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Effect of Educational Program on Pregnant Women' Awareness regarding Prevention of Vitamin D Deficiency:

Randomized Control Trial

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Abstract

Background: Vitamin D deficiency has been identified as a global health problem and has affected more than 1 billion people globally especially among pregnant women. **The aim of this study** was to determine the effect of educational program on pregnant women' awareness regarding prevention of Vitamin D Deficiency. **Research design**: Quasi-experimental research design was used in this study. **Setting**: The study was conducted at pregnant follow up Outpatient Clinic in Maternal and Child health care Center at Benha City. **Sample**: Simple random sample was used. The total sample of the study was included (222) pregnant women. **Tools:** Two tools were used I): A structured interviewing questionnaire which consisted of four parts to assess personal characteristics, obstetric history, knowledge and reported practices II): Scale to measure attitude of the pregnant women regarding vitamin D deficiency. **Results** of this study showed pre-program 3.6% of study group and 4.5% of control group had good knowledge regarding vitamin D deficiency. While post program 75.7% of study group had good knowledge compared with 4.5% of the control group. Pre-program 18.0% of study group and 22.5% of control group had satisfactory practices regarding prevention of vitamin D deficiency. While post program 87.4% of study group had satisfactory practices compared with 21.6% of the control group. Pre-program 3.6% of study group and 4.5% of control group had positive attitude regarding vitamin D deficiency. While post program 73.9% of study group had positive attitude compared with 4.5% of control group. **This study concluded** that the educational program increase knowledge, improve practices and change attitude of study group of pregnant women regarding vitamin D deficiency. There were a statistical positive correlation between study group' total knowledge, total practices and total attitude post program implementation. The study **recommended that**: Continuing educational programs for the pregnant women to increase their awareness about vitamin D importance for their own health & for that of their infants.

Keywords: Pregnant women, Vitamin D Deficiency, prevention, Educational program.

Introduction

Vitamin D is a steroid hormone, a group of fat-soluble pro-hormones, which encourages the absorption and metabolism of calcium and phosphorous. The requirement for the nutrient is high at particular stages of the lifecycle especially during pregnancy and infancy. Severe vitamin D deficiency during pregnancy may increase the risk of developing preeclampsia and gestational diabetes in pregnancy and rickets in the child **(Kalyani1 & Sharma, 2016).**

Vitamin D deficiency during pregnancy is emerging as a public health issue globally; around 36% of the population in the USA has been shown to be Vitamin D deficient. Children, pregnant and lactating women, and young adults are at equally high risk as elderly population; nearly 76% mothers and 81% newborns were found to be Vitamin D deficient. In India, more than 50% pregnant women are Vitamin D deficient. Vitamin D deficiency during pregnancy can have negative health effects for the mother and the developing fetus. Vitamin D has many important roles during pregnancy such as in the facilitation of the transport of several nutrients across the placenta including calcium, and the modulation of the maternal immune response **(Kochar et al., 2019).**

Pregnancy is an important period in women's lives, which is associated with physiological changes, including changes in micronutrient requirement. The prevalence of vitamin D deficiency in pregnant women is higher than the general population. Vitamin D deficiency can cause many maternal and fetal complications. Maternal complications include increased insulin resistance and gestational diabetes, increased risk of preeclampsia, bacterial vaginitis, increase in cesarean section and fetal and neonatal complications, including type 1 diabetes, autism, delayed fetal development, low birth weight, respiratory infections in the infant, increase in the transmission of Human Immunodeficiency Virus (HIV) from mother to fetus, asthma, and eczema in newborns, neonatal seizures and neonatal sepsis. The role of vitamin D deficiency is also known in chronic diseases, including autoimmune diseases, lupus, multiple sclerosis, and malignancies **(Hosseinzadeh et al., 2018).**

Vitamin D deficiency is a preventable health problem. Adequate vitamin D intake in pregnancy is optimal for maternal, fetal and child health. Vitamin D deficiency during pregnancy is the origin for a host of future perils for the child, especially effect on neurodevelopment and immune system. Some of this damage done by maternal Vitamin D deficiency gets evident after many years. Therefore, prevention of vitamin D deficiency among pregnant women is essential **(Kaushal & Magon, 2013).**

The main source of vitamin D is sun exposure; person should spend between 15 to 20 minutes per day in the sun with skin exposed in order to produce enough vitamin D to prevent deficiency. Another source of vitamin D is dietary intake of vitamin D-rich foods such as egg yolk, fatty fish, beef liver, and mushrooms. The amount of Vitamin D in the body can also be increased through the consumption of fortified foods or supplements. Vitamin D synthesis can be affected by different factors, including geographical location, age, use of sunblock, and clothing practices. Consequently, a high level of vitamin D deficiency is associated with populations that live in high latitudes or that typically cover the skin with clothing **(Alomari, 2016)**.

The vitamin D dose that the World Health Organization recommends for pregnant women is 200 IU/day. The Institute of Medicine suggested that the "Estimated Average Requirement" and "Recommended Dietary Allowance" (RDA) for pregnant women be 400 and 600 IU/day, respectively. Recent studies reported that the daily dose for pregnant women should be greater than 1000 IU/day to achieve adequate levels. The safety dose during pregnancy is not clear, but showed that vitamin D supplementation of 4000 IU/day for achieving adequate levels was safe and effective in pregnant women. Limited sun exposure, regular use of sunscreens, dark skin, obesity, extensive clothing cover, aging, poor nutritional status, malabsorption syndromes and medications have been reported as risk factors for vitamin D deficiency**(Avar et al., 2018)**

Community health nurses play an important role in the prevention of VDD through health education. Community health nurses should take urgent steps through motivation and create awareness about VDD. Health education raising women'

awareness about vitamin D, its importance to health and wellbeing, the consequences of its deficiency and practices to prevent VDD. Community health nurses could educate women about sources of vitamin D and importance of sun exposure because it is not possible to obtain an adequate amount of vitamin D from dietary sources alone. Therefore, a combination of sun exposure along with adequate deficiency **(Kamal, 2018).**

Significance of the study:

Vitamin D high insufficiency levels were found in the KSA (86.4%) and Egypt (40%). For example, 54% of 50 pregnant women and 72.6% of 51 lactating women were found to have insufficient vitamin D (serum 25(OH) D < 50 nmol/L) [27]. Neonatal serum 25(OH) D was consistently found to correlate with maternal serum status in studies reported from Egypt and the KSA **(Hwalla et al., 2017).It** reported the high prevalence of vitamin D deficiency between healthy Egyptian females. 72.6% of the nursing group, 54% of the pregnant group, 72% of the childbearing age group, and 39.5% of the elderly group (**Mousa et al., 2018**).

