saudi women can be managed by increasing the public awareness related to vitamin D, availability of more efficient vitamin D supplementation and widespread vitamin D screening protocols.

Likewise, Gerkowicz et al. investigated the problem of hair loss due to the deficiency of the vitamins D in the women [26]. They explained that hair loss without scar is a general dilemma equally affecting both the male and female members of population. Alopecia, or hair-fall can be caused by any change in the hair follicle cycle and the potential role of vitamin D deficiency in alopecia has been investigated in several studies. In this study, existing literature related to the role of vitamin D in alopecia areata and female pattern hair loss was reviewed by the authors. It was stated that vitamin D and its receptor are main mediators involved in maintenance of skin homeostasis as well as calcium homeostasis. Moreover, deficiency of vitamin D is described to be major cause of hair loss in men and women. Also, vitamin D was found to be one of the main factors that normalize the cutaneous innate and adaptive resistance. The authors concluded that vitamin D supplementation can be used as a therapeutic strategy for patients manifesting alopecia areata, telogen, or female pattern hair loss effluvium. Moreover, further studies on a larger group of patients were suggested.

Furthermore, Abdullah A. et al. also reported vitamin D deficiency being an international medical problem and it has primary relation to a lot of other diseases such as bone disorders, Alzheimer‘s disease, multiple sclerosis, alopecia, and obesity [8]. The authors reported an increasing trend of vitamin D deficiency in the local population of Saudi Arabia, which can be controlled by increased knowledge, awareness and education about the disorders and causing factors. This study was performed to measure the knowledge and routine practice of adult inhabitants related to vitamin D deficiency and associated risk of hair loss by collecting cross-sectional data from Majmaah city and nearby villages, Riyadh, Saudi Arabia, through developing a questionnaire. They observed that most of the study participants were aware about vitamin D though media as a major source of information. Approximately 17% believed that there is connection between hair loss and vitamin D deficiency. This study concluded that the deficiency of the vitamin D is major cause of the hair loss and other problems, thus, there is a dire need of awareness in local population of Saudi Arabia.

Comment [SA4]: Abbreviate to what is essential for background & rationale… too long for journal readers.

2.Aims and objectives of the Study:

To assess Knowledge and practice of vitamin D deficiency and risk of hair loss among adult female population in Saudi Arabia

Comment [SA5]: in relation to hair loss, identify practices used to obtain the vitamin and identify any demographic, residential, chronological or educational differences among the participants.

1.Specific objectives:

- To assess the level of knowledge and awareness regarding vitamin D deficiency and associated hair loss among adult female population in Saudi Arabia.
- To assess practices related to vitamin D deficiency among adult female population in Saudi Arabia.
- To identify differences between various groups (based on participants' demographics such as age, residence, education) regarding knowledge and practices about vitamin D deficiency and risk of hair loss.

Comment [SA6]: Delete

2. Materials and Methods:

2.1. Study Area/Setting

The sample was selected by contacting participants via social media platforms (WhatsApp, Facebook, Twitter, Telegram, etc.).

2.2. Study Subjects:

The study was conducted on selected sample of adult females who are residing in Saudi Arabia at the time of study period. The study included both Saudi and non-Saudi national females with age criteria being set at greater than 16 years. The only exclusion criteria are healthcare worker females

Comment [SA7]: Why?

2.3. Study Design:

This is an observational, cross-sectional, descriptive, community based study.

3.4. Sample Size:

The sample size was determined using Epi Info 7 software with following parameters being taken into consideration

2.Confidence interval = 95%

3.Acceptable margin of error = 5%

4.Expected frequency(lack of awareness of the relationship between vitamin D deficiency and hair loss) = 83% (Based on Alotaibi AA study [8])

5.Population size=Based on Saudi General Authority of Statistics in 2018,total Saudi / Non-Saudi female population who are > 15 years is 10,138,222.

6.Sample size = 384 subjects

7.The survey form was available online until the required sample size is achieved.

