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Educational Program for Empowering Mothers of Fewer Than Five Children to Overcome Sickle Cell Crisis

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Abstract:
Background: one of most blood disorder hereditary is sickle cell anemia; it has a series crises and results to children who have it. Also, empowerment is measurement that established in order to enhance the self-determination and autonomy via support and engagement. Therefore, the level of mothers' education and their engagement are important elements for caring with high-quality the children who have sickle cell crises (SCC).
Objective*:* To empower mothers of fewer than five children to manage sickle cell crises through engagement and education.
Method: A quasi-experimental (pretest/ posttest) research design was used.
Setting: The study was conducted in pediatric hematology clinic at Minia University Hospital for Obstetrics and Pediatrics.
Sample: A purposive sample composed of 50 mothers who have fewer than five children to manage sickle cell crises.
Tools: Two tools were used to collect data including, first: Interview questionnaire sheet, second: Empowerment scale.
Results: Result of this study showed that there was significant improvement in mothers' knowledge about sickle cell crises in post/test.
Conclusion: after the implementation of the program there was remarkable improvement of mothers' knowledge. Mothers' empowerment was low in pre/test and improved in post/test with statistical significant difference between pre and post/test.
Recommendations: There should be a continuous developing educational program for empowering and engaging mothers in caring for their children with sickle cell anemia.

Keywords: Mothers' of fewer than Five Children, Empowerment, Sickle Cell Crisis

INTRODUCTION

Empowerment considered as the capacity and ability of an individual or a group to do correct choices and actions; in which it is inspiring the options, and then converting them into required activities and outcomes. Empowerment has two parts – first is related to Amartya Sen's concept of agency which means the ones' capacity to do on behalf of what he/she value and have cause to value – and second is related to the organizational environment, which provide the individuals the opportunity to extend agency fruitfully **(Solava & Sabina, 2007).**

Also, empowerment is a created agent which can help in improving self-determination and autonomy among individuals. It increases the capacity of persons in order to do their own authority, as well suppose the responsibilities for each person to implement his/her actions and concerns, thus they will be able to work autonomously and with self-determination. It can be supported by using the suitable professional actions, and interactions; as well as it may be developed by persons themselves when they have the ability to cope with their influence deficiency, sense of fragility and powerlessness, as well realize and employ their own resources and opportunities **(Adams, 2008).**

Moreover, there are three components of empowerment. **First** is "an interactional element" which means the relationship between individuals and their social environment; **second** is "a behavioral element" which means the ability of individual to practice the control of their environment; **third** is "an intrapersonal element" which means the beliefs of individuals about their self-efficacy and perceived capability. Each of these components has been recognized in researches about the maternal empowerment; as well its relations with the quality of child care by empowering mothers, in which it be achieved by means of engagement and education of mothers. By this path, mothers can be supported to control over their children's comfort, when they preserving their own freedom **(Ebrahimi, et al., 2013).**

One of most blood disorder hereditary is sickle cell anemia. Normal red blood cells are elastic discs and soft, and shaped as the letter O, which help them to proceed readily through the child's blood vessels. While, sickle cells are viscous and rigid, and formed like the letter C. Sickle cells with each other are being clustered, and to the lining of blood vessels, as well as making it difficult for them to transfer through the small blood vessels. This created clusters establish obstructions in small blood vessels of child, this hinder the motion of oxygen-carrying and healthful blood. This obstruction can lowering tissues oxygen delivery, consequence with pain, dysfunction of organ, and result in the most of the diseases' complications **(Yawn, et al., 2014)**. The most special common disease among people whose ancestors come from sub-Saharan Africa is sickle cell disease; Spanish-speaking regions (South America, Cuba, Central America); India; Saudi Arabia; and Mediterranean countries such as Greece, Italy and Turkey **(WHO, 2010).**

Sickle cell disease was detected in 108 of 45.682 children and adolescent **(Mansour, et al., 2008).**

Moreover, the main features of sickle cell anemia are the chronic anemia and periodic incident of pain. The red blood cells' format is modified from normal cells to sickle or crescent form. The disfigured or misshapen sickle shaped RBCs can result in tissue infarction and microcirculation become blocked. It mainly causes breath shortness, fatigue, organ joint or pain; hand-foot syndrome, eyes problems, yellowish eyes and skin, as well as the other complications which include stroke, infections, acute chest pain, slow growth and puberty in children, and often a little structure in adults **(WHO, 2010).**

Sickle-cell crisis or Sickling crisis characterized by many independent acute conditions that happen in sickle cell disease's patients. There are many causes result from sickle cell disease such as; anemia and crises that comprise the vaso-occlusive crisis, sequestration crisis, haemolytic crisis, aplastic crisis, acute chest syndrome, and others **(Best Bets, 2010).** The predisposing cause for sickle cell disease is not specified; but dehydration, infection, and acidosis (all of which favor sickling) can work as excitement in most instances, **(Kumar, et al., 2009)**