In Egypt, over the last two decades, accumulating data on the vitamin D status indicate increasing the prevalence of vitamin D deficiency among healthy members of the population, particularly mothers and their neonates. 9 It was indicated that between 25.7% and 77.2% of Egyptian infants and women (pregnant and non-pregnant) had vitamin D inadequacy. Several studies from different parts of the world show that knowledge, attitude and behavior play an important role in influencing the major risk factors leading to vitamin D deficiency **(Soliman et al., 2020).**

Vitamin D deficiency is common during pregnancy especially among high risk groups, including vegetarian women with limited sun exposure, and newborn vitamin D levels are largely dependent on maternal Vitamin D status. It has been suggested that educational programs about vitamin D for pregnant women could help prevent long-term health consequences.

Aim of the study:

The aim of the current study was to determine the effect of educational program on pregnant women' awareness regarding prevention of Vitamin D Deficiency. Through the following objectives:

- Assessing pregnant women' knowledge regarding vitamin D deficiency.
- Assessing pregnant women' attitude regarding vitamin D deficiency.
- Assessing pregnant women' practices regarding prevention of vitamin D deficiency.
- Designing and implementing educational program for pregnant women attitude and practices regarding prevention of vitamin D deficiency.

Research Hypothesis:

Educational program will exhibit improvement in pregnant women' knowledge, attitude and practices regarding prevention of vitamin D deficiency.

Subjects and Method

Study Design: A quasi-experimental equivalent groups design was utilized in carrying out this study.

Study Setting

This study was conducted at pregnant follow up Outpatient Clinic in Maternal and Child health care Center at Benha City where pregnant women go to have their antenatal care including (immunization, and follow up).

Sample:

Simple random sample was used in this study. The total numbers of pregnant women in the last six months attending at follow up Outpatient Clinic was 889, 25% were chosen. The total sample was included (222) pregnant women, (111) were included in the control group and (111) in the study group. They were selected according to certain criteria: Not diagnosed with Vit D deficiency, and accepted to participate in the study.

Tools of data collection:

Two tools were used for data collection

Tool I: An in structured interviewing questionnaire:

It developed by the researchers based on literature review and written in a simple clear Arabic language consisted of four parts

First part: It was included personal characteristics of pregnant women **(control and study group) such as** (age, residence, educational level, occupation, monthly income, and type of family).

Second part: It was included obstetric history of pregnant women **(control and study group) such as** (pregnancy trimester and order of pregnancy)

Third part: Included questionnaire to assess pregnant women ` knowledge **(control and study group)** about Vitamin D Deficiency. This part included 9 questions related to the meaning of VIT D, importance of VIT D, sources of VIT D, suitable time for exposure to sunlight, factors affecting vitamin D level among antenatal mothers, meaning of VIT D deficiency, manifestation of VIT D deficiency, complication of VIT D deficiency during pregnancy and prevention of VIT D deficiency during pregnancy.

Scoring system for knowledge items was adapted as follows:

The complete correct answer was scored (2), the incomplete correct answer was scored (1) and the don`t know answer was scored (0). For each area of knowledge, the score of the items was summed- up and the total divided by the number of the items, these scores were converted into a percent score. The total knowledge scores were considered good if the score of the total knowledge >75 % (>13 points), considered average if it equals 50-75 %(9-13 points), and considered poor if it less than 50 %(< 9 points).

Fourth part: Pregnant women **(control and study group)** reported practices regarding prevention of vitamin D deficiency**,** this part included diet (7 items), sun exposure (4 items), and Vitamin D supplements (2 items).

Scoring system for reported practices:

Each question of the item has 2 levels of answers: Done, and not done. These were respectively scored 1, 0. The scores of the items were summed- up and the total divided by the number of the items, giving a level score. These scores were converted into a percent score. The total of reported practices was considered satisfactory if the score >60 % (>7 points), and considered unsatisfactory if it less than 60 %(< 7 points).

Tool II: Scale to measure the attitude of the pregnant women **(control and study group)** for **vitamin D deficiency**, adopted from **(Kavitha**, **et al., 2015)** and modified by researcher .The questionnaire was measured on a Likert type scale of (Agree, Uncertain and Disagree). It was translated into Arabic by the researcher which included (12 items). Vitamin D is important for health, Vitamin D reduces the risk of abnormal hardening of the tissue (Multiple Sclerosis), Vitamin D decrease the risk of high blood pressure, Vitamin D reduces the infertility, Vitamin D reduces the allergic disorders, Vitamin D reduces the caesarian delivery, Vitamin D supplementation during pregnancy reduces language difficulty (Autism) in children, Vitamin D supplements protects the children from softening of the bones (Rickets), Vitamin D supplement reduce cancer risk, Vitamin D supplement helps to prevent heart disease, Vitamin D supplement increases the muscle strength and Vitamin D supplements make bones healthy and strong

Scoring system for pregnant women` attitude:

Attitude scale score was calculated as (2) scores for agree, (1) scores for neutral and (0) for disagree.

The total attitude score was considered positive if the score ≥60 % (≥14 points), and considered negative if it is < 60% (< 14 points).

Content validity and reliability of the tools:

All tools were reviewed by expertise in Community Health Nursing to test the content of validity. According to expert suggestions and comments modification was considered. Reliability of the tool was applied by the researchers for testing the internal consistency of the tool, by administration of the same tools to the same

subjects under similar condition on one or more occasion. Answers from repeated testing were compared. Reliability for knowledge =0.87, attitude = 0.76 and reliability for practice =0. 82.

Ethical consideration:

Formal permission has been obtained from each pregnant woman before conducting the interview and given a brief orientation to the purpose of the study. They were also reassured that all information gathered would be confidential and used only for the purpose of the study. No names were required on the forms to ensure anonymity and confidentiality. They were also informed about their right to withdraw at any time from the study without giving any reasons .

Pilot study:

A pilot study was carried out on 10% (N=22) of the studied pregnant women at the previously mentioned settings to test the study tools for clarity, applicability to fill out the questionnaires. The necessary modifications were done through omission of unneeded or repeated questions. The sample of the pregnant women who participated in the pilot study was included from the main study sample.

Administrative approval

Official permission was obtained by submission of an official letter from the Faculty of Nursing to the responsible authorities of the Maternal and Child health care Center at Benha City to obtain the permission for data collection.

Field Work:

Data were collected over 10 months in addition to 2 weeks for pre-test from the first April 2019 to the end of January 2020. The study was conducted by the researcher for the studied sample in the selected settings at Maternal and Child health care Center at Benha City. The researchers were attended the previously mentioned study setting 3 days/week from 9:00 am – 12:00 mid-day.

Program construction:

The current study was carried out on four phases.

1. Program assessment phase: The program was designed after extensive review of related literature, by the researchers. Based on results obtained from pre-assessment tools, it was revised and modified. Before implementation the program, the

researchers visit the selected Maternal and Child health care Center at Benha City to explain the nature and purpose of the study, as will to discuss the plan of work to ensure their cooperation.