Comment [SA8]: Include a copy in English as a JPEG

2.5. Sampling Technique:

Non-random convenience sampling techniques was deployed to selected study participants**.**

2.6. Data Collection Methods, Instrument Used, Measurements:

Data was collected utilizing an electronic, self-administered, author designed, pre-tested, close-ended questionnaire to obtain information about demographic data, knowledge and practice of vitamin D deficiency and risk of hair loss. The questionnaire will consist of three sections; the first section was enquiring about information regarding demographic and participants' characteristics (age, residence, education, skin color), the second part was asking about knowledge related to vitamin D deficiency, whereas third part was collecting information on practices regarding vitamin D deficiency and hair loss. The questions were originally synthesized in English language, and later, was translated to Arabic language and back to English language

by two independent certified English language speakers to avoid translation bias. The questionnaire was pre-tested in individuals with the same characteristics as those of the target population, to improve readability and relevance of the content, followed by adjustments as required. The average time needed to fill the questionnaire is 10 minutes.

Comment [SA9]: If a copy of the questionnaire is provided, this section can be disregarded

8.7. Data Management and Analysis Plan:

Data was coded, entered and analyzed using Statistical Package for Social sciences (SPSS) software version 24. Quantitative categorical variables were analyzed and presented as frequencies and percentages, while continuous data was reported as means and standard deviations (SD). In addition, one way ANOVA test and independent T test were used to explore differences between proportions of study groups. Knowledge score was devised and calculated such that for every positive response was awarded 1 point and every negative response was awarded 0 point.

Comment [SA10]: Qualitative !!!!

Comment [SA11]: How about chi square test for QUALITATIVE data?

Practice scores was devised and calculated such that every positive response was awarded 1 point and every negative response was awarded 0 point and the responses "Yes/sometimes/No" were given the scores of 2/1/0 respectively, "usually/sometimes/rarely" were given the scores of 3/2/1 respectively and the scores were inversed for the question (11) the responses "usually/sometimes/rarely/never" were given score of 1/2/3/4. The sum of total points was used to describe the overall level of knowledge and practice regarding vitamin D deficiency. As decisive criteria, p-value < 0.05 was regarded as the cut-off for statistical significance in all assessments.

Comment [SA12]: A simple table or graph of the questionnaire and the scoring system can summarize all this

9.8. Ethical Considerations:

Ethical approval was obtained from the ethical committee of King Abdullah International Medical Research Center. Informed consent was obtained from each participant after explaining the aims and benefits of the study.

Results

The present study included 810 adult females. The age groups of the participating females were as follows: 18 to 25 years (41.6%), 26 to 35 years (39.5%), 36 to 45 years (9.5%), 46 to 55 years (7.3%) and more than 55 years (2.1%). Saudi individuals were the most dominant (n=740, 91.4%), while non-Saudi individuals were 70 (8.6%) only.

Comment [SA13]: Too many for the calculated sample size!!!

Most of participants were from central region (n=589, 72.7%) while 105 (13%) were from western region and 100 (12.3%) from eastern region. The majority of the participants were single during the time of this study (42.6%) while the others were: married (33.7%), divorced (22.3%) and widowed (1.4%). Baseline characteristics of the participants are shown in Table 1.

Table 1: Socio-demographic characteristics of the study participants (*n*=810)

Variable	Category	Frequency	Percent
Age in years	18-25	337	41.6%
	26-35	320	39.5%
	36-45	77	9.5%
	46-55	59	7.3%
	≥ 56	17	2.1%
Nationality	Saudi	740	91.4%
	Non-Saudi	70	8.6%
Residency Region	Central Region	589	72.7%
	Western Region	105	13%
	Eastern Region	100	12.3%
	Northern Region	12	1.5%
	Southern Region	4	0.5%
Marital status	Single	345	42.6%
	Married	273	33.7%
	Divorced	181	22.3%
	Widow/er	11	1.4%

Comment [SA14]: A woman is called widow whereas a man is called a widower. Please correct or explain.

