

Mothers' Health Education Based on Health Belief Model to Prevent Vitamin D Deficiency in Children with Cerebral Palsy

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Abstract Background: vitamin D deficiency is a problem among children that used to describe low level of serum 25- hydroxy vitamin D. Children with cerebral palsy have many risk factors for osteopenia and fracture. **Aim:** To evaluate effect of mothers' health education based on health belief model to prevent vitamin D deficiency in children with cerebral palsy. **Design:** A quasi-experimental design was utilized. **Setting:** The study was conducted at Outpatient Clinic of Benha University Hospital, Benha Teaching Hospital, and Benha Specialized Pediatric Hospital. **Sample:** A convenience sample of 105 mothers and their children have cerebral palsy. **Tools of data collection:** structured interview sheet; baseline characteristics of mothers and children, mothers' knowledge regarding vitamin D deficiency, vitamin D questionnaire, Health belief model questionnaire. **Result:** the result of the present study revealed that mothers had satisfactory knowledge, competent practice, and positive attitude after health education implantation. **Conclusion:** Health education program was effective and help mothers to prevent vitamin D deficiency among their children with cerebral palsy. **Recommendation:** continuous health education should be implemented for mothers to prevent vitamin D deficiency in children with cerebral palsy.

Keywords: health belief model, health education, vitamin D deficiency, cerebral palsy

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1. Introduction

Vitamin D is a vital metabolically active compound that is either synthesized by the body using UVB light or absorbed via the digestive system from certain foods. The role of vitamin D is to facilitate calcium absorption from the gut and maintain calcium homeostasis [1]. Severely low levels of vitamin D can result in soft, brittle bones; bone pain; and muscle pain and weakness [2].

Vitamin D is important for healthy bones that can be low in children who have poor nutritional intake or decreased exposure to sunlight. Supplement with regular Vit D2/3 (800-1000 international units per day). However, vitamin D level should be checked if possible, to reach baseline and then repeat after 6 months to ensure that the children is in the normal range Wherefore, it is necessary to determine and know the optimal dose of vitamin D to ensure Vitamin D sufficiency [3].

Deficiency of vitamin D is implicated in a great number of orthopedic conditions, including SUFE, Perthes, osteomalacia and fragility fractures [1]. There are two types of Vitamin D: Ergocalciferol (Vitamin D2) a plant product and Colecalciferol (Vitamin D3) which is a fish or mammal product [4]. Furthermore, children who are

decrease exposure to sunshine as over clothing, and exclusively breast feeding especially if their mothers have vitamin D deficient are at risk to vit D deficiency [5].

People at a high risk of vitamin D deficiency and particularly those with a combination of risk factors should be treated with vitamin D supplementation. Additionally, they should be encouraged to seek some sun exposure - keeping in mind that short periods of sun exposure to a large area of skin is best for vitamin D production,

The best strategies for preventing vitamin D deficiency are Eating foods rich in vitamin D and spending 15-20 minutes each day in natural sunlight. Also, other lifestyle strategies that may support healthy vitamin D levels include, using vitamin D supplement, and maintain a healthy body weight by walking outside to get daily exercise and exposure to sunlight [6]. All infants and children are advised to take a vitamin D supplement containing 400 international units (10 micrograms) of vitamin D, starting within days of birth. For infants and children, vitamin D is included in most nonprescription infant multivitamin drops [7].

Health Belief Model (HBM) is one of the most widely used conceptual frameworks for understanding health behavior [8]. Health belief model is a theoretical model that used to guide in health promotion and disease

prevention. Help to explain and predict individual changes in health behaviors. It is one of the most widely used models for understanding health behaviors. [9]. in addition, health Belief Model focus on individual beliefs about health conditions, which predict individual health-related behaviors. The model defines the key factors that influence health behaviors as an individual's perceived threat to sickness or disease [10].

Cerebral palsy refers to a group of neurological disorders that appear in infancy or early childhood and permanently affect body movement and muscle coordination Cerebral palsy (CP) is caused by damage to or abnormalities inside the developing brain that disrupt the brain's ability to control movement and maintain posture and balance [11].

In an Egyptian study conducted by [12] the prevalence of CP it was 2.04 per 1000 live births. However, it is not accurately estimated in Egypt due to lack of relevant medical records and registries of the total number of affected children. Children with cerebral palsy that have severe motor impairment such as spastic diplegia and quadriplegia will experience oropharyngeal dysphagia resulting in -nutrient deficiencies as well as, vitamin D deficiency [13].

Children with cerebral palsy have feeding problem leading to inadequate dietary intake of vitamin D and calcium that causing vit D deficiency [14]. Low serum Vitamin D level is another major deficiency noted in children with cerebral palsy [15]. Inadequate exposure to sunshine results in decreased mean bone mineral density, causing muscular weaknesses, development of contractures, functional impairment, and fractures [16, 17].