The main signs and symptoms of sickle cell anemia SCA can include severe pain, fatigue, arthritis, dactylitis (swelling and inflammation of the hands and/or feet), bacterial infections, splenic sequestration (sudden collection of blood in the spleen and liver), harms to the heart, lung congestion, leg ulcers, asepsis and bone infarction leading to the death bone portions **(Valav, et al., 2010; Julie, et al., 2014).**

Incidence of severe pain among sickle cell anemia children is requiring hospitalization as well requiring reducing their daily activities. The pain of sickle cell anemia child may be continued from hours to week or may be more, and this pain has pulsate nature with a susceptibility to proceed around the body. Often, there is common abdominal pain with tenderness and complication in bones with sickle cell anemia child has no cure; thus the aim of treatment is, firstly to prohibit the sickling phenomenon, then secondly, to provide an emergency treatment when SCC happens **(Joshua, et al., 2014).**

Therefore, the pediatric nurse has professional goal, which is to help children and their families "mothers" to participate in a scope of interventions that are proper to their clinical status. A regular and systematic implementation of this strategy is predictable to improve health outcomes, and minimize and block superfluous costs of health care **(Benjamin and Chu, 2013)**. The development of children cognitively, emotionally, socially, and physically has been displayed to be linked with maternal participation in primary care and education as it has a positive and achievable status of mind; in general engagement with the health care professionals is associated with a group of organizational policies that established to assure a sharing between these parties **(Maurer, et al., 2012).**

The role of pediatric nurse is; supplying family and the affected children with basic information about the illness; providing them by information about how to control it; helping them to recognize infection signs; and upgrading their lifestyle attitudes that don't increase the complications of the disease **(Joshua, et al., 2014)**. The nurse should provide care for acute pain of tissue hypoxia which contain caring and elevating swollen joints, and teach patients relaxation techniques, distraction and breathing exercises in order to decrease and relief pain. When the pain has been deactivated and calmed down, the nurse has to perform measures of maintaining function; for example, providing the physical therapy, stimulating nerve via transcutaneous, and monitoring the patients for infection signs or dehydration **(Julie, et al., 2014).**

The failure to pass the symptoms effectively can let the family feeling dysfunction and raise duty and onus of care and despair. For caring the child with sickle cell anemia, the nurse should take advantage of the practical and psychological demands of parents especially mothers. Thus, health education of mothers should empower them in order to educate them about how to lessen or restrain situations that can alert and prompt sickle cell crisis for example; warming children as possible, safeguarding adequate hydration, by preventing stressful situations, and excessive physical activities **(Hand, 2014)**.

Significant of the study:

Sickle cell disease pointed out to be the accumulation or aggregate of genetic blood turmoil that depicted by a hemoglobin varied called (HbS). And the persons who are have the sickle cell anemia, have beta globin variant with two copies, and the initial hemoglobin existed in their red blood cells is (HbS) **(WHO, 2010).**

Moreover, the studied of hemoglobin S expansion in Siwa Oasis, Egypt, mentioned that is high frequency of Hb S carriers; as out of 349 primary school children screened, there were 22% (77/349) own the abnormal Hb profiles; and from them there were 88% (68/77) had Hb S (sickle cell disorder); and there was 94% of those having Hb S (64/68) had sickle cell trait, while 6% had sickle cell anemia **(Moez & Younan, 2016)**.

Thus, providing knowledge as regards to chronic illness such as sickle cell disease can enhance and foster child and family health outcomes, in order to identify signs of infection and in general adopt lifestyle behaviors that don't arouse the disease, as well support healthy positive behavior. Also, empowerment of mothers can be achieved through engagement and education. By this route, mothers can be helped to control over their children's wellbeing by maintaining their own independence. Educational program is crucial/ decisive aspect for encouraging mothers and their child to cope with diseases by increasing their information and helping mothers to understand alternative they have. Therefore, developing and applying educational program for mothers of fewer than five children about sickle cell crises, is prerequisite and beneficial in terms regarding the quality of care to decrease morbidity and mortality rates, in addition to minify the onus on families, hospitals and the community as well.

THE AIM OF THE STUDY

The aim of this study is to empower mothers of fewer than five children to manage sickle cell crises through engagement and educational.

SUBJECTS AND METHODS

3.1. Research design: A quasi-experimental (pretest / posttest) research design was utilized to meet the aim of this study.

3.2. Setting: this study was conducted at pediatric hematology clinic with sickle cell crisis, at Minia University Hospital for Obstetrics and Pediatrics.

3.3 Sampling and population: A purposive sample composed of Fifty (50) mothers of fewer than five children who were admitted to the pediatric hematology clinic with sickle cell crises, under the following **Inclusive Criteria:** Mothers of fewer than five children, Mothers who are willing to participate in the study. **Exclusive Criteria:** Mothers of children with sickle cell anemia associated with other disease (ex. thalassemia).