Knowledge about Vitamin D deficiency & risk of hair loss

The vast majority of the participants (96%) have heard about vitamin D while only 32 (4%) did not know about it. The most common source of participants' information about vitamin D was

relatives and friends representing 452 (55.8%), followed by health care professionals 411 (50.7%), then internet 377 (46.5%), media 270 (33.3%) and other different sources 117 (14.4%).

This study revealed that 488 (60.2%) of participants correctly knew at least one source of vitamin D without giving any wrong answers. The most reported vitamin D source was the sunlight (77.5%), followed by fish (56.8%), eggs (44.8%), and then milk (28.6%).

When asked about the Benefits of vitamin D, 553 (68.3%) correctly knew that vitamin D strengthening the bones, 363 (44.8%) knew that it regulates calcium level, 272 (33.6%) knew it improves memory and 166 (20.5%) correctly knew that vitamin D reduce cardiovascular diseases.

In addition, 398 (49.1%) correctly knew at least one cause of vitamin D deficiency without giving any wrong answers. Regarding the causes of vitamin D deficiency, the most common correct answer was lack of sun exposure (77.9%) followed by unhealthy diet (59.3%), wearing excessive clothes (25.9%), use of excessive sunscreen products (25.4%) and inflammatory bowel diseases (7.4%).

379 (46.8%) of the participants correctly knew complications of vitamin D deficiency without giving any wrong answers. The most reported vitamin D deficiency complications were osteoporosis (72.8%), followed by hair loss (70.2%), and then depression (63.1%). 503 (62.1%) of the participating females correctly knew that there is a relationship between vitamin D deficiency and hair loss, 188 (23.2%) thought that there is no relationship while 119 (14.7%) did not know or did not have any opinion (Figure 1).Details of the participants' knowledge are shown in Table 2.

Table 2: Knowledge about Vitamin D deficiency & risk of hair loss

	N	%
1. Have you ever heard about vitamin D?		
Yes	778	96%
No	32	4%

2. Source of your information about vitamin D :		
Health care professionals	411	50.75
Media	270	33.3%
Relatives & friends	452	55.8%
Internet	377	46.5%
Others	117	14.4%
I never heard of it	32	4%
3. Sources of vitamin D:		
Sunlight	628	77.5%
Fish	460	56.8%
Eggs	363	44.8%
Milk	232	28.6%
Water	167	20.6%
Apple	224	27.7%
I don't know	46	5.7%
4. Benefits of vitamin D:		
Reduction of cardiovascular diseases	166	20.5%
Regulation of calcium level	363	44.8%
Strengthening the bones	553	68.3%
Improvement of memory	272	33.6%
Treatment of stomach cancer	176	21.7%
Treatment of irritable bowel syndrome	277	34.2%
Stop bleeding	125	15.4%
Reduction of muscle pain	357	44.1%
I don't know	29	3.6%
5. Causes of vitamin D deficiency:		
Unhealthy diet	480	59.3%
Use of excessive sunscreen products	206	25.4%
Wearing excessive clothes	210	25.9%
Lack of sun exposure	631	77.9%
Inflammatory bowel diseases	60	7.4%
Diabetes mellitus	188	23.2%
Thyroid diseases	275	34%
Hypertension	93	11.5%
6. Vitamin D deficiency may lead to:		
Depression	511	63.1%
Hair loss	569	70.2%
Osteoporosis	590	72.8%
Eczema	121	14.9%
Obesity	206	25.4%
Gastric ulcer	176	21.7%
Development of many cancers	78	9.6%
Acne vulgaris	166	20.5%
Blindness	11	1.4%

Comment [SA15]: Table would be more appreciated if data were presented in decreasing frequencies

Practices related to Vitamin D deficiency

Regarding practice toward vitamin D deficiency, there were 222 (27.4%) participants who reported that they perform the physical activity as individuals with the same age, while 365 (45.1%) reported less activity and 223 (27.5%) reported more activity. There were 216 (26.7%) participants who reported that they expose themselves to sunlight, and 726 (89.6%)reported exposure duration of less than 20 minutes. The majority of participants 268 (33.1%) reported that they sometimes use sunscreen and 208 (25.7%) rarely use it. 559 (69%) said that they sometimes eat food containing vitamin D, and there were 324 (40%) participants who were administrating vitamin D supplements. Details of the participants 'practice are shown in Table 3.