1.1. Significance of the Study

Vitamin D deficiency is the most common nutritional deficiency worldwide [18]. The greatest burden of disease world-wide appears to be in Africa, the Middle East and Asia [19]. Adequate vitamin D levels are essential for normal skeletal system development and mineralization. There has been a marked increase in diagnosis of vitamin D deficiency in children over the past decade. Future research should explore the drivers for this change in diagnostic behavior and the reasons prompting investigation of vitamin D status in clinical practice. Recent global consensus guidelines recommend that all infants from birth to 12 months of age, independent of their mode of feeding are treated with colecalciferol 400 units/day to prevent rickets [20]. In addition, vitamin D deficiency is very common in the Arabian countries such as Egypt, with a prevalence of 50%–90% in the general pediatric population with a higher incidence in critically ill children [21].

Children with cerebral palsy have low bone mineral density bones that cause their bones are weak and at risk for fragility fractures this is because children wit may have poor nutrition and decreased exposure to sunlight. Vitamin D is essential for bone health. Infants up to age 12 months require 400 international units (IU) daily of vitamin D, children and adolescents require 600 IU daily [22]. Supplementing 400 IU daily of Vitamin D, as recommended by the American Academy of Pediatrics (AAP) and the Institute of Medicine, or up to 800 IU as

recommended by the Canadian Pediatric Society may provide sufficient vitamin D to prevent rickets, but higher doses may be needed to achieve other health benefits [23].

The most of mothers have limitation of current knowledge related vit D deficiency, and benefit of vitamin D. In recent years there has been increasing awareness of the importance of vitamin D to prevent disease and disability [24]. Therefore, the researchers found urgent to conduct this research to increases mothers' health education based on health belief model to prevent vitamin D deficiency. Meanwhile, improve children with cerebral palsy general health and outcomes.

1.2. Aim of the Study

The study aim was to evaluate the effect of mothers' health education based on health belief model to prevent vitamin D deficiency in children with cerebral palsy.

1.3. Research Hypotheses

The study results were testing the following hypotheses:

Mothers who received health education based on health belief model will have higher mean score of knowledge to prevent vitamin D deficiency in children with cerebral palsy.

2. Subjects and Method

2.1. Research Design

A quasi- experimental research design was utilized to conduct the current study.

2.2. Setting

The study carried out in the outpatient Clinic of Benha University Hospital, Benha Teaching Hospital and Benha Specialized Pediatric Hospital, which Affiliated to the Ministry of Health.

2.3. Sample

None probability convenience sample was used to collect the data from (105) mothers and their children the samples were collected from previous setting. Their inclusion criteria were, their age between 1-3 years, children with cerebral palsy.

2.4. Tools of Data Collection

Tool I:

Structured questionnaires were used to collect the data. The questionnaires were designed by the researcher after reviewing related literature, it was written in English language, then translated to simple Arabic language to fit the sample measures and it consisted of five parts:

Part 1: characteristics of the studied children as age and gender

Part 2: characteristics of the studied mothers as age, educational level, occupation and residence.

Part 3: mothers' knowledge related to vitamin D deficiency

- a. General knowledge consisted of 10 questions as children, who remain indoors, are at high risk of vitamin D deficiency; Vitamin D intake more than dietary recommendations could be harmful, and children are at high risk of vitamin D deficiency etc....
- b. Knowledge related to nutrition consisted of 5 questions as dairy products are one of the main dietary sources of vitamin D; eggs are one of the main dietary sources of vitamin D; meat and poultry are the main dietary sources of vitamin D; fatty fishes are one of the main dietary sources of vitamin D and fruits are one of the main dietary sources of vitamin D.

Part 4: Mother's attitude related to vitamin D deficiency consisted of 12 questions to measure mothers' attitude according to liker scale as full time indoor prevents the sun exposure required for production of vitamin D; inefficient education regarding benefits of sun exposure prevents production of required vitamin D through sun exposure; a shortage of public places for outdoor activities prevents the sun exposure required for production of vitamin D and urbanization prevents sun exposure and production of required vitamin D. etc.....

Part 5: Reported vitamin D practices Questionnaire was developed based on review of literature to assess vitamin D practice recommendations among mothers of cerebral palsy. Such as sufficient exposure to sunlight the child walk outdoors daily; during the day the child directly exposed to sunlight (outdoors); in order to be vitamin D sufficient, the child consumes fish at least twice a week; for sufficient exposure to sunlight the child regularly engage in outdoor physical activities and during the day the child indirectly exposed to sunlight (through glass) etc...

2.4.1. Knowledge Scoring

Each item was assigned a score of (2) given when the answer was correct and a score (0) was given when the answer was incorrect / do not know. Mothers' total knowledge score was 30 and classified as the following; unsatisfactory score was < 60% and satisfactory when total score was $\geq 75\%$.