Tools for Data Collection:

Two tools were used in this study and developed by the researcher, based on related literatures, to collect the necessary data for this study, which divided as the followings:

Tool I: Pre-designed questionnaire sheet for mothers of fewer than five children as pre/post , was designed by the researchers after reviewing of the related literature to assess the mothers of fewer than children knowledge about sickle cell anemia and sickle cell crisis. **It was consisted of the following two parts:**

1. **Part I:** Personal data: as children age, sex, mothers age, education level, number of children, residence.
2. **Part II:** Interview mothers' knowledge questionnaire sheets: This part was used as a pre and post education test for all mothers. It includes: mothers knowledge regarding sickle cell anemia and sickle cell crisis, including definition, signs and symptoms, causes of crisis, risk factors, medical treatment, health education, and health prevention for sickle cell crisis in children and mothers knowledge regarding actions taken to overcome sickle cell crisis including: giving immunization, plenty of fluids, enough oxygen .....etc.

Scoring system of mothers' knowledge was graded according to the items of the interviewing questionnaire sheet; mother answers were evaluated by using model answer sheet that was prepared by the researchers. A score of one was given for correct answer and a zero for incorrect answer. For each part, the scores of the items were summed up and the total divided by number of the items. These scores were converted into a percent score and mean and standard deviations were computed. The total mothers' knowledge was scored as less than 50% was considered as unsatisfactory while score of 50% and more is considered as satisfactory.

Tool II: was family empowerment scale: The scale was originally performed by **Koren, et al., (1992)** and revised by the Behavioral and Developmental Services: Children's **Quality Improvement, (2008)** and revised by Research and Training Center on **Family Support and Children's Mental Health, (2010)**. It consisted of 17 items within three construct areas family (6 statements), child service system (6 statements) and community (5 statements); measured by five point Likert scale and was summarized in the current research to be easy to use by the mothers, Never (1), Seldom (2) and Sometimes (3) Often (4) Very often (5) for ease applicability. The researchers adopted the scale, translated it into Arabic language and summarized it. The tool was tested for validity and reliability pre conduction the study. **A score of each area** is the sum of the item responses. The higher score indicates relatively more empowerment in each area. To obtain a score for each area, sum the item responses and scored in the same direction. **The Scoring of family empowerment scale was as the following:**

1. Low empowerment ranged between (17-39)
2. Moderate empowerment ranged between (40-62)
3. High empowerment ranged between (63-85)

Validity and Reliability:

The tools was tested the content validity by a jury of three experts in the field of the study to test the content validity of tool and necessary modifications were done. Reliability of the tools was performed to confirm its consistency using Cronbach's alpha coefficient method.

Pilot study:

A pilot study on (10 %) 5 mothers was conducted at Minia University Hospital for Obstetrics and Pediatrics. A pilot study was conducted to test clarity & completeness of the study tools and to determine the time required to fill each tool. According to the results of pilot, the needed modification, omissions and/or additions were done. A jury acceptance of the final forms was secured before actual study work and the reliability was assessed in a pilot study by measuring their internal consistency using Cronbach's alpha coefficient method.

Ethical consideration:

The oral consent was obtained from all mothers to participate in the study after explaining the nature and purpose of the study. The researchers initially introduced themselves to all optional subjects and they were assured that the collected data would be absolutely confidential. They were informed that participation is voluntary and that they could withdraw at any time of the study. Confidentiality of the mother's data was ascertained. Confidentiality and anonymity were assured.

Educational program:

The researchers prepared educational booklet after assessment of knowledge to identify the needs of mothers of fewer than five children with sickle cell crises in a form of printed (Arabic booklet). Information based on review of relevant literature and internet resources about sickle cell crises.

Field work:

The field work was carried out through a period of 6 months starting from March 2017 to August 2017; the time required for the program implementation was 6 months. One month for pre/post-test, 5 months for implementation of the

program. Mothers of fewer than five children was divided into 10 small groups, each group had 5 mothers. There were 5 total sessions for each group; each session was variable and ranged between 30-45 minutes. Each participant gets a copy of the program booklet that included all the educational materials. Each session usually started by a summary of what has been taught during the preceding sessions and the objectives of the new one. Giving praise and/or recognition to the interested mothers were used as a motivator during program implementation.

The actual work started by meeting the mothers in pediatric hematology clinic at Minia University Hospital for Obstetrics and Pediatrics, the researcher first introduced herself to them and gave them a complete back ground about the study, it's aim, then the pre-test format, was distributed in order to collect the required data. The researcher was available for more clarification whenever needed. Then, the content of the program was designed based on actual educational need assessment of the studied mothers.

Consequently, the subject content has been sequenced through theoretical sessions. The session 1, content: personal interviewing of the studied mothers, the aim, duration of the study explained by the researcher through direct personal communication, mother class and discussion and pre-test. The session 2, content: definition of sickle cell anemia, causes and precipitated factors of sickle cell crisis. The session 3, content: clinical manifestations of sickle cell anemia / sickle cell crisis and complications of sickle cell crisis. The session 4, content: management of sickle cell crisis and health teaching for the mothers about how to prevent sickle cell crisis. The session 5, content: Revision. Methods of teaching such as lecture, and small group discussion, different media was used for example, illustrative pictures, and videos. At the last, post-test format was distributed in order to collect the required data.