2. Program development phase: The program was developed based on the actual results that were obtained from pre-program assessment.

An objective of the program was to to determine the effect of educational program on pregnant women' awareness regarding prevention of Vitamin D deficiency

Contents of program: it included:

- Meaning of VIT D, importance of VIT D, sources of VIT D, suitable time for exposure to sunlight, and factors affecting vitamin D level among pregnant women.
- Meaning of VIT D deficiency, manifestation of VIT D deficiency, complication of VIT D deficiency during pregnancy and prevention of VIT D deficiency during pregnancy.
- Practices for prevention of vitamin D deficiency**,** included diet, sun exposure, and Vitamin D supplements.
- **Teaching methods:**

Methods used in teaching the program content included the following: lectures, discussion, role play and presentation

Teaching aids:

Suitable teaching aids were specially prepared for the program application as: Handout, lab top CD, and posters.

Program implementation phase:

Implementation of the program took 10 months in addition to 2 weeks for pre-test from the first April 2019 to the end of January 2020. The researchers were attended the previously mentioned study setting 3 days/week from 9:00 am – 12:00 mid-day.; the study was conducted by the researchers for the studied sample in the selected settings at Maternal and Child health care Center at Benha City. The program carried out in 6

sessions (4 theoretical, 2 practical). The duration of each session ranged from 30 to 45 minutes including times for discussion according to women' achievement, progress and feedback. . Each session started by a summary about the previous session and the objectives of the new one.

Discussion, motivation and reinforcement during program sessions were used to enhance learning. Direct reinforcement in the form, a copy of the program was given as a gift for each pregnant women to use it as future reference. All the participants were cooperative with the researcher. At the end of each session, pregnant women participated in a discussion to correct any misunderstanding. Also, they were informed about the time of the next session.

Program evaluation phase:

Evaluation of the educational program was carried out after session implementation immediately posttest.

Statistical design

The collected data were verified prior to computerized entry; statistical analysis was done by using the Statistical Package for Social Science (SPSS) version 22. Data were presented in tables by using mean, number, percentage distribution, and Chi- Square. Statistical significance was considered at: P- Value > 0.05 insignificant, P- Value < 0.05 significant, and P- Value < 0.001 highly significant

Results

Table (1) Distribution of the studied subjects (control and study group) according to their personal characteristics (n=222).

Personnel characteristics	Control group (n=111)		Study group (n=111)	
	No.	%	No.	%
Age in years				
Less than 21	4	3.6	3	2.7
21-25	42	37.8	49	44.1
26-30	46	41.4	40	36.0
31-35	8	7.2	8	7.2
>35	11	9.9	11	9.9
Mean ±SD	27.74±6.59		27.34±5.97	
Residence				
Urban	86	77.5	81	73.0
Rural	25	22.5	30	27.0
Educational level				
Read and write	31	27.9	40	36.0
Secondary	47	42.3	46	41.4
University	32	28.8	25	22.5
Postgraduate	1	.9	0	0.0
Occupation				
Employed	38	34.2	50	35.1
Housewife	51	45.9	39	45.0
Private work	22	19.8	22	19.8
Monthly income				
Enough	54	48.6	49	44.1
Not enough	57	51.4	62	55.9
Type of family				
Nuclear	68	61.3	61	55.0
Extended	43	38.7	50	45.0

Table (1): Shows personal characteristics of the studied subjects. It was cleared that 41.4% of the control group were aged 26 to 30 years with a mean age of 27.74±6.59 years and 44.1% of the study group were aged 21 to 25 years with a mean age of 27.34±5.97 years. Regarding the residence, 77.5% of the control group and 73.0% of study group were lived in urban area. As regards educational level, 42.3% & 41.4% of both control and study groups respectively were secondary education. Concerning the Occupational status, 45.9% of control group and 45.0% of

study group were housewives. Also 51.4% & 55.9% of control and study groups respectively didn't have enough monthly income. Moreover 61.3% & 55.0% of control and study groups respectively were members in nuclear families.

Table (2): Distribution of the studied subjects related to their obstetric history (n=222)

obstetric history	Control group(n=111)		Study group(n=111)	
	No	%	No	%
Pregnancy trimester				
First	6	5.4	15	13.5
Second	92	82.9	85	76.6
Third	13	11.7	11	9.9
Order of pregnancy				
Gravida 1	24	21.6	21	18.9
Gravida 2	42	37.8	46	41.4
Gravida 3	30	27.0	29	26.1
Gravida 4	15	13.5	15	13.5

Table (2): Denotes that, 82.9% of the control group and 76.6% of the study group were in the second trimester of pregnancy. Regarding the order of pregnancy, 37.8% of the control group and 41.4% of study group were gravida 2.

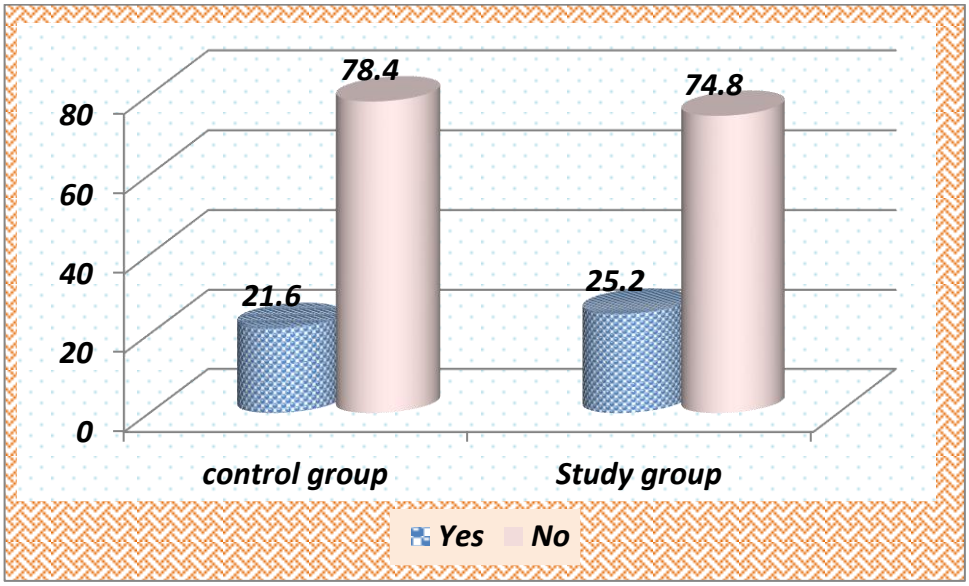

Figure (1) : Percentage distribution of the studied subjects related to their intake of vitamin D supplements (n=222)

Figure (1): Displays that, 78.4% & 74.8% of both control and study groups respectively didn't take vitamin D supplements.