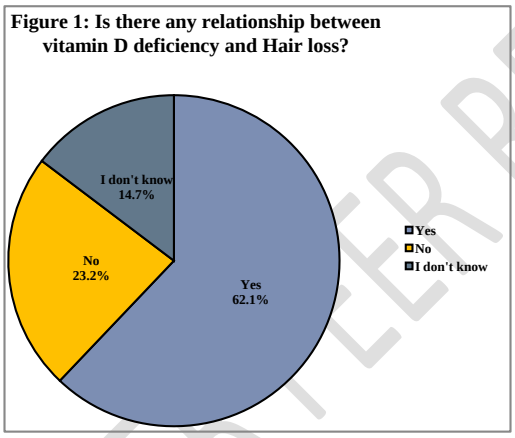

Table 3: Practice regarding Vitamin Ddeficiency

Practice of Vitamin D deficiency	N	%
8. Compared to other people your age, would you say you are physically more active, less active, or about as active?		
More active	223	27.5%
Less active	365	45.1%
About as active	222	27.4%
9. Do you expose to sunlight daily?		

Yes No Sometimes	216 436 158	26.7% 53.8% 19.5%
10. How many minutes do you expose to sunlight daily?		
< 20 minutes > 20 minutes	726 84	89.6% 10.4%
11. Do you use sunscreen products?		
Usually Sometimes Rarely Never	170 268 208 164	21% 33.1% 25.7% 20.2%
12. Do you usually eat food containing vitamin D (fish, egg yolk, milk, cheese, and yogurt)?		
Usually Sometimes Rarely	143 559 108	17.7% 69% 13.3%
13. Do you take vitamin D supplements?		
Yes No	324 486	40% 60%

Comment [SA16]: Same as previous comment

The overall knowledge and practice scores are shown in Table 4. Regarding knowledge, the mean score of participants was 9.4 ± 2.80 out of 18, with a minimum score of 3 and a maximum score of 16. The mean practice score was found to be 6.7 ± 1.41 out of 12, with a minimum score of 3 and a maximum score of 10.

Table 4: Total knowledge and practice scores

	Mean	SD	Minimum	Maximum
Knowledge score	9.4	2.80	3	16
Practice score	6.7	1.41	3	10

Factors associated with knowledge and practices about vitamin D deficiency and risk of hair loss:

One way ANOVA test and independent samples T test were performed to identify differences between various groups (based on participants' demographics: age, nationality, residence, marital status) regarding knowledge and practices about vitamin D deficiency and risk of hair loss.

Regarding knowledge score, a statistically significant association ($p < 0.05$) was found with the following factors: age, nationality, residence and marital status. The comparison demonstrated that participants who aged 26 to 35 years had a significantly higher score (10.7 ± 2.22) while who aged 56 years or older had the lower score compared to other age groups (*P=0.000*). Also, Saudi Arabian nationals showed a higher score (9.4 ± 2.76) compared to non-Saudi (*P=0.026*). Participants who resident in northern region and married participants had a significantly higher score compared to other groups (*P=0.000*).

Regarding practice score, a statistically significant association ($p < 0.05$) was found with the following factors: age, nationality, residence and marital status. The comparison demonstrated that participants who aged 56 years older had a significantly higher practice score (8.4 ± 0.51) compared to other age groups (*P=0.000*). Also, non-Saudi Arabian nationals showed a higher score (7.1 ± 1.63) compared to Saudi (*P=0.032*). Participants who resident in eastern region or western and widowed participants had a significantly higher score compared to other groups (*P=0.000*). All comparisons are detailed in Table 5.