2.4.2. Attitude vitamin D practices Score

The Questionnaire consisted of 12 items to assess mother's attitude to prevent vitamin D deficiency in children with cerebral palsy; and asked respondents to use a Liker scale of 1-3.

Corresponding disagree took (1) score, no idea took (2) score and agree took (3) score. The total attitude was 36 divided into positive if the total scores above 75 and negative if less than 75.

2.4.3. Reported vitamin D practices Score

The Questionnaire consisted of 9 items to assess how much they concur with statements to prevent vitamin D deficiency in children with cerebral palsy; and asked respondents to use a Liker scale of 1-3.

Corresponding never took (1) score, sometimes took (2) score and always took (3) score. The total reported

practice was 27 divided into competent if the total scores above 75 and incompetent if less than 75.

Tool II: The questionnaire included key questions developed using constructs of the HBM.

It included perceived susceptibility, perceived severity, perceived barriers, perceived benefits and cues to action [25,26]

This tool was included a 25-item to measure:

- perceived susceptibility included five items (the chances of vitamin D deficiency affecting my child, I worry a lot about vitamin D deficiency, vitamin D deficiency is a big problem, There is a good possibility that my child will die from vitamin D deficiency and Within the next year, I know that a baby could die vitamin D deficiency).
- Perceived severity included five items such as (I am afraid to even think about vitamin D deficiency, The thought of vitamin D deficiency scares me, the vitamin D deficiency hopeless condition, When I think about vitamin D deficiency my heart beats faster, I am afraid to Bone pain and fatigue from vitamin D deficiency).
- Perceived benefits included four items such as (exposure of sunshine will prevent vitamin D deficiency, It's best for babies to exposure to sunshine and give vitamin D supplementation, Its best for child to eat food that contain source of vitamin D I don't worry so much about vitamin D deficiency when a baby exposure to sunlight).
- Perceived barriers included six items such as (I can't reduce the chance of child complication from vitamin D deficiency, The best exposure to sunshine for child from 11-to 12 Am, the better for the child when exposure to sunshine with wear more clothes, my family/friends would make fun of me if I exposure the child to sunshine, Putting a baby on sunshine would require starting a new habit, which is Difficult and I prefer placing child with his clothes during exposure to sunshine).
- Cues to action included five items such as (I receive much of my child care information from health professionals such as doctors and nurses; I receive much of my child care information from family members, I know the food that contain vitamin D, I know changes that accord from vitamin Deficiency and I know of a child that died of vitamin D deficiency).

2.4.3. Health Belief Model Scoring System

- The Questionnaire consisted of 25 items used a 5-point Liker scale (ranging from strongly agree to strongly disagree) to measure perceptions of behavior related SIDS (Strongly agree took one score. - Agree took 2 score - Natural took 3 score. - Disagree took 4 score. - Strongly disagree took 5 score).
- Perceived susceptibility included 5 questions (a min score of 5 and a max score of 25).
- Perceived severity included five questions (a min of 5 and a max score of 25).
- Perceived benefits included four questions (a min of 4 and a max score 20).

- Perceived barriers included six questions (a min score of 6 and a max score of 30).
- Cues to action included five questions (a min score of 5 and a max score of 25).

2.5. Validity and Reliability

Data collection tools were submitted to five experts of pediatric nursing to test the content validity. The experts agreed on the content. Regarding reliability, the reliability coefficients alpha between questions was 0.72.

2.6. Ethical considerations

An official permission was obtained from the director of Benha University Hospital, Benha Teaching Hospital and Benha Specialized Pediatric Hospital after clarifying the purpose of the study and the time for beginning the study. All mothers received written and verbal explanations about the nature of the study; their participation will be voluntary; what study involvement would entail; anonymity and confidentiality issues; and their right to withdraw from the study at any time and based on the basic ethical principle of beneficence.

2.7. Pilot Study

A pilot study was conducted on 10% of the studied sample (10 mothers) to test the clarity and applicability of the tools and then they excluded from the studied sample.

2.8. Field Work

The study was carried out from beginning of March 2018 to the end of May 2018, covering a period of 3 months. Official approvals and letters to conduct this study were obtained from the Dean of Faculty of Nursing to Director of Benha University Hospital, Benha Teaching Hospital and Benha Specialized Hospital. To fulfill the aim of the current study the health education was constructed in four phases: interviewing and assessment, planning, implementation, and evaluation.

2.8.1. Health Education Related to Vitamin D Deficiency

The Health education was designed by the researcher after extensive review of related literature.

The first part of the health education was conducted 14 days in outpatient clinic. It focused on gave the

mothers description about vitamin D, assessed her knowledge about vitamin D, mother’s attitude and reported practice and health belief model.