Table (3): Distribution of studied subjects regarding their knowledge about vitamin D deficiency pre-program (n=222)

Knowledge	Control group(n=111)						Study group(n=111)						Chi square test	P value
	Don't know		Incomplete Correct		complete Correct		Don't know		Incomplete Correct		complete Correct			
	No	%	No	%			No	%	No	%	No	%		
Definition of vitamin D	66	59.5	45	40.5	0	0.0	68	61.3	40	36.0	3	2.7%	3.32	>0.05
Importance of vitamin D	69	62.2	38	34.2	4	3.6	73	65.8	34	30.6	4	3.6%	0.335	>0.05
Source of vitamin D	63	56.8	45	40.5	3	2.7	68	61.3	40	36.0	3	2.7%	0.485	>0.05
Suitable time for exposure to sunlight	69	62.2	37	33.3	5	4.5	71	64.0	35	31.5	5	4.5%	0.084	>0.05
factors affecting vitamin D level among antenatal mothers	60	54.1	42	37.8	9	8.1	61	55.0	39	35.1	11	9.9%	0.319	>0.05
Definition of vitamin D deficiency	63	56.8	44	39.6	4	3.6	61	55.0	44	39.6	6	5.4%	0.432	>0.05
Manifestation of vitamin D deficiency	62	55.9	42	37.8	7	6.3	60	54.1	46	41.4	5	4.5%	0.548	>0.05
Complication of vitamin D deficiency during pregnancy women	63	56.8	40	36.0	8	7.2	56	50.5	50	45.0	5	4.5%	2.21	>0.05
prevention of vitamin D deficiency	61	55.0	43	38.7	7	6.3	54	48.6	52	46.8	5	4.5%	1.61	>0.05

Table (3): Illustrates that 62.2% of the control group and 65.8% of the study group didn't know importance of vitamin D. Also, 62.2% of the control group and 64.0% of the study group didn't know suitable time for exposure to sunlight. There was no statistically significant difference was observed in knowledge about vitamin D deficiency between two groups pre-program at p-values >0.05.

Table (4): Distribution of studied subjects regarding their knowledge about vitamin D deficiency post-program (n=222)

	Control group(n=111)						Study group(n=111)						Chi square test	P value
	Don't know		Incomplete Correct		complete Correct		Don't know		Incomplete Correct		complete Correct			
	No	%	No	%			No	%	No	%	No	%		
Definition of vitamin D	66	59.5	42	37.8	3	2.7	14	12.6	20	18.0	77	69.4	110.05	<0.001**
Importance of vitamin D	69	62.2	38	34.2	4	3.6	11	9.9	11	9.9	89	80.2	134.61	<0.001**
Source of vitamin D	65	58.6	43	38.7	3	2.7	19	17.1	14	12.6	78	70.3	109.38	<0.001**
Suitable time for exposure to sunlight	69	62.2	37	33.3	5	4.5	16	14.4	24	21.6	71	64.0	93.13	<0.001**
factors affecting vitamin D level among antenatal mothers	58	52.3	42	37.8	11	9.9	16	14.4	17	15.3	78	70.3	84.86	<0.00 1**
Definition of vitamin D deficiency	59	53.2	44	39.6	8	7.2	15	13.5	23	20.7	73	65.8	84.90	<0.001**
Manifestation of vitamin D deficiency	57	51.4	46	41.4	8	7.2	14	12.6	17	15.3	80	72.1	93.30	<0.001**
Complication of vitamin D deficiency during pregnancy women	57	51.4	43	38.7	11	9.9	11	9.9	32	28.8	68	61.3	73.85	<0.001**
prevention of vitamin D deficiency	56	50.5	44	39.6	11	9.9	11	9.9	20	18.0	80	72.1	91.54	<0.001**

Table (4): Reveals that there was a highly statistical significant difference was observed in knowledge about vitamin D deficiency between two groups post program at p-values <0.001. Also, this table clears that, post program, 80.2%, 72.1% & 72.1% of the study group compared to 3.6%, 7.2% & 9.9% of the control group had complete correct knowledge about importance of vitamin D, manifestation of vitamin D deficiency and prevention of vitamin D deficiency respectively.

Table (5): Distribution of studied subjects regarding their practices for prevention vitamin D deficiency pre-program (n=222)

Practices	Control group(n=111)				Study group(n=111)				Chi square test	P value
	Not done		Done		Not done		Done			
	%	No	%	No	%	No	%	No		
Diet										
Eat healthy and balanced meals	72	64.9	39	35.1	76	68.5	35	31.5	0.324	>0.05
Eat 3 to 4 servings of dairy foods per day.	87	78.4	24	21.6	93	83.8	18	16.2	1.05	>0.05
Eat more foods rich in vitamin D.	74	66.7	37	33.3	78	70.3	33	29.7	0.334	>0.05
Eat fortified milk and foods .	69	62.2	42	37.8	73	65.8	38	34.2	0.313	>0.05
Eat plenty of fruits and vegetables.	81	73.0	30	27.0	84	75.7	27	24.3	0.212	>0.05
Eat at least 42 grams of healthy fat every day.	76	68.5	35	31.5	77	69.4	34	30.6	0.021	>0.05
Drink at least 8 glasses of water a day.	68	61.3	43	38.7	70	63.1	41	36.9	0.077	>0.05
Sun exposure										
Exposure to sunlight for 20-30 minutes per day	75	67.6	36	32.4	80	72.1	31	27.9	0.534	>0.05
Choose the right time of day	80	72.1	31	27.9	89	80.2	22	19.8	2.00	>0.05
Protect face and ears, as they are the most exposed areas.	64	57.7	47	42.3	67	60.4	44	39.6	0.168	>0.05
Exposure to your arms, legs, belly and back to the sun.	60	54.1	51	45.9	63	56.8	48	43.2	0.164	>0.05
Vitamin D supplements										
take vitamins daily to get some nutrients that are hard to get from foods alone	75	67.6	36	32.4	79	71.2	32	28.8	0.339	>0.05
Take vitamin D supplements regularly under doctor supervision	76	68.5	35	31.5	73	65.8	38	34.2	0.184	>0.05

Table (5): Shows that there was no statistically significant difference was found in practices for prevention vitamin D deficiency between two groups pre-program at p-values >0.05. Meanwhile, this table clarifies that, 78.4%, 72.1% of the control group and 83.8%, 80.2% of the study group didn't eat 3 to 4 servings of dairy foods per day and didn't choose the right time for sun exposure of day respectively.

