

Effect of Educational Program on Women Knowledge Regarding Vitamin D Deficiency at Assiut City

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Abstract:

Background: Prevention of vitamin D deficiency is a public health priority, as it has severe and long lasting consequences on general health of children and women. **Aim:** To evaluate the effect of educational program on women knowledge regarding vitamin D deficiency. **Subjects and Methods:** Quasi-experimental (Pre-post-test) research design was applied on 300 women in Maternal and Child Health centers. **Tool: Part (1):** Personal data, **Part 2 and 3:** Women's knowledge regarding vitamin D deficiency among women and children. **Results:** the present study showed that 47.3%, 44.3% and 39.7% of women gave incorrect answer about the sources of vitamin D, the benefits and its role for women and vitamin D benefits for children in pretest respectively; which improved in posttest p-values= 0.001. There were statistical significance differences between women knowledge regarding vitamin D with their age, educational level and marital status in pretest while there weren't in post program. **Conclusion:** Existence of inadequate level of knowledge regarding vitamin D deficiency, maternal knowledge was significantly affected by age, educational level, marital status and religion. The educational program improved knowledge regarding vitamin D among women. **Recommendations:** Educational campaigns and health promotion programs targeted women to increase knowledge about adequate intake of vitamin D.

Keywords: *Deficiency, Educational program, Knowledge, Vitamin D & Women.*

Introduction:

Acrucial strategy to realize the Sustainable Development Goals (SDGs) is maintaining healthy diets from sustainable food systems that support the human condition. While nutritional patterns are not mentioned in the SDGs, the providing of sustainable diets is critically important to multiple SDGs. Micronutrient deficiencies containing vitamin D remain to be challenges in all regions all over the world on the planet including low, middle and high-income countries with especial effecting on women and children (Fanzo, 2019 & de Romaña et al, 2021).

Vitamin D is a fat-soluble "sunshine vitamin". It is formed when ultra-violet from the sun strikes the skin. Vitamin D Deficiency (VDD) is a broadly prevalent dietary problem that has reached epidemic proportions around the world, with an expected one billion people suffering from deficiency or insufficiency of vitamin D. It was shown that between 25.7% and 77.2% of the Egyptian infants and women (pregnant and non-pregnant) had vitamin D 2 inadequacy (Soliman et al, 2020, Manandhar et al, 2020 & National Institutes of Health, 2020).

Vitamin D is critical for preserving bone health. Also, it is vital in maintaining cardiovascular health and

preventing chronic diseases. It is present in a diversity of foods as: Fatty seafood like (salmon, tuna and mackerel), beef liver, cheese and egg yolk. VDD can be caused by a lot of factors; including an increasing indoor lifestyle that prevents enough exposure to sunlight. Low dietary intake is a result of changing eating patterns. Fiber-rich diets contain phytates and phosphates, which can deplete vitamin D reserves and raise calcium requirements. Pregnancies that are not spaced and unplanned in women who have a nutritional deficiency can lead to a worsening of vitamin D status in both the mother and the child (Aparna et al, 2018, Elsobkey and Amer, 2019, Hashem et al, 2020; Aghaei et al, 2021 & Mortensen et al, 2022).

Vitamin D deficiency has been shown to affect up to 40% of pregnant women even in the sun-rich places and it is also quite prevalent and severe during lactation. During pregnancy, vitamin D shortage and inadequacy are highly frequent, with rates ranging from 96.0% to 99.4 % and low maternal vitamin D levels have been linked to a two-fold increased risk of congenital heart defects in offspring, as well as a higher rate of fetal miscarriage, gestational diabetes, bacterial vaginosis and perinatal depression in

mothers, in addition to stunted fetus and childhood growth (Ates et al., 2016, Hong-Bi et al, 2018 and Fogacci et al, 2019 & Siddiquee et al, 2022).

Professional health nurses play a significant role in the prevention of VDD as numerous readings from different parts of the world show that knowledge, attitude and behavior play an essential role in influencing the major risk factors leading to VDD or inadequacy. Through health education nurses can take urgent steps to create awareness about VDD and instruct mothers about sources of vitamin D and importance of sun exposure because it is not possible to obtain a sufficient amount of vitamin D from dietary sources only (Çiçek et al, 2015, Lhamo et al, 2017, Kamel et al, 2017 & AlFaris et al, 2019).