DATA ANALYSIS

Data entry was done using compatible personal computer. The statistically analysis was done using SPSS-20 statistical software package. The content of each tool was analyzed, categorized and then coded. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative continuous data were compared by using student T-test in case of comparisons between the mean scores of the two studied groups. Qualitative studied variables were compared using Chi-square test. Statistical significance was used at P. value <0.05

RESULTS

Table (1): Distribution of mothers according socio-demographic characteristics (n= 50)

Items		**No**	**%**
1.	**Age in years of mothers:**		
-	Under 20: 29 years	6	12
-	From 30 : 39 years	28	56
-	40 and more	16	32
Mean ± SD		38.2 ± 8.1	
2.	**Sex of under five children:**		
-	Mal	30	60
-	Female	20	40
3.	**Formal education of mothers**		
-	Cannot read and write	18	36
-	Secondary School	24	48
-	Higher Education	8	16
4.	**Residence:**		
-	Rural	36	72
-	Urban	14	28

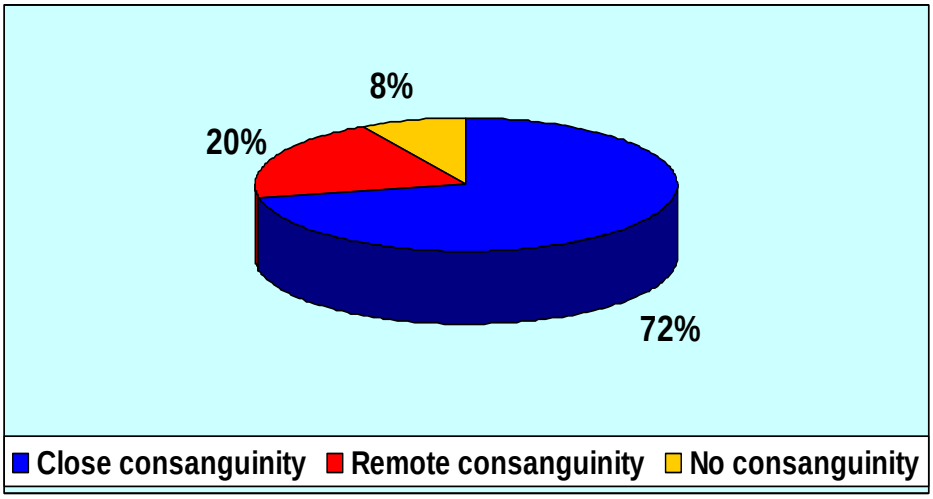

Fig. (1) Percent distribution of consanguinity among parents:

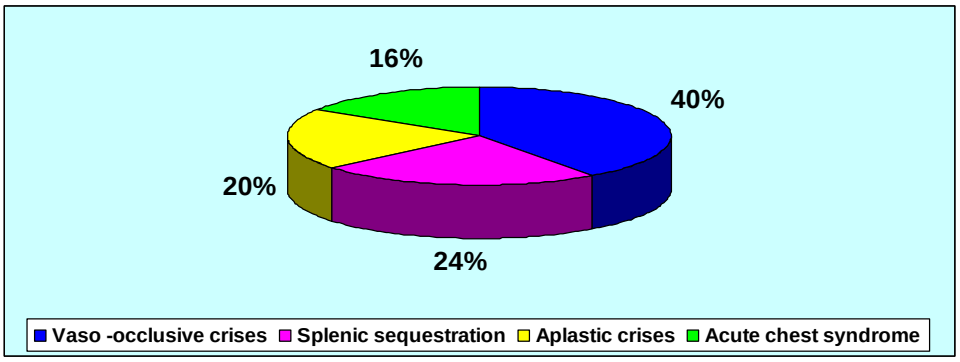

Fig. (2) Percent distribution of children according to types of sickle cell crises

Table (1) & figures (1, 2) show the distribution of the mothers according to socio-demographic characteristics. It was regarded that, 56% of mothers age from 30:39 years, with mean age (38.2±.8.1). Their formal education revealed that, 48% of mothers have secondary school. Regarding residence, 72% of mothers were living in rural but 28% were living in urban. In addition 72% have close consanguinity among parents. Regarding types of sickle cell crises among children under five years; 40% of children have vaso-occlusive crisis.

Table (2): Distribution of mothers of fewer than five children according to their knowledge about sickle cell anemia n=50

Items	Pre test		Post-test		T. test	P. value
	No	%	No	%		
Definition of sickle cell anemia.						
- Know	6	12	45	90	5.5	0.01*
- Don't know	44	88	5	10		
Causes of sickle cell anemia						
- Know	7	14	42	84	6.4	0.01*
- Don't know	43	86	8	16		
Signs and symptoms sickle cell anemia						
- Know	15	30	40	80	8.3	0.02*
- Don't know	35	70	10	20		
Treatment of sickle cell Anemia						
- Know	10	20	46	92	5.4	0.02*
- Don't know	40	80	4	8		
Preventions of sickle cell crises						
- Know	9	18	45	90	8.2	0.03*
- Don't know	41	82	5	10		
Complications of Sickle cell Anemia						
- Know	7	14	47	94	6.2	0.01*
- Don't know	43	86	3	6		