Table (6): Distribution of studied subjects regarding their practices for prevention vitamin D deficiency post-program (n=222)

Practice	Control group(n=111)				Study group(n=111)				Chi square test	P value
	Not done		Done		Not done		Done			
	%	No	%	No	%	No	%	No		
Diet										
Eat healthy and balanced meals	72	64.9	39	35.1	15	13.5	96	86.5	61.41	<0.001**
Eat 3 to 4 servings of dairy foods per day.	90	81.1	21	18.9	12	10.8	99	89.2	110.30	<0.001**
Eat more foods rich in vitamin D.	75	67.6	36	32.4	15	13.5	96	86.5	67.27	<0.001**
Eat fortified milk and foods.	70	63.1	41	36.9	13	11.7	98	88.3	62.51	<0.001**
Eat plenty of fruits and vegetables.	82	73.9	29	26.1	14	12.6	97	87.4	84.86	<0.001**
Eat at least 42 grams of healthy fat every day.	76	68.5	35	31.5	15	13.5	96	86.5	69.29	<0.001**
Drink at least 8 glasses of water a day.	68	61.3	43	38.7	15	13.5	96	86.5	54.05	<0.001**
Sun exposure										
Exposure to sunlight for 20-30 minutes per day	76	68.5	35	31.5	11	9.9	100	90.1	79.86	<0.001**
Choose the right time of day	84	75.7	27	24.3	9	8.1	102	91.9	104.08	<0.001**
Protect face and ears, as they are the most exposed areas.	67	60.4	44	39.6	4	3.6	107	96.4	82.18	<0.001**
Exposure to arms, legs, belly and back to the sun .	63	56.8	48	43.2	4	3.6	107	96.4	74.41	<0.001**
Vitamin D supplements										
Take vitamins daily to get some nutrients that are hard to get from foods alone	79	71.2	32	28.8	3	2.7	108	97.3	111.69	<0.001**
Taking vitamin D supplements regularly under doctor supervision	73	65.8	38	34.2	7	6.3	104	93.7	85.12	<0.001**

Table (6): Denotes that, 89.2%, 96.4% & 97.3% of the study group compared to 18.9%, 39.6% & 28.8% of the control group ate 3 to 4 servings of dairy foods per day, protected face and ears, as they were the most exposed areas and take vitamins daily to get some nutrients that are hard to get from foods alone respectively. there was a highly statistical significant difference was noticed in practices for prevention of vitamin D deficiency between two groups post program at p-values <0.001.

Table (7): Distribution of studied pregnant women 'attitude regarding vitamin D deficiency pre-program (n=222)

Attitude	Control group (n=111)						Study group (n=111)						Chi square test	P value
	Disagree		Neutral		Agree		Disagree		Neutral		Agree			
	No	%	No	%	No	%	No	%	No	%	No	%		
vitamin D is important for health	18	16.2	91	82.0	2	1.8	18	16.2	88	79.3	5	4.5	1.33	>0.05
Vitamin D reduces the risk of abnormal hardening of the tissue (Multiple Sclerosis)	70	63.1	39	35.1	2	1.8	74	66.7	36	32.4	1	0.9	0.564	>0.05
Vitamin D decrease the risk of high blood pressure	80	72.1	31	27.9	0	0.0	83	74.8	27	24.3	1	0.9	1.33	>0.05
Vitamin D reduces the infertility	73	65.8	33	29.7	5	4.5	75	67.6	31	27.	5	4.5	0.090	>0.05
Vitamin D reduces the allergic disorders	70	63.1	36	32.4	5	4.5	73	65.8	33	29.7	5	4.5	0.193	>0.05
Vitamin D reduces the caesarian delivery	67	60.4	43	38.7	1	0.9	70	63.1	36	32.4	5	4.5	3.35	>0.05
Vitamin D supplementation during pregnancy reduces language difficulty (Autism) in children	75	67.6	35	31.5	1	0.9	80	72.1	27	24.3	4	3.6	2.99	>0.05
Vitamin D supplements protects the children from softening of the bones (Rickets)	68	61.3	36	32.4	7	6.3	72	64.9	33	29.	6	5.4	0.322	>0.05
Vitamin D supplement reduce cancer risk.	69	62.2	36	32.4	6	5.4	72	64.9	34	30.6	5	4.5	0.212	>0.05
Vitamin D supplement helps to prevent heart disease.	72	64.9	35	31.5	4	3.6	76	68.5	31	27.9	4	3.6	0.351	>0.05
Vitamin D supplement increases the muscle strength.	62	55.9	40	36.0	9	8.1	67	60.4	32	28.8	12	10.8	1.51	>0.05
Vitamin D supplements make bones healthy and strong	60	54.1	46	41.4	5	4.5	65	58.6	42	37.8	4	3.6	0.493	>0.05

Table (7): Reveals that there was no statistical significant difference was found in attitude between the two groups pre-program at p-values >0.05. Also, clears that, 72.1% of control group and 74.8% of study group disagreed that, vitamin D decrease the risk of high blood pressure.

Table (8): Distribution of studied pregnant women 'attitude regarding vitamin D deficiency post-program (n=222)

Attitude	Control group (n=111)						Study group (n=111)						Chi square test	P value
	Disagree		Neutral		Agree		Disagree		Neutral		Agree			
	No	%	No	%	No	%	No	%	No	%	No	%		
vitamin D is important for health	18	16.2	88	79.3	5	4.5	7	6.3	22	19.8	82	73.9	112.58	<0.001**
Vitamin D reduces the risk of abnormal hardening of the tissue (Multiple Sclerosis)	70	63.1	36	32.4	5	4.5	7	6.3	15	13.5	89	80.2	135.25	<0.001**
Vitamin D decrease the risk of high blood pressure	80	72.1	27	24.3	4	3.6	7	6.3	21	18.9	83	74.8	133.73	<0.001**
Vitamin D reduces the infertility	73	65.8	31	27.9	7	6.3	7	6.3	13	11.7	91	82.0	133.81	<0.001**
Vitamin D reduces the allergic disorders	70	63.1	34	30.6	7	6.3	7	6.3	20	18.0	84	75.7	120.32	<0.001**
Vitamin D reduces the caesarian delivery	67	60.4	39	35.1	5	4.5	4	3.6	25	22.5	82	73.9	127.11	<0.001**
Vitamin D supplementation during pregnancy reduces language difficulty (Autism) in children	75	67.6	30	27.0	6	5.4	5	4.5	12	10.8	94	84.7	146.40	**<0.001****
Vitamin D supplements protects the children from softening of the bones (Rickets)	68	61.3	33	29.7	10	9.0	8	7.2	22	19.8	81	73.0	104.96	**<0.001****
Vitamin D supplement reduce cancer risk.	69	62.2	34	30.6	8	7.2	8	7.2	18	16.2	85	76.6	117.00	**<0.001****
Vitamin D supplement helps to prevent heart disease.	72	64.9	31	27.9	8	7.2	9	8.1	27	24.3	75	67.6	103.36	<0.001**
Vitamin D supplement increases the muscle strength.	65	58.6	32	28.8	14	12.6	10	9.0	19	17.1	82	73.9	91.81	<0.001**
Vitamin D supplements make bones healthy and strong	60	54.1	42	37.8	9	8.1	8	7.2	26	23.4	77	69.4	97.29	<0.001**

Table (8): Clears that, 84.7% of study group compared to 5.4% of control group agreed that, vitamin D supplementation during pregnancy reduces language difficulty (Autism) in children. There was a highly statistical significant difference was observed in attitude between the two groups post-program at p- values < 0.001.