Significance of the study:

Internationally, VDD is a global health problem in both children and women and is considered an epidemic. It is a significant public health problem in both developed and developing countries, including The Middle East and North African region which includes Egypt has a very high rate of vitamin D deficiency which reaches 81% among various age 3 groups. Prevalence of VDD in Egypt has reached epidemic proportions especially among Egyptian females. In Egypt, a study conducted on population of 5046 persons found that (34.3%) of females and (10.9%) of males were had severe VDD (Botros et al, 2019, Abdel Nabi et al, 2020 & Mangaiyarkarasi et al, 2021).

Many studies show that there is lack of knowledge regarding role of vitamin D and sources in several countries which leading to potential risk factors. Complications of VDD are preventable during antenatal period if the mother is enriched with vitamin D knowledge along with antenatal nutritional education program. Community health and gynecological nurses are having an essential function in generating meaningful understanding of VDD (Aljefree et al, 2017 and Alamoudi et al, 2019 & Abdel Nabi et al, 2020).

Aim of the study:

To evaluate the effect of educational program on women knowledge regarding vitamin D deficiency

Research hypothesis:

Alternative hypothesis (H1):

There will be expected significant differences between the mean score of women knowledge pre and post program regarding VDD with significant association between the pre-test knowledge score with selected personal variables.

Subjects and Method:

Research design: An evaluative approach with Quasi-experimental (pre-post-test) design was adopted in this study.

Settings: The total number of Maternal and Child Health centers (MCH) in West and East Assiut City is five centers; these MCH providing care and services for expectant mothers in the City of Assiut as antenatal care, vaccinations for mothers and their children, family planning services, laboratory tests, premarital screening and health education. This research performed at three MCH centers namely: Qulta, Gharb albalad and Eliarbaeayn center, which selected by random sample technique; through closed envelope method; 5 pieces of paper were representing MCH centers which were placed in 5 envelopes; one piece in each envelope, which were placed in a box, then three envelopes were chosen without any bias.

Sampling and sample size calculation:

A convenience sample of 300 women was selected using the following formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where 'n' is sample size.

'N' is total number of all mothers attended to previously mentioned settings in the last six months at 2020.

N=5355

'e' is Coefficient factor= 0.05

Sample size is estimated to be 372. The actual total sample was 300. This dropout was due to Corona virus disease 19 pandemic which limited the number of respondents in MCH.

Tool of the study:

An interviewing questionnaire was used to collect data in pre and post-program. The questionnaire was designed by the researchers after reviewing related literature; it consisted of three parts:

Part (1): Personal data of the studied women as: Age, religion, educational level, marital status, occupation, residence and reasons for visiting the MCH center.

Part (2): Women's knowledge regarding VDD in women such as: Vitamin D benefits for women, the best time to be exposed to the sun, body parts that should be exposed to the sun, causes of VDD in women, diseases of VDD and symptoms of VDD in women and prevention of VDD.

Part (3): Women's knowledge regarding VDD in children such as: Benefits of Vitamin D for children, parts of the body should be exposed to the sun, the right time to be exposed to the sun, causes of VDD among children, diseases result from VDD in children, symptoms of VDD in children and prevention of VDD.

Scoring system of the tool:

The scoring system for women's knowledge was calculated as the following: (2) scores for complete answer, (1) score for incomplete answer and (0) for

wrong answer or didn't know. For each area of knowledge, the score of the items was summed-up and the total divided by the number of the items, giving a mean score for this part. These scores were converted into a percent score. The total knowledge score was considered **Good** if the score $\geq 75\%$, **Faire** 50 -< 75% and **Poor** < 50% (Ibrahima & Abd El-Maksoud, 2018). 5

Face Validity: Tool was evaluated by five experts from Community Health and Obstetric Health Nursing Departments, Faculty of Nursing, Assiut University the required modifications were done after their review of the tool.

Reliability: The reliability was done by calculating Cronbach's Alpha which was 0.871.