*= Significant

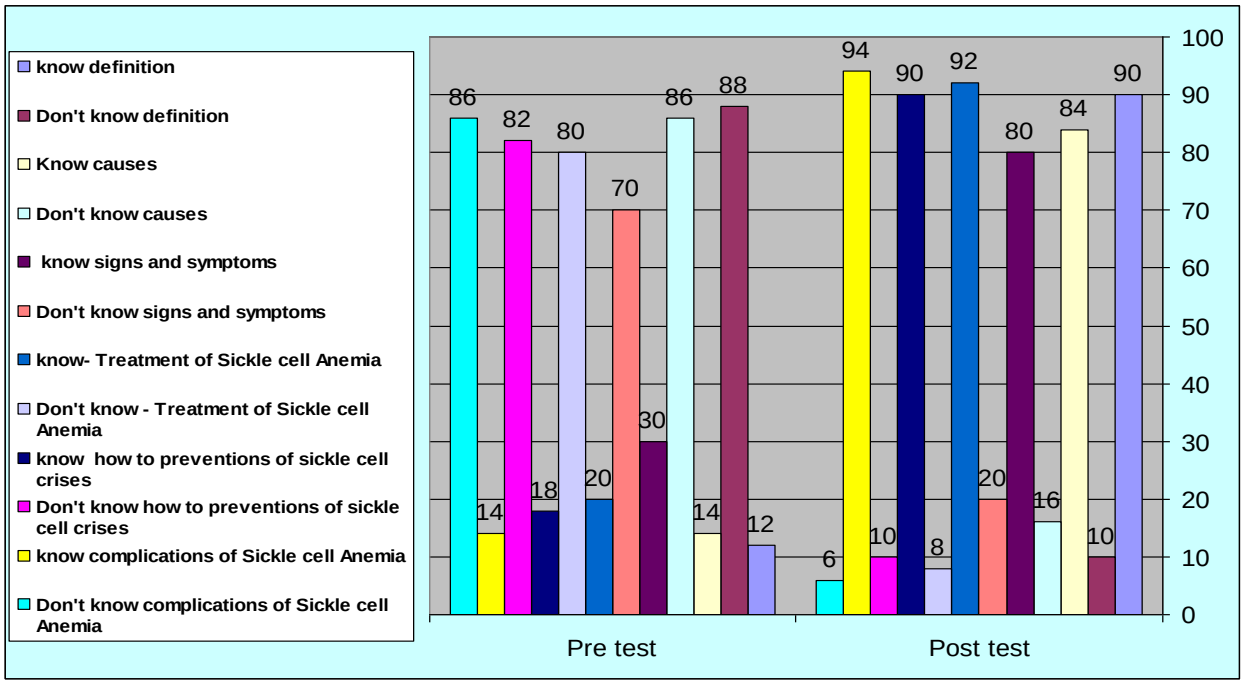

Fig. (3) Distribution of mothers of fewer five children according to their knowledge about sickle cell anemia

Table (2) & figure (3) illustrate that 12% of mothers knowledge about meaning of sickle cell anemia in pre-test but 90% of mothers of children of fewer than five children in post-test. Regarding signs and symptoms of sickle cell anemia, 30% in pre-test but 80% in post test say the signs and symptoms of sickle cell anemia. 20% of mothers know treatment of sickle cell anemia in pre-test and 92% in post-test. 18% of mothers know preventions of sickle cell crises in pre-test and 90% in post-test. However, this increase reached statistically significant difference between the mothers of fewer than five children know definition, signs and symptoms, treatment and prevention of sickle cell crisis (P. 0.01, 0.02,0.02 and 0.03); respectively.

Table (3) Distribution of the mothers knowledge regarding precipitating factors of sickle cell crises in pre and post/ test no=50

Items	Pre test		Post-test		T. test	P. value
	No	%	No	%		
Anemia.						
- know	10	20	46	92	4.45	0.02*
- Don't know	40	80	4	8		
Fever						
- know	6	12	41	82	5.54	0.01*
- Don't know	44	88	9	18		
Pain						
- know	11	22	43	86	5.33	0.03*
- Don't know	39	78	7	14		
Infection						
- know	6	12	47	94	6.44	0.03*
- Don't know	44	88	3	6		
Dehydration						
- know	10	20	41	82	5.32	0.03*
- Don't know	40	80	9	18		
Nutrition deficiency						
- know	5	10	47	94	4.51	0.01*
- Don't know	45	90	3	6		
Cold						
- Know	6	12	42	84	5.45	0.01*
- Don't know	44	88	8	16		

In table (3) it was found that, the mothers of fewer than five children who know knowledge regarding precipitating factors of sickle cell crises in pre and post/ test were 20% in pre/test, and 92% in post/ test of anemia, regarded fever, 12% in pre/test and 82% in post/test, pain 22% in pre/test and 86% in post/test, infection 12% in pre/test and 94% post/test, dehydration 20% in pre/test and 82% in post/test, nutrition deficiency 10% in pre/test 94% in post/test, cold 12% in pre/test and 84% in post/test. However, this increase reached statistically significant difference between mothers of fewer than five children who know anemia, fever, pain, infection, dehydration, nutrition deficiency, cold (P. 0.02,0.01, 0.03, 0.03, 0.03, 0.01 and 0.01); respectively.