The second part of the health education involved provision of health education activities, provided by the researcher included a half-hour session with each mother. Post follow-up care after 1-month post-visit of each child during each follow-up to reinforce the mother’s knowledge attitude, reported practice and health belief model which provided during first part of the program.

2.8.2. Assessment Phase

This phase encompassed interviewing the participant to collect baseline data, at the beginning of the interview the researchers greeted the participation, introduced herself to each participant included in the study, explained all information about the study purpose, duration, and activities and taken oral consent. The average time for the completion of each participant interview was around (30-45minutes). Average number collected was 10 participant/day. The total sample was divided into 11 groups according to their hospital then every hospital group divided into subgroups included 5 participants for each session.

2.8.3. Planning Phase

Based on the results obtained from the assessment phase and relevant review of literature, a booklet about vitamin D health education was designed by the researchers. This was prepared in simple Arabic language to suit mothers' level of understanding and distributed to all recruited mothers. As well as, different methods of teaching and instructional media were determined.

Items
A-level recommendations
For sufficient exposure to sunlight the child regularly engages in outdoor physical activities.
The child consumes fortified milk to be vitamin D sufficient.
The child consumes fish at least twice a week in order to be vitamin D sufficient.
The child walks outdoors daily For sufficient exposure to sunlight.
The child use caps/hats to avoid severe sun exposure.
To be vitamin D sufficient, the child takes vitamin D supplements.
During the day the child indirectly exposed to sunlight (through glass).
During the day the child directly exposed to sunlight (outdoors).
Taking supplements is necessary for treatment of vitamin D deficiency but not for its prevention.

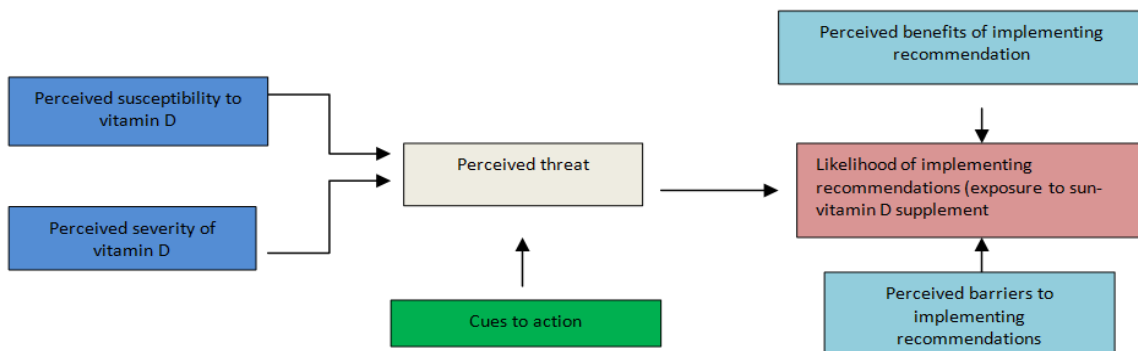


Figure 1. Vitamin D and the Health Belief Model

2.8.4. Implementation Phase

The researchers visited the previously mentioned settings five days/week (Sunday and Wednesday) in the University hospital; (Monday and Tuesday) in the Specialized hospitals and (Saturday) in Teaching Hospital, from 11.00 Am to 2.00 Pm. The average time consumed to fill in the tools was 30-45 minutes. The health education was conducted in 4 sessions each session took approximately 30 to 45 minutes, during this time the mothers were able to provide interventions that included all knowledge and skills regarding vitamin D practice. The health education included illustrated Arabic booklet involve instructions to improve mothers' knowledge, attitude and reported practice regarding vitamin D, and the posttest done after one month from the health education implementation

The health education was implemented; it included 4 sessions.

- At the beginning of the first session; each mother was given a brief explanation related to vitamin D for children with cerebral palsy and importance of giving vitamin D supplementation.

- The second session was held about the beliefs, assumptions and incorrect beliefs about vitamin D and issues that may be a barrier to vitamin D supplement practice and proper behaviors.

- The third session, the mothers are encouraged to be sensitive about the vitamin D and problems if they do not act in future (perceived susceptibility) and depth perception of complications that may be occurred with unsafe practice (perceived severity).

- The fourth and final session about the benefits of healthy exposure to sun (perceived benefits) during this period was discussed and safety practice (exposure to sunrise during activity outside the door, or through glasses, take nutrition high in calcium and vitamin D, importance of vitamin D supplementation).

Each session started with a feedback about the previous session and the objectives of the new session, using simple Arabic language to suit mothers' level of understanding. At the end of each session, mothers' inquiries were discussed to correct any misunderstanding. Methods of teaching were used including modified lectures and group discussions. Instructional media included colored poster about vitamin D.