Method:

Administrative phase: An official letter approval obtained from the Dean of the Faculty of Nursing, Assiut University to the Undersecretary Ministry of Health at Assiut Governorate to conduct the study after full explanation of study aim. The letter involved agreement to perform the study at MCH centers at Assiut City.

Ethical considerations: All ethical issues related to research were addressed according to Ethical Review Committee in Faculty of Nursing, Assiut University. Each participant was given a full explanation of the study objectives before enrollment. Participants were assured of the confidentiality of their responses. Informed consent was taken and confidentiality of collected information was ensured. There was no risk for study subjects during application of the research. Study subjects have the right to refuse to participate or withdraw from the study without any rational at any time.

Pilot study: It was conducted on 10% (30) women who included in the study because there weren't any modifications. The aim of the pilot study was to evaluate clarity, simplicity, applicability of tool as well as to determine the time allowed to fulfill the developed tool.

Teaching methods and materials: The researchers used lectures and discussion as a method of teaching and giving simple Arabic booklet handouts suit mothers' level of understanding which were distributed to every mother at the end of the program.

-Sessions: The contents of the program were divided into two sessions: session one: It was composed of teaching women concerning several aspects of VDD such as: Sources of vitamin D, importance of sun exposure, causes of VDD in women and children and prevention of VDD. Session two: For post program evaluation.

Implementation phase: The researchers visited the previously mentioned settings two days/week (Saturday and Sunday) 9.00 Am to 2.00 Pm. The

educational program was conducted for six months; every mother took two sessions one session to complete the program contents and the second session to perform the post program test.

Evaluation phase: Two months later; the researchers arranged with the same participants through telephone call the time when they will come to the MCH for follow-up visit to perform the post program test and evaluate their knowledge using the same pretest questionnaire.

Field work: Data collection started from the first of January 2020 until the end of June 2020 for 6 months. The researchers met women in the three previously mentioned MCH centers, two days/week with average number of 12-13 women were met per day; each interview took about 20:30 minutes. During the first contact with women; the researchers introduced themselves, explained all information about the study purpose, duration and activities along with taken oral consent. In the first contact with the researchers filled out the structured form and pretest was done then the researchers explicated the contents of the educational program and gave handout booklet for all the participated women.

Statistical analysis:

The data was tabulated and analyzed using SPSS V.20. The data was tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Descriptive data was analyzed by calculation of mean value and SD for quantitative data, whereas frequency and percentage were used for qualitative data, which were analyzed using Chi-square test and fisher exact test used to compare between two independent qualitative variables, where compare between two independent quantitative variables by t-test \and ANOVA TEST and Multivariate linier regression. A two-tailed $p < 0.05$ was considered statistically significant.

Results:**Table (1): Distribution of the studied women regarding their personal data at Assiut City**

Items	No (n=300)	%
Age (years):		
Less than 25 year	47	15.7
25-30 year	74	24.7
30-35 year	78	26.0
More than 35 year	101	33.7
Mean \pm SD(range)	32.71 \pm 6.45(18-48)	
Educational level:		
Illiterate	15	5.0
Read and write	19	6.3
Primary education	12	4.0
Preparatory education	17	5.7
Secondary education	60	20.0
High Institutes	66	22.0
University education	104	34.7
Post graduate education	7	2.3
Marital status:		
Single	38	12.7
Married	246	82.0
Divorced	7	2.3
Widow	9	3.0
Occupation:		
Working	118	39.3
Not working	182	60.7
Religion:		
Muslim	262	87.3
Christian	38	12.7
Reasons for visiting the MCH center:		
Follow-up of pregnancy	40	13.3
Follow-up of the child	84	28.0
Using of family planning method	121	40.3
Immunization of the child	55	18.3