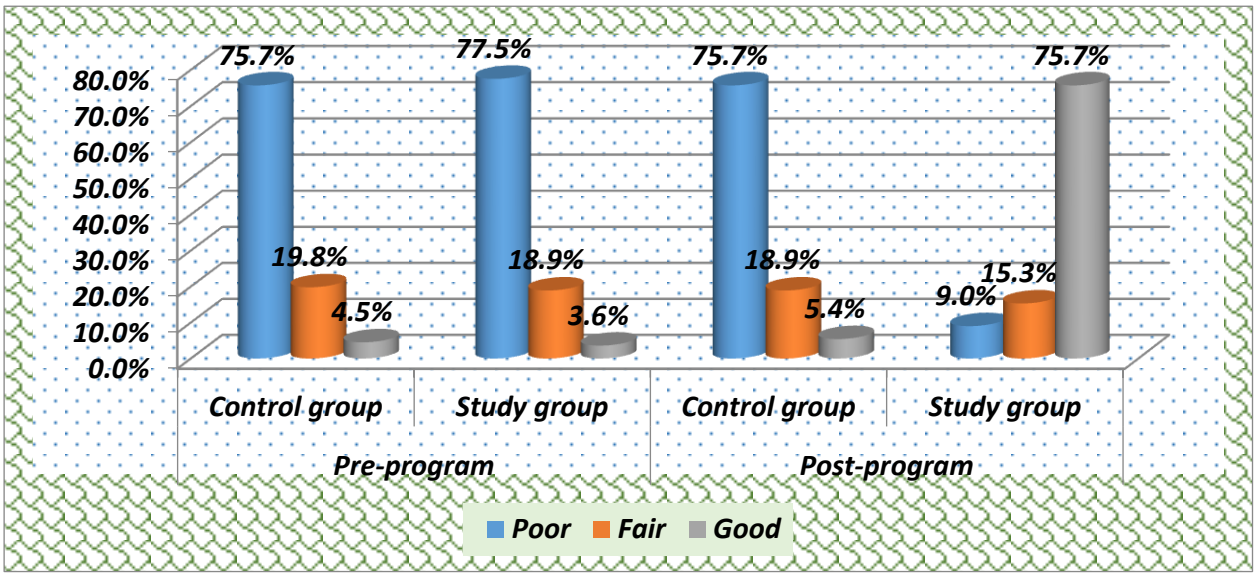

Figure (2): Percentage distribution of total knowledge score of the studied subjects regarding vitamin D deficiency.

Figure (2): Displays that, pre-program 3.6% of study group and 4.5% of control group had good total knowledge scores regarding vitamin D deficiency. Also 77.5% of study group and 75.7% of control group had poor knowledge. While post program 75.7% of study group had good knowledge compared with 5.4% of the control group and 9.0% of study group had poor knowledge compared with 75.7% of the control group.

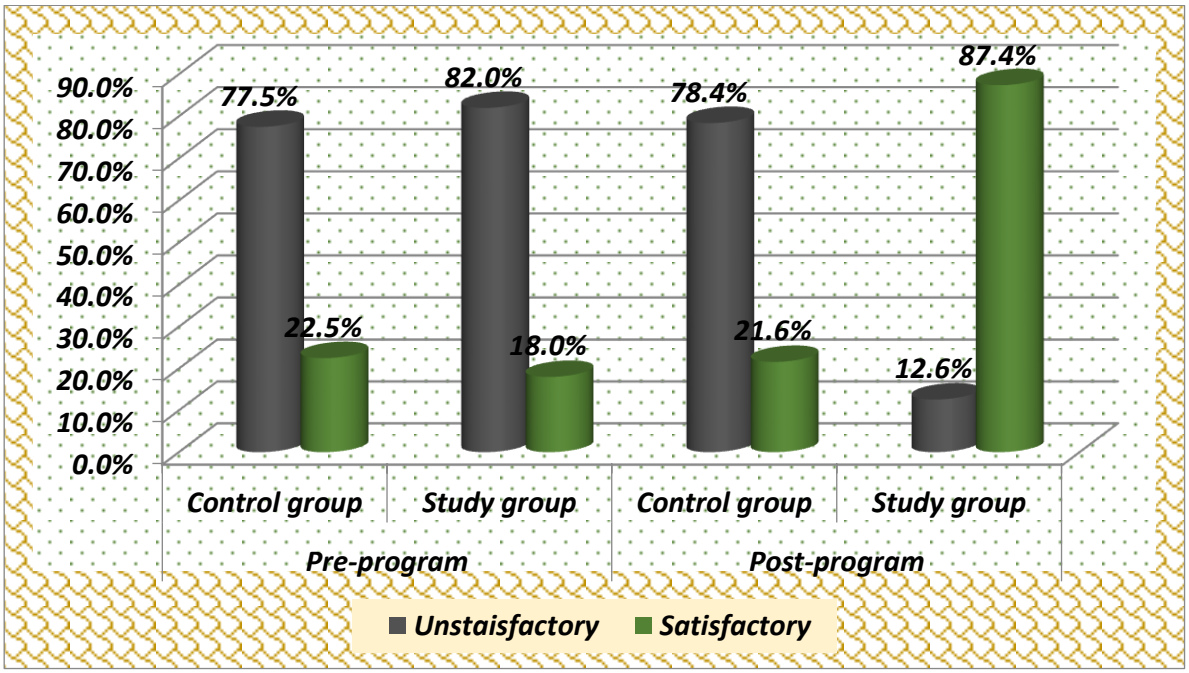

Figure (3): Percentage distribution of total practices of the studied subjects regarding prevention of vitamin D deficiency.

Figure (3): Displays that, pre-program 18.0% of study group and 22.5% of control group had satisfactory practices regarding prevention of vitamin D deficiency. While post program 87.4% of study group had satisfactory practices compared with 21.6% of the control group.