2.8.5. Evaluation Phase

The mothers' knowledge, attitude and reported practice and health belief model was evaluated after 1 month from implementation of health education used tool 1 (part 3, 4 and 5) and tool 11. The researcher evaluated and compared the effect of health education on mothers' knowledge, attitude and reported practice and health belief model pre and after 1 month.

3. Results

Table 1. Marked that 55.2% of them were female. 37.1% of them their age ranged from 18- <24 month their mean of age was 24.361 ± 6.403 month. On the same context 46.7% of them from children specialized Hospital.

Table 1. Percentage Distribution of Children related to their Baseline Characteristics

Items	N (105)	%
Child age:	3	2.9
6- < 12 months	17	16.2
12 < 18 months	39	37.1
18 - <24 months	29	27.6
24 < 30 months	17	16.2
30 \leq 36 months		
Mean \pm SD	24.361 \pm 6.403	
Gender:		
Male	47	44.8
Female	58	55.2
hospital:		
University hospital	35	33.3
Teaching hospital	21	20.0
Specialized hospital	49	46.7

Table 2. Percentage Distribution the Mothers of Preterm Infants related to Baseline Characteristics

Items	N (105)	%
Mother's age:		
<20	6	5.7
20-<25	21	20.0
25- <30	20	19.0
30- < 35	18	17.1
\geq 35	40	38.2
Mean +SD	32.257 \pm 7.494	
Educational Level:		
Read and Write	42	40.0
Secondary Education	39	37.1
University	24	22.9
Occupation:		
Working	43	41.0
Housewife	62	59.0
Residence:		
Urban	29	27.6
Rural	76	72.4

Table 2 revealed that the mean age of mothers was 32.257 ± 7.494 years. 40% of mothers read and write. More than half (59%) of mothers were housewives and nearly two third of them from rural residence.

Table 3. Indicated that the mothers' general knowledge regarding vitamin D deficiency, more than half (66.7%, 67.6%, 68.6 & 64.8% respectively) of them had incorrect knowledge about children, who remain indoors, are at high risk of vitamin D deficiency, Vitamin D intake more than dietary recommendations could be harmful, Inappropriate dietary intakes are related to vitamin D deficiency and Vitamin D supplement intake requirements, differ for different age groups respectively. To evaluate the knowledge retention among mothers after health education implementation at 1 month 81.0%, 79.0%, 81.9% & 82.9% respectively of the mothers had correct of knowledge and there was statistically significant difference between pre and after 1 month from implementation ($p < 0.001$).

Table 3. Mother's Knowledge about vitamin D before Health Education Implementation and after 1 Month from Health Education Implementation

General knowledge about Vitamin D	Pre-Health Education						After one month from Health Education						X ²	P
	Correct		Incorrect		unknown		Correct		Incorrect		unknown			
	N	%	N	%	N	%	N	%	N	%	N	%		
children, who remain indoors, are at high risk of vitamin D deficiency	17	16.2	70	66.7	18	17.1	85	81.0	12	11.4	8	7.6	12.35	<.005
Vitamin D intake more than dietary recommendations could be harmful.	20	19.0	71	67.6	14	13.3	83	79.0	15	14.3	7	6.7	10.11	<.001
children are at high risk of vitamin D deficiency	13	12.4	79	75.2	13	12.4	82	78.1	13	12.4	10	9.5	13.04	<.005
Inappropriate dietary intakes are related to vitamin D deficiency	19	18.1	72	68.6	14	13.3	86	81.9	10	9.5	9	8.6	4.6	<.005
Vitamin D supplement intake requirements, differ for different age groups	25	23.8	68	64.8	12	11.4	87	82.9	13	12.4	5	4.8	12.59	<.005
Children with cerebral palsy are at high risk of vitamin D deficiency.	24	22.9	74	70.5	7	6.7	85	81.0	12	11.4	8	7.6	5.54	<.005
Most of the vitamin D required is produced when the skin is directly exposed to the sun	8	7.6	85	81.0	12	11.4	88	83.8	13	12.4	4	3.8	7.34	<.005
Currently, vitamin D deficiency is one of the most important health issues in our country	9.2321	55	52.4	27	25.7		82	78.1	14	13.3	9	8.6	33.4	<.001
Bone pain and fatigue are among the vitamin D deficiency symptoms.	13	12.4	77	73.3	15	14.3	79	75.2	13	12.4	13	12.4	48.29	<.001
Both boy and girl at risk are of vitamin D deficiency.	16	15.2	77	73.3	12	11.4	88	83.8	10	9.5	7	6.7	27.84	<.001
Knowledge about Nutrition														
Fatty fishes are one of the main dietary sources of vitamin D	11	10.5	65	61.9	29	27.6	78	74.3	19	18.1	8	7.6	11.29	<.005
Dairy products are one of the main dietary sources of vitamin D.	18	17.1	67	63.8	20	19.0	90	85.7	8	7.6	7	6.7	9.92	<.005
Eggs are one of the main dietary sources of vitamin D	13	12.4	57	54.3	35	33.3	85	80.2	8	7.5	12	11.3	9.96	<.005
Meat and poultry are the main dietary sources of vitamin D	13	12.4	60	57.1	32	30.5	94	89.5	6	5.7	5	4.8	9.21	<.005
Fruits are one of the main dietary sources of vitamin D.	13	12.4	67	63.8	25	23.8	89	84.8	6	5.7	10	9.5	10.70	<.005