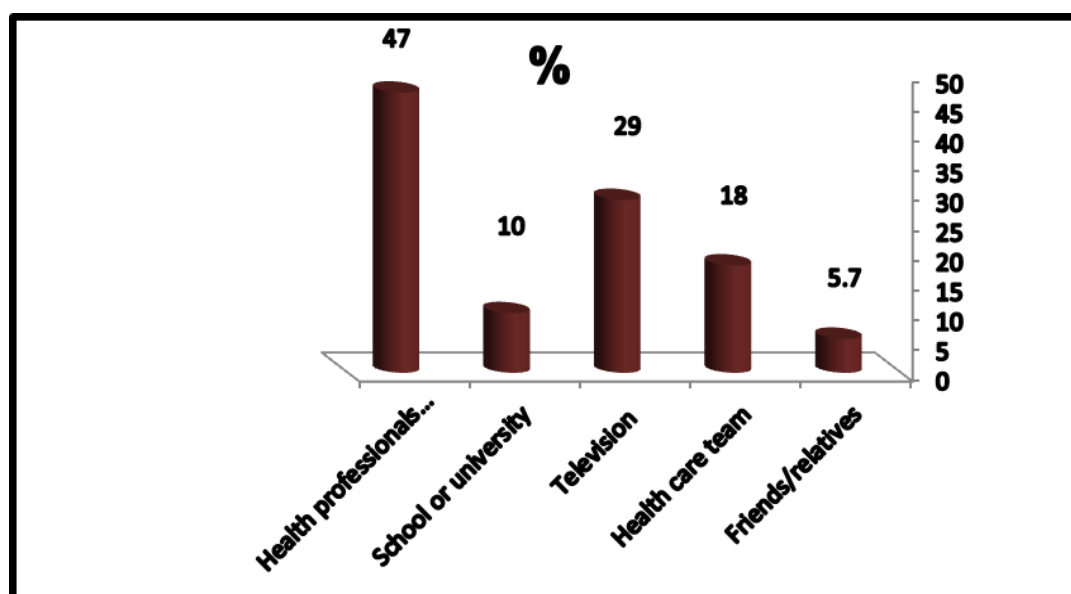
**Figure (1): Sources of women's knowledge regarding VDD at Assiut City**

Table (2): Relation between women's knowledge regarding vitamin D in women during pre and posttest at Assiut City

Items	Pre (n=300)		Post (n=300)		P. value
	No	%	No	%	
Sources of vitamin D:					
Correct	65	21.7	232	77.3	<0.001**
Incorrect	235	78.3	68	22.7	
The benefits of vitamin D and its role for women:					
Correct	14	4.7	112	37.3	<0.001**
Incorrect	286	95.3	188	62.7	
Known steps of VDD:					
Yes	193	64.3	282	94.0	<0.001**
Causes of VDD among women:					
Correct	10	3.3	108	36.0	<0.001**
Incorrect	290	96.7	192	64.0	
Diseases of VDD in women:					
Correct	15	5.0	267	89.0	<0.001**
Incorrect	285	95.0	33	11.0	
Symptoms of VDD in women:					
Correct	33	11.0	269	89.7	<0.001**
Incorrect	267	89.0	31	10.3	

Table (3): Relation between women's knowledge regarding VDD in children during pre and posttest at Assiut City

Items	Pre (n=300)		Post (n=300)		P. value
	No	%	No	%	
Vitamin D benefits for children:					
Correct	8	2.7	251	83.7	<0.001**
Incorrect	292	97.4	49	16.3	
The best time to be exposed to the sun:					
Correct	40	13.3	195	65.0	<0.001**
Incorrect	260	86.7	105	35.0	
Body parts that should be exposed to the sun:					
Correct	0	0.0	148	49.3	<0.001**
Incorrect	300	100.0	152	50.7	
Causes of VDD among children:					
Correct	19	6.3	135	45.0	<0.001**
Incorrect	177	93.7	165	55.0	
Diseases of VDD in children:					
Correct	10	3.3	198	66.0	<0.001**
Incorrect	290	96.7	102	34.0	
Symptoms of VDD in children:					
Correct	17	5.7	129	43.0	<0.001**
Incorrect	283	94.3	171	57.0	
Prevention of VDD:					
Correct	19	6.3	96	32.0	<0.001**
Incorrect	281	93.7	204	68.0	

Chi square test

**Significant level at P value < 0.01

Table (4): Relation between total score of women knowledge regarding VDD during pre and posttest at Assiut City