Table (4) Distribution of the mothers actions to overcome sickle cell crises of their fewer than children in pre/posttest no = 50

Items	Pre test		Post-test		T. test	P. value
	No	%	No	%		
Give Immunization						
- Always	22	44	36	72	6.35	0.01*
- Sometimes	13	26	10	20		
- Never	15	30	4	8		
Offer plenty of fluids						
- Always	8	16	40	80	5.44	0.03*
- Sometimes	11	22	8	16		
- Never	31	62	2	4		
Avoid physical activity						
- Always	6	12	33	66	5.33	0.03*
- Sometimes	17	34	14	28		
- Never	27	54	3	6		
Avoid infection						
- Always	12	24	35	70	4.40	0.02*
- Sometimes	12	24	10	20		
- Never	26	52	5	10		
Give enough oxygen						
- Always	6	12	42	84	6.30	0.01*
- Sometimes	12	24	5	10		
- Never	32	64	3	6		
Follow up visit						
- Always	15	30	41	82	5.52	0.02*
- Sometimes	17	34	6	12		
- Never	32	64	3	6		
Avoid emotional stress						
- Always	10	20	24	48	6.40	0.03*
- Sometimes	18	36	11	22		
- Never	22	44	10	20		
Avoid sun						
- Always	7	14	40	80	4.35	0.04*
- Sometimes	15	30	7	14		
- Never	22	44	3	6		

Table (4) shows mothers actions to overcome sickle cell crisis; as it was evident in pretest that there was 44% of mothers had always, and 30% never give their children immunization; while, 72% of mothers in post/test give immunization to their children. 16% in pre/test and 80% of mothers in post/test always offer plenty of fluids to their children. 30% in pre/test and 82% of mothers in post/ test always follow up visit. However, this increase reached statistically significant difference between mothers actions to overcome sickle cell crisis through give immunization, offer plenty of fluids, follow up visit (P. 0.01, 0.03, 0.02,); respectively.

Table (5): The relation between the studied sample knowledge about sickle cell crisis and their characteristics n= 50

Items	Knowledge								*P.* value
	Pre/test				Post/test				
	Satisfactory		Un Satisfactory		Satisfactory		Un Satisfactory		
	No	%	No	%	No	%	No	%	
Age in years of mothers									
- Under 20: 29 years	2	4	4	8	5	10	1	2	X^2=0.90
- From 30 : 39 years	6	12	22	44	25	50	3	6	0.01*
- 40 and more	5	10	11	22	14	28	2	4	
Formal education									
- Cannot read and write	4	8	14	28	16	32	2	4	X^2=0.95
- Secondary School	6	12	18	36	21	42	3	6	0.01*
- Higher Education	2	4	6	12	7	14	1	2	
Residence:									
- Rural	10	20	26	52	32	64	4	8	X^2=0.80
- Urban	4	8	10	20	12	24	2	4	0.01*

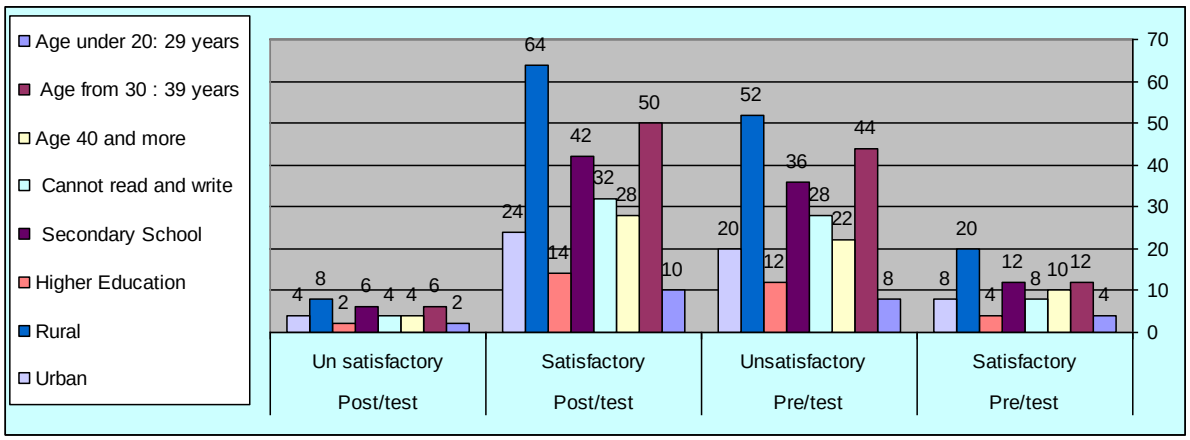

Fig. (4) The relation between the studied sample knowledge about sickle cell crisis and their characteristics

Table (5) & figure (4) revealed that, the relation between the studied sample knowledge about sickle cell crisis and their characteristics. It indicates an increase in satisfactory knowledge of mothers age from 30:39 years were12% in pre/test and increase to 50% in post/test, satisfactory knowledge of mothers who have secondary school education in pre/test was 12% and increase to 42% in post/test, satisfactory knowledge of mothers in rural area 20% in pre/test and increase to 64% in post/test. However, this increase reached statistically significant difference between the mothers age, formal education and residence their knowledge (P. 0.01, 0.01, and 0.01); respectively.