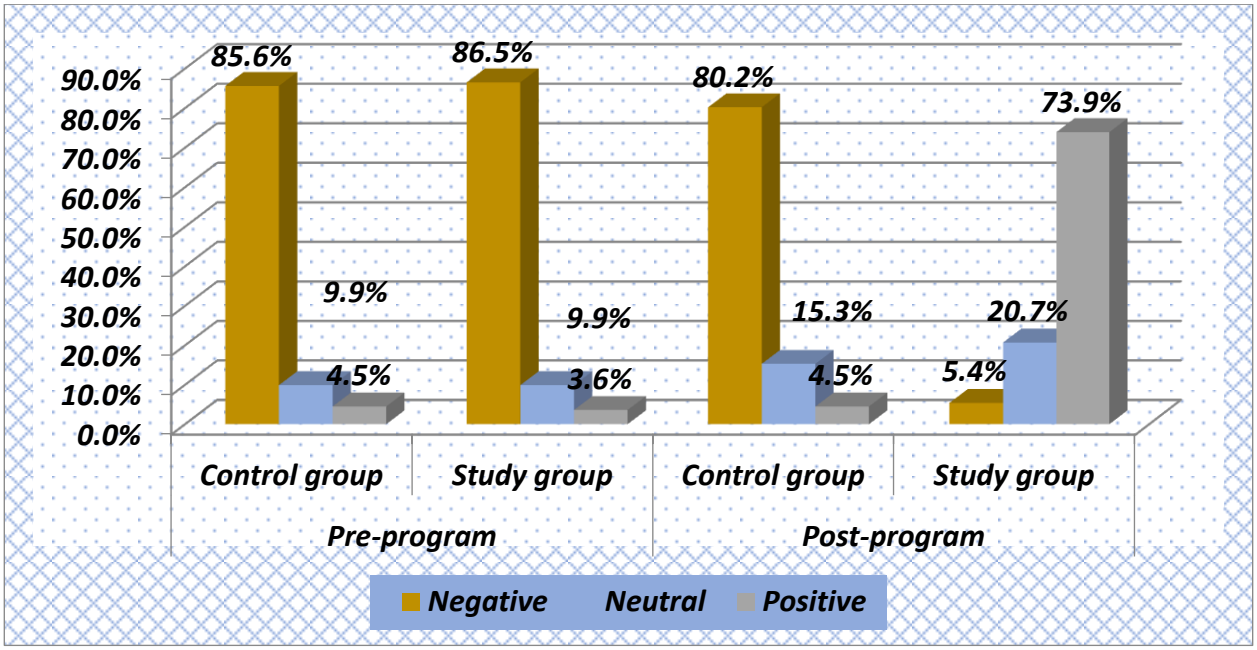

Figure (4): Percentage distribution of total attitude score of the studied pregnant women regarding vitamin D deficiency.

Figure (4): Displays that, pre-program 3.6% of study group and 4.5% of control group had positive attitude regarding vitamin D deficiency. Also 86.5% of study group and 85.6% of control group had negative attitude. While post program 73.9% of study group had positive attitude compared with 4.5% of control group and 5.4% of study group had negative attitude compared with 80.2% of the control group.

Table (9): Correlation between the control group' total knowledge, total practices and total attitude regarding vitamin D deficiency pre/post-program

Variables	Time of assessment	Attitude score		Practice score	
		r	P value	r	P value
Knowledge score	**Pre**	0.014	>0.05	0.086	>0.05
	Post	0.034	>0.05	0.128	>0.05

Table (9): Shows that there was negative correlation between control group' total knowledge, total practices and total attitude pre/post program implementation with no statistical significant difference, (P>0.05).

Table (10): Correlation between the study group' total knowledge, total practices and total attitude regarding vitamin D deficiency pre/post-program

Variables	Time of assessment	Attitude score		Practice score	
		r	P value	r	P value
Knowledge score	Pre	0.054	>0.05	0.063	>0.05
	Post	0.217	<0.05	0.412	<0.001**

Table (10): Reveals that there was negative correlation between study group' total knowledge, total practices and total attitude pre-program implementation with no statistical significant difference, (P>0.05). While post program, there was statistical significant positive correlation between total knowledge and total attitude (P<0.05). Also, there was a highly statistical significant positive correlation between study group' total knowledge and total practices post program implementation, (P<0.001).

Discussion

Vitamin D is not a simple vitamin but a pro-hormone that plays many important roles in the body in addition to the main function of regulating mineral salt deposition in bones, include regulation of body metabolism, mood, blood pressure and immune function. Vitamin D is especially important during pregnancy as low maternal vitamin D stores may contribute to problems such as low birth weight and small for gestational age babies besides an increased risk of maternal comorbidities **(Augoulea et al., 2020)**

Regarding personal characteristics of the studied subjects, less than half of the control group was aged 26 to 30 years with a mean age of 27.74±6.59 years and less than half of the study group was aged 21 to 25 years with a mean age of 27.34±5.97 years, also around three quarters of studied subjects were lived in urban areas, less than half of the studied subjects were housewives, while more than half of the studied subjects didn't have enough monthly income. These findings were in the same line with **Shaheena et al. (2021),** who studied the "Changes in maternal knowledge regarding vitamin D and its health importance after application of an educational program. Menoufia. (N=297)" and reported that the women' age ranged from 23 to 32 years, with a mean value of 27.718 ± 2.729 years, 69% of them were housewives, more than half of the participants (67.3%) had medium socioeconomic state, and 66.3% of the participants were living in an urban area

While these findings disagreed with **Al-Musharaf et al. (2018),** who studied "Vitamin D Deficiency Prevalence and Predictors in Early Pregnancy among Arab Women" (n = 578) and found that, the mean maternal age was 28.8±5.4 (range 18-39) years. Among them, 320 (57.3%) were university graduates or post-graduates, 183 (32.7%) were employed and 62 (12%) were earning more than SAR 10,000/month. The residence of the studied mothers was in urban area.

Regarding to obstetric history of studied subjects, the current results denotes that, more than three quarters of the studied subjects were in the second trimester of pregnancy, and two fifths of them were gravida 2 (table 2). This result agreed with **Albakaa et al. (2020)**, who studied the " Determination of Pregnant women Knowledge toward Risk Factors of Vitamin D Deficiency and Measuring Level During Pregnancy in Al- Nasiriyah City" (n =

100) and their results indicated that, the majority of study sample gestational age found at second semester. Also supported by **Woon et al. (2019**), who studied "Vitamin D deficiency during pregnancy and its associated factors among third trimester Malaysian pregnant women" (n= 535) and reported that, most of respondents were multigravida and less than half of them were gravida 2.

As regards the studied subjects' intake of vitamin D supplements, the current study indicates that around one-quarter of both control and study groups were taking vitamin D supplements (figure 1). This finding was in contrast to **Kavitha et al., (2015)** who conducted study on "Knowledge, Attitude and Practice regarding Vitamin D Deficiency among Antenatal Mothers in Tamilnadu" who found that none of mothers were taking vitamin D supplements during antenatal period.