Total score of knowledge	Max score	Pre (n=300)		Post (n=300)		P. value
		No	%	No	%	
Good	>75%	21	7.0	283	94.3	<0.001**
Faire	65-75%	77	25.7	17	5.7	
Poor	<65%	202	67.3	0	0.0	
Mean ± SD	26	12.73±5.62		22.69±2.07		<0.001**

Chi square test for qualitative data between the two groups or more
Independent T-test quantitative data between the two groups

**Significant level at P value < 0.01

Table (5): Relation between women's knowledge regarding VDD during pre and posttest and their personal data at Assiut City

Personal data	No. (n=300)	Knowledge about VDD	
		Pre (n=300) Mean ±SD	Post (n=300) Mean ±SD
Age (years):			
Less than 25 year	47	11.3±6.56	22.62±2.23
25-30 year	74	12.42±5.38	22.45±2.2
30-35 year	78	14.31±5.19	22.88±1.97
More than 35 year	101	12.41±5.43	22.74±1.96
P. value		0.020*	0.607
Educational level:			
Illiterate	15	5.2±3.41	22.4±2.23
Read and write	19	14.95±5.89	22.53±2.09
Primary education	12	16.58±7.44	22.33±2.15
Preparatory education	17	7.24±6	22.06±2.01
Secondary education	60	12.35±5.96	22.58±2.2
Institutes	66	16.38±3.5	22.91±1.99
University education	104	11.28±3.7	22.71±2.03
Post graduate education	7	20±2.77	24.29±1.6
P. value		<0.001**	0.386
Marital status:			
Single	38	12.53±5.96	22.39±2.32
Married	246	12.42±5.54	22.67±2.03
Divorced	7	19.86±2.91	25.43±0.79
Widow	9	16.44±2.51	22.33±1
P. value		0.001**	0.004**
Occupation:			
Working	118	12.43±4.22	22.81±2.08
Not working	182	12.92±6.36	22.6±2.06
P. value		0.460	0.393
Religion			
Muslim	262	12.21±5.6	22.59±2.07
Christian	38	16.29±4.31	23.37±1.95
P. value		<0.001**	0.029*
Residence:			
Rural	20	14.95±5.2	22.5±2.4
Urban	280	12.57±5.62	22.7±2.05
P. value		0.067	0.677
Reasons for visiting the MCH center:			
Follow-up of pregnancy	40	15.48±6.33	23.15±1.73
Follow-up of the child	84	13.65±5.24	22.49±2.2
Use of family planning method	121	11.29±5.12	22.7±2.01
Immunization of child	55	12.49±5.8	22.62±2.21
P. value		<0.001**	0.416

Independent T-test quantitative data between the two groups

One way Anova test quantitative data between the three groups or more

**Significant level at P value < 0.01

Table (6): Multivariate Linear regression model for the effect personal data on knowledge regarding VDD in pre and posttest at Assiut City

Items	Pretest			Posttest		
	Beta	t	Sig.	Beta	t	Sig.
Age	0.027	0.616	0.538	0.088	1.272	0.204
Religion	0.112	2.951	0.003**	0.123	2.059	0.040*
Residence	-0.039	-1.051	0.294	0.016	0.276	0.783
Education	0.194	4.277	0.000**	0.081	1.126	0.261
Occupation	-0.030	-0.653	0.515	-0.016	-0.219	0.827
Marital status	0.014	0.315	0.753	0.014	0.209	0.835
The reason for visiting the MCH center	-0.049	-1.204	0.230	-0.038	-0.595	0.552

Dependent Variable is Knowledge Score about Vitamin D

*Significant Factor at P value < 0.05

**Significant Factor at P value < 0.01

Table (1): Shows that 33.7%, 34.7%, of the participated women were aged more than 35 year and had university education respectively. Also, it was observed that 82.0%, 60.7% and 40.3% of them were married, not working and were coming to the MCH for using of family planning method respectively.

Figure (1): Illustrates that health professionals were the main source of women's knowledge regarding VDD.