The same table also illustrated the more than half (61.9 %, 63.8% , 54.3% & 57.1respectively) of them had incorrect knowledge about Fatty fishes are one of the main dietary sources of vitamin D, Dairy products are one of the main dietary sources of vitamin D, Eggs are one of the main dietary sources of vitamin D, Meat and poultry are the main dietary sources of vitamin D and Fruits are

one of the main dietary sources of vitamin D. respectively. To evaluate the knowledge retention among mothers after 1 month After health education implementation 74.3%, 85.7, 80.2,89.5& 84.8% respectively of the mothers had correct of knowledge and there was statistically significant difference between pre and after 1 month (p<0.001).

Table 4. Mother's Attitude about vitamin D before Health Education Implementation and after1 Month from Health Education Implementation

Items	Pre-Health Education						After one month from Health Education						X ²	P
	Disagree		No idea		Agree		Disagree		No idea		Agree			
	N	%	N	%	N	%	N	%	N	%	N	%		
Urbanization prevents sun exposure and production of required vitamin D.	75	71.4	19	18.1	11	10.5	9	8.6	23	21.9	73	69.5	9.62	<.005
A shortage of public places for outdoor activities prevents the sun exposure required for production of vitamin D	62	59.0	27	25.7	16	15.3	16	15.2	20	19.0	69	65.7	19.35	<.001
Full time indoor occupation prevents the sun exposure required for production of vitamin D.	63	60.0	31	29.5	11	10.5	15	14.3	15	14.3	75	71.4	28.00	<.001
Inefficient education regarding benefits of sun exposure prevents production of required vitamin D through sun exposure.	74	70.5	18	17.1	13	12.4	15	14.3	30	28.6	60	57.1	16.24	<.001
The undesirable taste of sea foods is one of the barriers to their consumption of dietary sources of vitamin D.	59	56.2	28	26.7	18	17.1	18	17.1	23	21.9	64	61.0	7.65	<.005
In vitamin D deficiency, supplement intake is more effective compared to dietary intake and sun exposure.	75	71.4	22	21.0	8	7.6	7	6.7	28	26.7	70	66.7	17.87	<.001
Taking vitamin D supplement, unless recommended by physicians is wrong.	48	45.1	40	38.1	17	16.2	12	11.4	16	15.2	77	73.3	13.36	<.005
Unwillingness of individuals to take vitamin D supplement is one of the barriers of providing this nutrient.	65	61.9	15	14.3	25	23.8	7	6.7	11	10.5	87	82.9	48.34	<.001
Taking supplements is necessary for treatment of vitamin D deficiency but not for its prevention.	72	68.6	20	19.0	13	12.4	17	16.2	11	10.5	77	73.3	16.505	<.001
Permanent using of sunscreens on face, neck and hands prevents the sun exposure required for production of vitamin D.	56	53.3	31	29.5	18	17.1	10	9.5	16	15.2	79	75.2	8.697	<.005
Taking supplement is only necessary in case of lack of exposure to sunlight	80	76.2	13	12.4	12	11.4	7	6.7	15	14.3	83	79.0	24.044	<.001
A high expense of dietary sources of vitamin D is one of the barriers of providing this nutrient.	50	47.6	26	24.8	29	27.6	10	9.5	8	7.6	87	82.9	46.599	<.001

Table 4. The study results revealed nearly two third mothers (71.4%, 70.5, 71.4%, & 76.2. % respectively) had disagree about urbanization prevents sun exposure and production of required vitamin D, inefficient education regarding benefits of sun exposure prevents production of required vitamin D through sun exposure, in vitamin D deficiency, supplement intake is more effective compared to dietary intake and sun exposure, Taking supplement is only necessary in case of lack of exposure to sunlight and a high expense of dietary sources of vitamin D is one of the barriers of providing this nutrient respectively. While after one month they had agreed a high expense of dietary sources of vitamin D is one of the barriers of providing this nutrient. On the same mentioned items. There was statistically significant relation between pre health education implementation and after one month from implementation ($p < 0.001$).