Table (6): Distribution of the mothers' according to empowerment pre/posttest no = 50

Family empowerment Scales	Pre test		Post-test		T. test	P. value
	No	%	No	%		
- Low empowerment	28	56	9	18	6.30	0.01*
- Moderate empowerment	15	30	21	42	6.32	0.02*
- Higher empowerment	7	14	20	40	5.22	0.02*

Table (6) shows mothers' empowerment in caring for their children. It was evident that, low empowerment was 56% in pre/test and 18 % in post/test, moderate empowerment was 30% in pre/test and 42% in post/test and higher empowerment was 14% in pre/test and 40% in post/test. However, this increase reached statistically significant difference between the mothers low, moderate and higher empowerment (P. 0.01, 0.02, and 0.02); respectively.

Table (7): The correlation between the total scores of mothers knowledge in pre-test and post-test about sickle cell crisis in the program n= 50

Pre-test	Post-test	
	Correlation Coefficient (r)	P. value
Knowledge	0.95	0.002*
Family empowerment scales	0.90	0.001*

*=Significant

Table (7): this table shows the correlation between the total scores of mothers knowledge and family empowerment scales in pre-test and post-test about sickle cell crisis. It is evident that the highest strong positive statistical significant correlation was found between the total scores of knowledge in pre-test and post-test program of mothers of fewer than children about sickle cell crisis (r=0.95) and the highest strong positive statistical significant correlation was found between the total scores of family empowerment scales in pre-test and post-test program of mothers of fewer than children about sickle cell crisis (r=0.90).

DISCUSSION

Empowerment is very important to individuals' capabilities in order to help them do their own authority, and take personal accountability for their actions. This can be achieved through engagement and education. Pediatric nurse should help mothers to develop themselves to improve their lack of effectiveness, feeling of weakness, and use their own capabilities, interest and opportunities to provide care for their children **(Adams, 2008)**

In the present study, half of the mothers aged from 30:39 years with a mean age of 38.2 ± 8.1. Also, it was noted that less than half of the mothers were secondary school education, one third of them were illiterate, and the minority has higher education; and the majority of studied sample were lived in rural area.

In current study there were 72% had close consanguinity, less than half had remote consanguinity and 8% had no consanguinity. This result was in consistence with **Anwar, et al., (2014)** who mentioned that there were close consanguinity accounts for about 22% of the total marriage parents in Egypt and it was elevated in rural areas. The

spread for consanguineous/ relatives association was ranged from 20 to 33% across many various studies. In Egypt, the growth and increase of consanguineous association was differing by residence place. It extended from 25.4% in Lower Egypt to be 55.2% in Upper Egypt.

In the present study there were 40% of children had vaso-occlusive crisis, 24% had splenic sequestration, 20% had aplastic crises, and 16% had acute chest syndrome. These results were in agreement with **Lewing et al. (2011)** study who displayed that, most of the children aged in their study incurring from vaso-occlusive crisis. They reported that, there were less than one third of the children bearing from sickle cell crisis among the prevalence of acute chest syndrome and vaso-occlusive crisis in patients who admitted hospital with aching sickle cell episode.

Moreover, **Finkelstein, et al., (2007)** mentioned that, mostly of the study children come to the emergency unit with an aching vaso-occlusive crisis and acute progressed chest syndrome. **Abd El-Gawad, (2017)** notified that were about one quarter of the children had vaso-occlusive crises or plastic crises, as well there were less than half of the children had crises of splenic sequestration compared to minor percent of children who endured with acute chest syndrome.

The current study revealed that, majority of the mothers had unsatisfactory knowledge about sickle cell anemia definition, causes, signs and symptoms, treatment, preventions, and complications of sickle cell anemia in pre/test and improved to be satisfactory in post/test. These results were in agreement with the study of **Abd El-Gawad, (2017)** who stated that there were half of the mothers had low knowledge score regarding causes and complications of sickle cell anemia during pretest; while, there were less than half of them had high knowledge score in posttest.

There were two fifth of the mothers had high knowledge about the treatment of sickle cell anemia and the sickle cell crisis prevention posttest compared to a minority of them pretest. The majority of mothers had useful knowledge about signs and symptoms in both pre and posttest. **Jaffer, et al., (2009)** stated that, slightly less than three quarters of the respondents were able to define sickle cell crisis correctly while, one quarter was defined it wrongly.