Table 5: knowledge and practices about vitamin D deficiency and risk of hair loss among various groups based on participants' demographics

Variable	Knowledge Score			Practice Score		
	Mean	SD	P value	Mean	SD	P value
Age in years						
18-25	8.6	2.76	**0.000**	6.6	1.72	**0.000**
26-35	10.7	2.22		6.8	1.06	
36-45	8.8	1.37		6.7	1.20	
46-55	9.1	3.37		6.9	1.16	
≥ 56	3.4	0.51		8.4	0.51	
Nationality						
Saudi	9.4	2.76	**0.026**	6.7	1.38	**0.032**
Non-Saudi	8.5	3.16		7.1	1.63	
Residence						

Central Region	9.4	2.94	**0.000**	6.6	1.33	**0.000**
Western Region	9.9	2.54		7.2	1.74	
Eastern Region	8.1	1.44		7.3	1.09	
Northern Region	13.0	1.48		6.3	1.97	
Southern Region	10.5	0.58		7.0	0.00	
Marital status						
Single	9.2	3.13	**0.000**	6.4	1.40	**0.000**
Married	9.8	2.71		7.2	1.52	
Divorced	9.1	1.94		6.6	.87	
Widow/er	6.6	3.53		9.0	0.00	

Comment [SA17]: Summarize table by presenting figures as Mean±SD (e.g. 8.6±2.76)

Discussion:

Vitamin D deficiency is a global problem related to public health causing multiple disorders, for example rickets, osteoporosis (weak bones) and osteomalacia. Lack of information, education and perception about the normal requirements of vitamin D is leading to emergence of many diseases in Saudi population. We aimed to assess Knowledge and practice of vitamin D deficiency and risk of hair loss among adult female population in Saudi Arabia.

This study among Saudi female in Saudi Arabia showed that female had an average knowledge score about vitamin D and low knowledge for older and younger participants. Also, we found good practice toward vitamin D among included female, and there is difference in knowledge score according to age, nationality, residence and marital status.

Vitamin D is considered an essential vitamin for prevention from several diseases that affecting bone. In this study, a 96% of total female heard about vitamin D which is considered a high percentage and good indicator that female was aware about the importance of vitamin D. A previous study in Saudi Arabia among adult people found 80% of total participants heard about vitamin D and knew it [8], and this considered a high percentage and closer to our results. Other study among population also reported similar results [29].

Regarding the sources of information for vitamin D, our study identified Relatives & friends followed by health workers as the most common source of information. But in other previous study among population in Saudi Arabia, media (35%) then heath care professionals (28%) were the most common source of information [8], and this give a valuable information that most of female liked to hear information about vitamin D from relatives.

For the knowledge of vitamin D in our study, the overall score was 9.4 ±2.80, and majority of participants answered sunlight followed by fish as the source for taking vitamin D, and 68.3% said that vitamin D would strengthen their bones. Also, they identified lack of sun exposure as main cause for vitamin D deficiency, and hair loss (70.2%) and osteoporosis (72.8%) were identified as the endpoint for vitamin D by most of participants.

The overall practice of vitamin D was 6.7 ±1.41 in our study, and only 26.7% of total participants were exposing to sun, and half of them use sunscreen product usually and sometimes. Only 40% were taking vitamin D supplement. In Saudi Arabia, 40.7 % of adult population were found exposing to sun, and more than 67.8% were not using any kind of skin product [8].

As we know, involving in educational program would make a good impact in improving the knowledge and practice of vitamin D. Among 271 participants,educational intervention programs were found effective in increasing dietary intake of vitamin D [31].

Our study assessed the knowledge and practice toward vitamin D and hair loss among Saudi female in Saudi Arabia. Getting Data about vitamin D is important to know the age distribution and places for low knowledge and practice among female which fasten the intervention by ministry of health and local authority to show the importance of vitamin D for prevention from diseases caused by vitamin D deficiency.