Table (2): Presents that 47.3% and 44.3% of the participated women gave incorrect answer regarding the sources of vitamin D and the benefits of vitamin D and its role for women in pretest respectively; which improved in posttest p-values= 0.001. As well as, 60.0% of women gave incorrect answer about causes of VDD among women in pretest; with significance increase in posttest p-values= 0.001.

Table (3): Discloses that 39.7%, 86.7%, 59.0% and 61.0% of the participated women gave incorrect answer regarding vitamin D benefits for children, gave incorrect answer about the best time to be exposed to the sun, answered incorrectly about causes of VDD among children and diseases of VDD in children in pretest respectively, with improvement in posttest p-values= 0.001.

Table (4): Clarifies that there was statistical significance differences between women total score of knowledge regarding Vitamin D in pre and posttest with p-value= 0.001.

Table (5): Signifies that there were statistical significance differences between women knowledge regarding VDD with their age, educational level, marital status and reasons for visiting the MCH center p-values in pretest 0.020, 0.001, 0.001 and 0.001 respectively. On the other hand, there weren't statistical significance differences with women residence and occupation in pre and posttest p-values=0.460, 0.393, 0.677 and 0.067 respectively.

Table (6): Represents that the most effect on knowledge score about vitamin D done by the independent variable personal data with negative

impact before educational program, but religion with positive impact after educational program, finally religion factor has positive impact on the dependent variable.

Discussion:

Vitamin D is essential for adequate health throughout the lifespan. Women and children however are particularly vulnerable to VDD. Public health strategies such as food fortification and supplementation are not universal and their implementation has proven difficult despite the increasing evidence of the role of vitamin D status on health and disease status. Health education and behavioral changes are important tools to combating VDD (Fiscaletti et al, 2017 & Zareef; Jackson, 2021). The current study aimed to evaluate the effectiveness of an educational program on women knowledge regarding VDD at Assiut City.

Regarding personal data of the participated women; the present results showed that one-third were aged more than 35 years; this reading was contrasting with Nowreen and Hameed, (2019) who assessed the awareness regarding the importance of vitamin D and prevention of its deficiency among female undergraduate medical students in India and reported that nearly two-thirds were of the age group 17-20 years. Also, Al-Qudah et al, (2021) who presented a result of study in Jordan about Maternal Awareness of VDD in Infants and up to the Age of 6 Years and recorded three-fifths of the participants aged between 30-40 years old.

Concerning the educational level of the participated women; it was founded that one-third was have university education this not in the same line with Al-Qudah et al, (2021) who reported that three-fifths of the respondents were had bachelor's degree. The presented study findings disclosed that three-fifths of women were not working the same was observed by Al-Qudah et al, (2021). Also, Kavitha et al, (2015) who performed a study regarding

knowledge, attitude and practice regarding VDD among antenatal mothers and reported that the majority of the studied sample weren't working.

The proposed study figured out that the health professionals were the main source of women's knowledge regarding VDD. This can be contributing to that there were little spot on importance of vitamin D in mass media and other sources. This was disagreed with **Kamel et al, (2017)** who conducted a study in Kalyobia Governorate entitled mothers' awareness regarding vitamin D deficiency among their infants and found that less than half gained their information about vitamin D and its deficiency from doctors. Moreover, **Kavitha et al, (2015)** pointed out that book/magazine were the main source of knowledge for more than half of the studied women.

In the same regard; **Dağhan et al, (2019)** who studied knowledge and practices of mothers regarding use of vitamin d for infant health reported that nurses were the main source of knowledge. As well as, **Al-Agha et al, (2016)** who performed a study in Saudi Arabia under title "Awareness of Vitamin D and its Deficiency in Jeddah Population" found that mass media was the main source of knowledge regarding vitamin D.

The present study revealed that in pretest nearly less than half of women were didn't know the correct sources of vitamin D with significance improvement in post program p-values=0.001. While, **Dağhan et al, (2019)** reported that the respondents mentioned that sunlight is the most known vitamin D source. This was congruent with **Kavitha et al, (2015)**.