Table 5. The study results proved that more than half of mothers (63.8%, 69.5, 61.0%, 68.6& 61.9% respectively) had never reported practice about For sufficient exposure to sunlight the child regularly engage in outdoor physical activities, to be vitamin D sufficient, the child consumes fortified milk, in order to be vitamin D sufficient, the child consumes fish at least twice a week, to be vitamin D sufficient, the child takes vitamin D supplements, during the day the child directly exposed to sunlight (outdoors), and during the day the child indirectly exposed to sunlight (through glass) respectively. While after one month they had always reported practice on the same mentioned items. There was statistically significant relation between pre health education implementation and after one month from implementation ($p < 0.001$).

Table 5. Mother's Reported Practice about vitamin D before Health Education Implementation and after 1 Month from Health Education Implementation

Items	Pre-Health Education						After one month from Health Education						X ²	P
	Never		Sometimes		Always		Never		Sometimes		Always			
	N	%	N	%	N	%	N	%	N	%	N	%		
For sufficient exposure to sunlight the child regularly engages in outdoor physical activities.	67	63.8	23	21.9	15	14.3	0	0.0	17	16.2	88	83.8	11.50	<.005
To be vitamin D sufficient, the child consumes fortified milk.	73	69.5	21	20.0	11	10.5	0	0.0	31	29.5	74	70.5	19.28	<.001
In order to be vitamin D sufficient, the child consumes fish at least twice a week.	64	61.0	23	21.9	18	17.1	9	8.6	21	20.0	75	71.4	12.49	<.005
For sufficient exposure to sunlight the child walks outdoors daily.	60	57.1	27	25.7	18	17.1	6	5.7	25	23.8	74	70.5	24.26	<.001
The child use caps/hats to avoid severe sun exposure.	61	58.1	27	25.7	17	16.2	18	17.1	17	16.2	70	66.7	10.88	<.005
To be vitamin D sufficient, the child takes vitamin D supplements.	72	68.6	19	18.1	14	13.3	13	12.4	10	9.5	82	78.1	13.49	<.001
The child use sunscreen on hands.	67	63.8	22	21.0	16	15.2	7	6.7	18	17.1	80	76.2	11.007	<.005
During the day the child directly exposed to sunlight (outdoors).	64	61.0	26	24.8	15	14.3	5	4.8	11	10.5	89	84.8	13.43	<.001
During the day the child indirectly exposed to sunlight (through glass).	65	61.9	20	19.0	20	19.0	7	6.7	8	7.6	90	85.7	28.52	<.001

Table 6. Comparison of Mothers' Health Belief Models Mean score before Health Education Implementation and after 1 Month from Implementation

Items	Pre-Health education	After one month	t test	P value
	Mean ± SD	Mean ±SD		
Perceived Susceptibility	8.924 ± 3.097	21.419 ± 3.407	22.442	<0.001
Perceived Severity	9.057 ± 3.958	22.428 ± 2.051	26.376	<0.001
Perceived Barriers	11.866 ± 3.838	25.828 ± 3.259	24.310	<0.001
Perceived Benefits	7.866 ± 2.465	17.415 ± 2.032	24.594	<0.001
Cues to Action	8.3333. ± 3.124	22.104 ± 3.733	24.577	<0.001

Table 7. Distribution of the studied mother's total knowledge score, Total attitude and Total practice regarding to vitamin D deficiency

Items	Study group (No.105)				X ² P	P value
	Pre-Health education		Post Health education			
	No.	%	No.	%		
Total knowledge score						
Satisfactory	17	16.2	89	84.8	277.871	<0.001
Unsatisfactory	88	83.8	16	15.2		
Total Attitude						
Positive	11	10.2	90	85.7	274.700	<0.001
Negative	94	89.5	15	14.3		
Total practice						
Adequate	8	7.6	97	92.4	191.840	<0.001
Inadequate	97	92.4	8	7.6		

Table 6. Demonstrated that there was statistically significant difference between pre and after 1 month from health education ($p < 0.001$) related to health belief models items it showed that increase mean score of health belief model of the mothers after implementation of health education.

Table 7. The total mothers' knowledge regarding vitamin D deficiency, indicated that most half (83.8%) of them had unsatisfactory level of knowledge before health education implementation. And 89.5% of them had negative attitude. To evaluate the knowledge retention and attitude among mothers after 1 month from health education implementation the same table proved that 84.8% of the mothers had satisfactory knowledge and 90% of them had positive attitude. There was statistically significant difference between pre and after 1 month from health education ($p < 0.001$). The same table illustrated that the total mother's reported practice, indicated that 7.6% have adequate reported practice before health education implantation. While after one month from implementation 92.4% has adequate reported practice.

4. Discussion

Cerebral palsy is the most common movement disorder in children [27]. Therefore, their disabilities affect different aspects of health and behavior of their families [28]. Children with cerebral palsy are at an increased risk for vitamin D deficiency may be due to insufficient sunlight exposure, motor disabilities, and feeding difficulties. The study conducted by [29] illustrated that children with cerebral had lower level of vitamin D. The study conducted by [30] showed that there was a significant correlation between level of vitamin D and any health problem associated with impairment as cerebral palsy.