Regarding limitations, this study included only Saudi female to assess their knowledge and practice toward vitamin D without any response from male. Thus, we can‘t generalize the result and know the knowledge and practice for Saudi male. Also, the attitude toward vitamin D was not measured among the participants.

Conclusion:

The results for this study showed an average knowledge about vitamin D among Saudi female, and good practice toward vitamin D. Also, a difference in knowledge score were found according to age, nationality, residence and marital status.About two third of the participants knew that there is a relationship between vitamin D deficiency and hair loss.

The knowledge of vitamin D should be enhanced to decrease the incidence of diseases caused by vitamin D deficiency. According to age distribution of included participants, younger and older age female of included were having low knowledge score; thus, we they need an attention to enhance their knowledge toward vitamin D. Further research should investigate effective strategies to improve vitamin D knowledge and include a larger sample with representation of all subgroups of the Saudi Arabia population to confirm these results.

References:

1. Almohanna HM, Ahmed AA, Tsatalis JP, Tosti A. The Role of Vitamins and Minerals in Hair Loss: A Review. *Dermatol Ther (Heidelb).* 2019;9(1):51-70. doi:10.1007/s13555-018-0278-6

2. Antonucci R, Locci C, Clemente MG, Chicconi E, Antonucci L. Vitamin D deficiency in childhood: old lessons and current challenges. *J Pediatr Endocrinol Metab.* 2018;31(3):247-260. doi:10.1515/jpem-2017-0391

3. Chang S-W, Lee H-C. Vitamin D and health - The missing vitamin in humans. *Pediatr*

Neonatol. 2019;60(3):237-244. doi:10.1016/j.pedneo.2019.04.007

4. Hossein-nezhad A, Holick MF. Vitamin D for Health: A Global Perspective. *Mayo Clin Proc*. 2013;88(7):720-755. doi:10.1016/j.mayocp.2013.05.011

5. Bischofova S, Dofkova M, Blahova J, et al. Dietary Intake of Vitamin D in the Czech Population: A Comparison with Dietary Reference Values, Main Food Sources Identified by a Total Diet Study. *Nutrients*. 2018;10(10):1452. doi:10.3390/nu10101452

6. Vieth R, Kimball S. Vitamin D in congestive heart failure. *Am J Clin Nutr*. 2006;83(4):731-732. doi:10.1093/ajcn/83.4.731

7. Holick MF. Vitamin D Deficiency. *N Engl J Med*. 2007;357(3):266-281. doi:10.1056/NEJMra070553

8. Alotaibi A, Alsalhi W, Almutairy A, et al. Knowledge and practice of Vitamin D deficiency and risk of hair loss among adult population in Majmaah city, Saudi Arabia. *Int J Med Dev Ctries*. Published online 2019:173-178. doi:10.24911/IJMDC.51-1541624780

9. Masood SH, Iqbal MP. Prevalence of vitamin D deficiency in South Asia. *Prof Med Publ*. 2008;24(6):891-897. https://www.pjms.com.pk/issues/octdec208/article/reviewarticle1.html

10. Grant WB. An estimate of premature cancer mortality in the U.S. due to inadequate doses of solar ultraviolet-B radiation. *Cancer*. 2002;94(6):1867-1875. doi:10.1002/cncr.10427

11. Kaddam IM, Al-Shaikh AM, Abaalkhail BA, et al. Prevalence of vitamin D deficiency and its associated factors in three regions of Saudi Arabia. *Saudi Med J*. 2017;38(4):381-390. doi:10.15537/smj.2017.4.18753

12. Al-Faris N. High Prevalence of Vitamin D Deficiency among Pregnant Saudi Women. *Nutrients*. 2016;8(2):77. doi:10.3390/nu8020077

13. Babli A, Khamis A, AlDawood K. Knowledge, attitude, and practice of general practitioners in Dammam, Saudi Arabia towards Vitamin D supplementation to infants. *J Fam Community Med*. 2015;22(3):135. doi:10.4103/2230-8229.163025