In the same context; **Lhamo et al, (2017)** carried out a study in India entitled "Epidemic of Vitamin D Deficiency and Its Management: Awareness among Indian Medical Undergraduates" found that knowledge regarding vitamin D dietary sources was insufficient. it is important to improve the level of knowledge mothers have on vitamin D resources, healthcare professionals should explain that in addition to the primary source of vitamin D, sunlight, there are other sources, like vitamin D enriched foods and vitamin D supplements.

On the other hand; this was disagreed with **Nowreen & Hameed, (2019)** who studied "the awareness regarding the importance of vitamin D and prevention of its deficiency among female undergraduate medical students" and reported that the majority had adequate knowledge about main source of vitamin D. Also, **Al-Qudah et al, (2021)** reported that more than three-fifths recognized the main dietary sources of vitamin D.

The current study emphasized that nearly half and two-fifths of the women didn't know the benefits of vitamin D for women and children in pretest which improved in post program p-values= 0.001.

Researches findings suggested that mothers understand the general benefits of vitamin D but lack adequate information on the more recently identified benefits of vitamin D. This was in agreement with **Alshahrani, (2014)**, who performed a study entitled "Vitamin D Deficiency and Possible Risk Factors among Middle Eastern University Students in London", **Kavitha et al, (2015) & Dağhan et al, (2019)**. From other view; **Alwadei et al, (2018)** who studied "the Public Awareness of Vitamin " D " Deficiency among Children in Najran City" reported that more than three-quarters were had knowledge regarding Vitamin D benefits.

From the current result, it was reported that two-thirds of women in the pretest phase were didn't know the correct places that should be exposed to the sun. Despite of being a sun sufficient country the prevalence of VDD is very high in Egypt. There is inadequate knowledge about sun exposure as the best natural sources for prevention and treatment of vitamin D deficiency with negative attitudes towards sunlight and extensive use of sunscreens. This observation was in the same line with **Lhamo et al, (2017) Nowreen; Hameed, (2019) & Al-Qudah et al, (2021)** who reported the inadequacy of participants' knowledge regarding sun exposure.

Also, the results disclosed the majority of the participated women gave incorrect response regarding the best time to be exposed to the sun with correct response and improvement in the post program p-value= 0.001. One of the common causes of VDD is inability to go outside due to work or weather issues whilst lake of knowledge about best time of sun exposure is playing a significant role regardless of the parent's educational level. This was similar with **Kavitha et al, (2015)**. However; **Alwadei et al, (2018)** recorded that more than half of the respondents were know the best time of exposure.

As well as, there was improvement in women knowledge regarding causes of VDD with significance increase in posttest p-values= 0.001. This reading was in line with **Shaheen et al, (2021)** who conducted a study entitled "Changes in maternal knowledge regarding vitamin D and its health importance after application of an educational program". Meanwhile, **Al-ghraibawi et al, (2019)** who assessed "knowledge and practices regarding vitamin d deficiency among women in Karbala" reported that the participants were didn't know the causes of vitamin D.

In the same context; it was recorded that three-fifths of the participated women gave incorrect response regarding diseases of VDD in women and children, in pretest, with improvement post program p-values= 0.001. It is believed that if mothers understand the potential health problems that can arise from VDD in

infants, there will be a greater number who give vitamin D supplementation for infants. Therefore, this issue should be included in arising of women awareness sessions. These observations were the same as **Dağhan et al, (2019) & Al-ghraibawi et al, (2019)**. Also, **Rasheed et al, (2017)** who assessed the "Knowledge, attitude and practice of Iraqi mothers towards Vitamin D supplementation to their infants" reported the same observation. Also, the same findings reported by **Franklin, (2019)** who assessed "knowledge and attitudes of vitamin D and sun exposure practices amongst New Zealand mothers".

The results of the present study pointed out to that the participated women were had poor knowledge level in pretest with existence of statistical significance differences between their total score of knowledge regarding VDD in pre and posttest with p-value= 0.001. Hens, this result confirmed the alternative hypothesis (H1) and declined the null hypothesis.

This record was the same as reported by **Nowreen; Hameed, (2019) & Umarani, (2014)** who evaluated the "planned teaching program creates awareness regarding prevention of Vitamin-D and Calcium deficiency in Children" and reported poor knowledge level in pretest. Moreover, **Rasheed et al, (2017)** reported that nearly half of the sample were had poor level of knowledge.