In the current study the mothers of fewer than five children who know knowledge regarding precipitating factors of sickle cell crises in pretest were unsatisfactory, and there was satisfactory increasing in post/ test. These results were congruent with the study of **Olorunfemi, et al., (2016)** who displayed that, two fifth of the participants had adequate knowledge of sickle cell disease, three quarters had knowledge about prevention of crisis, and two thirds had knowledge about predisposing factors to sickle cell crisis.

Also, these results are consistent with the study of **Hussain et al. (2011)** who revealed that, nearly one third of the respondents mentioned some of predisposing factors as cold and dehydration; while the minority of them stated that predisposing factors were fever and activities. Another study done by **Jaffer et al. (2009)** displayed the findings of the current study, as they created that knowledge about fever, exhaustion, cold, diarrhea and vomiting were the predisposing factors of sickle cell crises. Also, in pretest there were half of the mothers cope with sickle cell crises for their children through providing immunization; while, less than one fifth of them were giving a plenty of fluids.

In the current study, the mothers' common actions to overcome the sickle cell crisis were give immunization, plenty of fluids, and follow up visit; which were improved after the engagement and education program that was provided to mothers. This result was in agreement with **Hussain, et al. (2011)** who mentioned that, the most common prophylactic procedures provided for sickle cell crisis according to participants were plenty of fluid by less than half, then administer the compatible prescribed medication and maintain the warmth for child; and the last procedure applied was providing sufficient nutritive food. **Abd El-Gawad, (2017)** notified that, the mothers' behaviors and actions were progress and get better after their engagement and education post-test; also there were three quarters of the mothers providing a plenty of fluids, then by immunization, followed by providing adequate oxygen, and followed by two thirds of them designing for follow up visit.

Moreover, in the current study regarding the mothers' empowerment in caring for their children, there were more than half in pre-test had low empowerment and it decreased to 18 % in post/test; while higher empowerment was 14% in pre/test and increased to 40% in post/test. These results were in agreement with the study of **Abd El-Gawad, (2017)** implied that half of the mothers had empowerment with "very true" at post-test. Also, there were about two thirds of the mothers had "very true" in regarding to the services provided by system and community/political sub-categories of empowerment in post-test in comparison to about one fifth of the mothers in pretest. **Mahat, (2007)** said that, empowerment and support groups can offer actual and professional methods in order to grow up participants' knowledge and attention-related actions. As noted, empowerment is considered to be an important component of operative public health strategies and this can be achieved by effective education/ training counseling, presenting of information and referral to other.

Also, in this study it was displayed that there an increase in knowledge post-test than pre-test; as half of mothers of age from 30:39 years in post/test the had satisfactory knowledge; and there was increase for satisfactory knowledge to 42% in post/test among mothers who have secondary school education, and the satisfactory knowledge of mothers in rural area increased to be more than half in post/test. These results were in congruent with the study conducted by **Al-Arrayed and Al-Hajeri (2010)** who agreed that the majority of participants with an older age provide the most of correct answers regarding the disease of sickle cell.

This can be illustrated that the older age mothers, the more experienced have, and the more knowledge have about sickle cell disease; as well as the more prevention of sickle cell crises. However, the younger mothers had lack in experience and had low knowledge about the disease.

Moreover, **Fahad, et al. (2017)** mentioned that, the older parents and caretakers of children had suitable and enough knowledge regarding the prohibition of sickle cell crises than those who are younger. Also, **Abd El-Gawad, (2017)** displayed that, the correlations between mothers' age, education, and their total knowledge were significantly positive; this can interpreted that with more training and education, there were growing in knowledge level, as well an improvement in activities which have an effect on level of empowerment.

In the current study the highest strong positive statistical significant correlation was founded between the total scores of knowledge and empowerment scales in pre-test and post-test program. This result may be due to the increase of mothers' education due to empowering them to be more knowledgeable and act effectively. These results were congruent with **Abd El-Gawad, (2017)** who reported that there were statistical significant positive correlations between mothers' total empowerment, total knowledge, and total actions; as the empowerment of mothers to provide effective care for their children had an improvement in their total knowledge in which this affect their performance about the sickle cell crisis of their children. Furthermore, these findings were supported by **Fahad, et al., (2017)** who elucidated that there was a relation between the knowledge level of sickle cell crises and its prevention procedures and actions. They indicated that the most of the respondents who had enough and proper knowledge also had positive practices and action.

CONCLUSION

It can be concluded from the current study that, mothers who participated in the present study didn't have the baseline data about sickle cell disease before education (pretest). And, mothers' knowledge and actions regarding sickle cell disease and sickle cell crisis were improved after the implementation of the educational program and engagement (posttest). Also, there were statistical significant differences regarding knowledge of predisposing factors (P. <0.05). Moreover, mothers' empowerment was low in pre/test and excessed to be high empowerment in post/test, and there was statistical significant difference between pre and post/test. After education, it was revealed that there were significant positive correlations between mothers' age, their education, and total knowledge. As well, there were significant correlations found between mothers' total knowledge, total empowerment in (pre post/test).

RECOMMENDATIONS

Empowering and engaging mothers for caring for their children with sickle cell anemia; as well developing an educational program for mothers about sickle cell anemia and sickle cell crises in children

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