14. Glerup H, Mikkelsen K, Poulsen L, et al. Commonly recommended daily intake of

vitamin D is not sufficient if sunlight exposure is limited. *J Intern Med*. 2000;247(2):260-268. doi:10.1046/j.1365-2796.2000.00595.x

15. Lappe JM, Travers-Gustafson D, Davies KM, Recker RR, Heaney RP. Vitamin D and calcium supplementation reduces cancer risk: results of a randomized trial. *Am J Clin Nutr*. 2007;85(6):1586-1591. doi:10.1093/ajcn/85.6.1586

16. Hyppönen E, Läärä E, Reunanen A, Järvelin M-R, Virtanen SM. Intake of vitamin D and risk of type 1 diabetes: a birth-cohort study. *Lancet*. 2001;358(9292):1500-1503. doi:10.1016/S0140-6736(01)06580-1

17. Pittas AG, Lau J, Hu FB, Dawson-Hughes B. The Role of Vitamin D and Calcium in Type 2 Diabetes. A Systematic Review and Meta-Analysis. *J Clin Endocrinol Metab*. 2007;92(6):2017-2029. doi:10.1210/jc.2007-0298

18. Mahon B., Gordon S., Cruz J, Cosman F, Cantorna M. Cytokine profile in patients with multiple sclerosis following vitamin D supplementation. *J Neuroimmunol*. 2003;134(1-2):128-132. doi:10.1016/S0165-5728(02)00396-X

19. Siddiqui AM, Kamfar HZ. Prevalence of vitamin D deficiency rickets in adolescent school girls in Western region, Saudi Arabia. *Saudi Med J* . 2007;28(3):441-444. https://pubmed.ncbi.nlm.nih.gov/17334476/

20. Lucock M, Jones P, Martin C, et al. Vitamin D. *J Evid Based Complementary Altern Med*. 2015;20(4):310-322. doi:10.1177/2156587215580491

21. Al-Elq A. 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. doi:10.4103/2230-8229.98293

22. Hoel DG, Berwick M, de Gruijl FR, Holick MF. The risks and benefits of sun exposure 2016. *Dermatoendocrinol*. 2016;8(1):e1248325. doi:10.1080/19381980.2016.1248325

23. Al Faraj S, Al Mutairi K. Vitamin D Deficiency and Chronic Low Back Pain in Saudi Arabia. *Spine (Phila Pa 1976)*. 2003;28(2):177-179. doi:10.1097/00007632-200301150-00015

24. Rhodes LE, Webb AR, Fraser HI, et al. Recommended Summer Sunlight Exposure Levels

Can Produce Sufficient (≥20ngml−1) but Not the Proposed Optimal (≥32ngml−1) 25(OH)D Levels at UK Latitudes. *J Invest Dermatol*. 2010;130(5):1411-1418. doi:10.1038/jid.2009.417

25. 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-e29. doi:10.1111/j.1756-185X.2011.01624.x

26. 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):2653. doi:10.3390/ijms18122653

27. 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):318-323. doi:10.1111/jocd.12224

28. Lim YY, Kim SY, Kim HM, 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):368-375. doi:10.1111/ced.12241

29. Babelghaith S, Ali W, Al-Zaaqi MA, et al. Knowledge and practice of vitamin d deficiency among people lives in riyadh, saudi arabia-a cross-sectional study. *Biomed Res*. 2017;28:3114-3118. https://www.researchgate.net/publication/316986645

30. AlFaris NA, AlKehayez NM, AlMushawah FI, AlNaeem AN, AlAmri ND, AlMudawah ES. Vitamin D Deficiency and Associated Risk Factors in Women from Riyadh, Saudi Arabia. *Sci Rep*. 2019;9(1):20371. doi:10.1038/s41598-019-56830-z

31. Park K-S, Yoo J-I, Kim H-Y, Jang S, Park Y, Ha Y-C. Education and exercise program improves osteoporosis knowledge and changes calcium and vitamin D dietary intake in community dwelling elderly. *BMC Public Health*. 2017;17(1):966. doi:10.1186/s12889-017-4966-4