On the other hand; **Al-Qudah et al, (2021)** reported that half of participants were knowledgeable about vitamin D. On the opposite side, **Alwadei et al, (2018)** reported that the participated respondents was had knowledge regarding vitamin D. The same results observed by **Özel et al, (2020)** who carried out study about "Vitamin D knowledge, attitudes, and behaviors in young Danish Women".

It was obvious that there was a statistical significance difference with women's' age and knowledge in pretest p-value=0.020. So, the present research hypothesis was accepted. The same was found by **Umarani, (2014)**, who studied "Planned teaching program creates awareness regarding prevention of Vitamin-D and Calcium deficiency in children, **Al-Qudah et al, (2021) & Shaheen et al, (2021)**. Also, **Abdel Nabi et al (2020)** who evaluated "Female Awareness Regarding Vitamin D Deficiency" reported the same result. Otherwise; **Alamoudi et al, (2019)** who assessed "Awareness of VDD among the general population in Jeddah, Saudi Arabia" reported that there was no significant difference found among age groups for all knowledge domains.

On the opposite side, there wasn't relation between women's knowledge and their working status in pre and posttest p-values= 0.677 and 0.067, this was in agreement with **Al-Qudah et al, (2021)**, also, **Al-**

ghraibawi et al, (2019) reported the same results. But the result was disagreed with **Hashem et al, (2020)** who performed a study about "Effect of counseling about VDD among pregnant women in Abo-teg health center" and found relation with the participants' working status.

The present study revealed that there was a significance statistical relation between women religion and their mean of knowledge regarding VDD p-values= 0.001 and 0.029 in pre and posttest respectively; this attributed to that women knowledge and even their practices toward prevention of VDD affected by some way by their norms, customs and religion rules and regulation for example restriction on eating some sorts of food is forbidden by Christianity religion.

Regarding to the relation between the participated women knowledge and their educational level; the study discovered the presence of statistically significance difference in the pretest with p-value=0.001. Likewise; **Alamoudi et al, (2019)** and **Özel et al, (2020)** found the same connection between educational level and knowledge. In the same regard, **Selim et al, (2020)** who evaluated "knowledge, attitude and practice towards vitamin d importance and supplementation among mothers of under five children" observed the same results. Otherwise; these readings were opposite with results of **Al-Qudah et al, (2021)**.

In referral to the marital status relation with participated women knowledge; the result disclosed the presence of significance connection. This was congruent with **Alamoudi et al, (2019)**. On the opposite side, **Al-ghraibawi et al, (2019)** reported that there wasn't relation between knowledge and marital status.

The current study pointed out that participated women who came to the MCH center for follow-up for pregnancy were had good improvement in their knowledge level after the program application with statistically significance differences. This is due to pregnant women have more desire to acquire correct knowledge for her health and their new coming baby. Similar observations were recorded by **Alamoudi et al, (2019)**.

On the other hand, there weren't statistical significance difference with women residence in pre and posttest p-values=0.460 and 0.393. This was in agreement with **Anishlyn et al, (2018)** who studied "Knowledge on VDD among antenatal women in a view to prepare information guide sheet" and reported that there went relation between knowledge and all personal data of respondents.

Conclusion:

The present study concluded that there was inadequate level of knowledge regarding vitamin D deficiency among women. Also, the results answered the research hypothesis; *first*: Significant difference between the mean pre-test and mean posttest knowledge score of women regarding VDD, knowledge of women regarding VDD significantly improved after application of the educational program. *Second*: Significant association between the pre-test knowledge score of women regarding VDD with selected personal variables which were significantly affected by their age, educational level and marital status.

Recommendations:

1. Health educational program about VDD should be delivered regularly by healthcare professionals including community health nurses; during routine appointments at timely stages throughout pregnancy and after birth to follow mothers on their use of vitamin D and correct any wrong practices through health education.
2. Booklets, posters and brochures should be available and distributed in all MCH and health centers to all women about the disease and health-related practices.
3. Further studies are needed to be implemented and focused on the associations between vitamin D and health.

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