Concerning pregnant women' knowledge about vitamin D deficiency pre-program, the current study showed that, less than two thirds of the studied groups didn't know the importance of vitamin D or the suitable time of sun exposure (table 3). These findings agreed with **Kavitha et al. (2015),** who enumerates the knowledge on benefits of vitamin D among antenatal mothers as follows. Most of the subjects (52%) didn't know the benefits of the vitamin D and majority of the subjects didn't have knowledge on time to spend to get adequate vitamin D. From the researchers' point of view, this result highlighted the need for health promotion programs regarding vitamin D deficiency.

As regards women' knowledge about of vitamin D deficiency post program, the current study presented that, the minority of the control group had correct knowledge about prevention and manifestation of vitamin D deficiency, while, the around three quarters of the study group had correct knowledge about prevention and manifestation of vitamin D deficiency (table 4). This result clarifies the importance of increasing people awareness about prevention of vitamin D deficiency as the first step for solving vitamin D deficiency problem. This finding agreed with **Anishlyn et al. (2018),** who studied the Knowledge on Vitamin D Deficiency among Antenatal Women in a View to Prepare Information Guide Sheet at Mangaluru, n=100" who found that 52% of the samples have knowledge on prevention of complications, 48% of samples are aware of the signs and symptoms

Regarding to pregnant women' total knowledge about vitamin D deficiency, the current study showed that , more than three quarters of the study groups had poor knowledge and the minority of them had good knowledge preprogram implementation and post program more than three quarters of the study group had good knowledge (Figure 2) . This reflects the importance of educational programs in improving knowledge and increasing awareness about different health issues. This result was similar to **Shaheena et al. (2021),** they found that Total knowledge score of women about vitamin D increased significantly after the implementation of the educational program from 14.7 ± 4.9 before the test to 50.6 ± 1.8 after the test.

As regarding the total practices of pregnant women for prevention of vitamin D deficiency, the present study displays that, pre-program minority of study group and control group had satisfactory practices regarding prevention of vitamin D deficiency. While post program the majority of study group had satisfactory practices compared with minority of the control group (figure 3). This might be due to that educational program help to enhance pregnant women practices including diet, sun exposure and vitamin D supplements. This finding was supported by **Al-Musharaf et al., (2018)** who conducted a study about "Vitamin D Deficiency Prevalence and Predictors in Early Pregnancy among Arab Women" and reported that, there is an important need to increase awareness regarding prevention of vitamin D deficiency among women during their reproductive age, especially women entering pregnancy.

Regarding the pregnant women practices for prevention vitamin D deficiency pre-program. The present study showed that more than three quarters of the control group and the study group didn't eat 3 to 4 servings of dairy foods per day, more than half of the control group and the study didn`t expose their arms, legs, belly and back to the sun (table 5). This might be due to lack of health awareness for pregnant women regarding risk factors of vitamin D deficiency, who found. 19.6% were obtained VIT D from dietary supplements, milk and milk products (28.2%), eggs (9.1%), meat and meat products (3.9%), others (1.3%), beverages (1.2%), and cereal and cereal products (0.9%).The median percentage of the

respondents was 1.14% by taking into account of the face, neck, arms, hands, legs, and feet being exposed to the sunlight, as well as the clothing and the usage of sunscreen.
Regarding the pregnant women practices for prevention vitamin D deficiency post-program, there was a highly statistical significant difference was noticed in practices for prevention of vitamin D deficiency between two groups post program at p-values <0.001 (table 6). It might be due to the effect of educational program in improving the practices of the study group.

Regarding to the pregnant women 'attitude regarding vitamin D deficiency pre-program. The present study clears that, less than three quarters of control group and of study group disagreed that, vitamin D decrease the risk of high blood pressure (table 7). This finding disagreed with **Kavitha et al. (2015),** who reported that minority of the subjects strongly disagreed that Vitamin D decrease the risk of high blood pressure.

Regarding to the pregnant women 'attitude regarding vitamin D deficiency post-program. There was a highly statistical significant difference was observed in attitude between the two groups post-program at p- values < 0.001 (table 8).This might be due to the study group knowledge improved after educational program which change their attitude regarding vitamin D deficiency.

In the current study, majority of study group compared to minority of control group agreed that, vitamin D supplementation during pregnancy reduces language difficulty (Autism) in children (table 8). This might be due to the study group acquired knowledge on the importance of VIT D in pregnancy from educational program which effect on their attitude. This finding disagreed with **Kavitha et al. (2015),** who reported that minority of the subjects agreed Vitamin D decrease the language difficulty (Autism) in children.

Regarding to the total attitude of the studied subjects regarding vitamin D deficiency. The present study illustrated that, the minority of study group and control group had positive attitude regarding vitamin D deficiency pre-program. While post program the majority of study group had positive attitude compared with minority of control group regarding vitamin D deficiency. This might be due to educational guidelines was effective in changing pregnant women` attitude because improve knowledge and practice is highly associated

with change attitude positively. This findings matched with **Kalliokoski et al. (2021)**, who conducted study on " Positive impact on vitamin D related lifestyle of medical advice in pregnant Somali-born women and new mothers: a mixed method study in Swedish primary care in Sweden n= 217: who reported that Vitamin D related attitudes and behavior improved in a Somali-born group of pregnant women/new mothers with severe vitamin D deficiency after health care intervention.

The present study shows that there was positive correlation between control group' total knowledge, total practices and total attitude pre/post program implementation with no statistical significant difference, ($P>0.05$) (table 9). This might be due to Plan for health education programs for this group are essential.

The present study reveals that there was positive correlation between study group' total knowledge and total attitude preprogram ($P<0.05$) (table 10). Also, there was a highly statistical significant positive correlation between study group' total knowledge and total practices post program implementation, ($P<0.001$). This might be due to educational program knowledge plays an important role in increasing knowledge which changing attitude and improve practices.

Conclusion

Based on the results of the study. It concluded that: Minority of study group and control group had good total knowledge scores regarding vitamin D deficiency pre-program. While post program three quarters of study group had good total knowledge scores compared with minority of the control group. Less than one quarter of study group and control group had satisfactory practices regarding prevention of vitamin D deficiency pre-program. While post program majority of study group had satisfactory practices compared with more than one fifth of the control group had satisfactory practices. Minority of study group and control group had positive attitude regarding vitamin D deficiency pre-program. While post program less than three quarters of study group had positive attitude compared with minority of control group. There were a statistical positive correlation between study group' total knowledge, total practices and total attitude post program implementation.

Recommendations

- Continuing educational programs for the pregnant women to increase their awareness about vitamin D importance for their own health & for that of their infants.
- Continuing education programs should provide recommendations for vitamin D supplementation among high risk groups (pregnancy and infancy).
- During pregnancy women should be checked for their vitamin D levels every three months.
- Booklets should be available and distributed in all health care centers to all mothers about the disease and health-related practices

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