Therefore, the aim of this study was to evaluate the effect of mothers' health education based on health belief model to prevent vitamin D deficiency in children with cerebral palsy. The result of the present study revealed that the mean age of the child was 24.361 ± 6.403 cerebral palsy is diagnosed around 12 to 24 months of age [31].

Regarding to, the child characteristics, the present study revealed that the number of females was more than male. This result was disagreed with [32] indicated that the number of females was more than male. In relation to, the mother's characteristics, the result of the present study illustrates that most of the studied sample was from rural area. According to [33] showed that the prevalence of CP is higher in developing countries such as Egypt, than it is in Europe. In addition, CP is more frequent in rural area than urban. This may be due inadequate health services in rural area that providing knowledge and education about importance of vitamin D.

Concerning, mothers' knowledge regarding vitamin D the result of the current study showed that more than half of them had incorrect knowledge about vitamin D. This finding was similarly to [34]. Also, the study conducted in Poland by [35] reported in her study that mothers had insufficient knowledge about vitamin D. However, mothers' knowledge related to vitamin D supplement intake requirement the present study revealed insufficient knowledge regarding vitamin D supplement. This result

agreement with [36] illustrated in their study conducted in Saudi Arabia that mothers had low knowledge level about vitamin supplement.

On the other hand, mothers' knowledge about sources of vitamin D the result of the present study emphasized poor mothers' knowledge about vitamin D resources. This result was consistent with the result of [37]. Meanwhile, the study carried out by [38] reported that mothers had poor knowledge regarding source of vitamin D. additionally supplementing of vitamin D in children with cerebral palsy increase bone density, and helps prevent fragility fractures [39]. The result of the present study revealed that more than half of mother had incorrect knowledge about fatty fishes are one of the main dietary sources of vitamin D, dairy products are one of the main dietary sources of vitamin D, eggs are one of the main dietary sources of vitamin D, meat and poultry are the main dietary sources of vitamin D and fruits are one of the main dietary sources of vitamin D. This result was the same with [40,41]. Regarding mothers' practice about exposure to sunlight the study revealed that more than half of them had insufficient education about importance of vitamin D. Sunlight is considering the most important source for vitamin D. This result was in the same with [42].

As regard to mothers' attitude regarding vitamin D the most of mothers had negative attitude about vitamin D pre health education implementation. This result agrees with [43] showed that mothers had poor attitude about vitamin D supplements. Moreover [44] revealed that the majority of the study participants had limited knowledge, poor practices, and negative attitude toward vitamin D in addition [45] indicated in her study that mothers had poor knowledge, attitude and practice among mothers regarding vitamin D supplement for their infants. From the researcher' point of view mothers' awareness about vitamin D sources, and supplement about are very important to prevent vitamin D deficiency for their children with cerebral palsy and for better quality of the child life and further outcomes.

In relation to, mothers' health belief models mean score, the result of the present study showed that there was a statistically significant difference between pre and after 1 month from health education ($p < 0.001$) related to health belief models items it showed that increase mean score of health belief model of the mothers. This results supported by [46] illustrate that by applying the health belief model in the experimental group, a significant difference was observed. Also, the study conducted by [47] revealed that, there were significant differences between the mean score of the studied mothers on prevention of vitamin D deficiency. Moreover, the item of health belief model as Perceived susceptibility there was a significant difference after health education implementation. This result was agreement with [48]. The mean score of perceived severity also reported a significant difference. This result was consistent with study conducted by [49]. Perceived benefits showed a significant difference after implementation of health education. This result supported by the result by [50]. As well, perceived barrier reported a significant difference. This result was consistent with study conducted by [47]. The mean score of cues to action, the result revealed a significant difference after health

education implementation than before. This result was consistent with study conducted by [51].

The research point of view emphasized on the importance of health education programs should focus on the sources of vitamin D, including sun exposure, vitamin supplementation, and food sources, and should clarify the available food fortified with vitamin D. They also need to increase the awareness about the long-term effect of vitamin D deficiency and its correlation with chronic disease. Health education programs should also highlight the importance of the consumption of vitamin D supplements as an affordable way to improve vitamin D status and should indicate the required amount of time of sunlight exposure in order to have sufficient vitamin D status.

5. Conclusion

Based on the results of the present study, it can be concluded that, Health education program was effective and help mothers to prevent vitamin D among their children with cerebral palsy.

6. Recommendations

- Health educational program for mothers aimed at increasing vitamin D knowledge, and to educate them about the importance of vitamin D
- Booklets should be available and distributed in all health care centers to all mothers about the disease and health-related practices.
- Further studies focusing on the associations between vitamin D and general health.

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