IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 8, Issue 6 Ser. XII. (Nov - Dec .2019), PP 53-65
www.iosrjournals.org

BASNEF Model: it's Effect on Blood Glucose Level among Children with Diabetes Mellitus

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Abstract
Background*: Diabetes mellitus is a chronic and progressive disease that needs on-going medical and self-care skills to prevent acute complications. The* ***aim*** *of the study was to evaluate the effect of BASNEF (Belief, Attitude, Subjective Norm and Enabling Factors) Model on blood glucose level among children with diabetes mellitus.* ***Methods:*** *A quasi-experimental design was utilized to conduct this study (experimental /control group).* ***Setting:*** *The study was conducted in the diabetic center at EL Mogamma EL Teby AL Shamal, Shebin El-Kom City.* ***Sample****: A purposive sample of 100 diabetic children from the previously mentioned setting was divided randomly and assigned into two groups (50 experimental group and 50-control group).* ***Tools****: Three tools were used for data collection, Tool I: A structured questionnaire designed based on the BASNEF model components. Tool II: Checklist about child's prophylactic behaviors concerning blood sugar control.Tool III: Biochemical findings of blood tests, including fasting plasma glucose level (FBS) and hemoglobin A1C (HbA1c).****Results****: The mean total scores of all BASNEF Model components were significantly improved post-intervention in the experimental group compared to the control group. In addition, the FBS, HbA1C levels and biochemical parameters significantly controlled among the experimental group compared to the control group (P < 0.001).* ***Conclusion****: Applying the BASNEF Model is very effective for diabetic children as the intervention based on its controlled children blood glucose level and changed their behavior toward a better life in the experimental group than in the control group.* ***Recommendations****: Highlight the importance of integrating and applying the BASNEF model as a standard of care to improve the quality of life for children with diabetes mellitus.*

Keywords*: BASNEF model, blood glucose level, children, diabetes mellitus*

Date of Submission: 20-12-2019 Date of Acceptance: 03-01-2020

I. Introduction

Diabetes mellitus is a common endocrine metabolic disorder (Diane et al., 2018 & Tan et al., 2016). It is considered a global health problem characterized by hyperglycemia resulting from defects in insulin secretion, action, or both. It is a chronic disease, which occurs as the result of a disorder in glycoside carbohydrate metabolism (Hazaveh & Delavari, 2017). A disorder in carbohydrate metabolism causes change in all body organs and as a result, it may cause serious or sometimes dangerous complications for the patient (Dickinson, 2018). The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eye, kidney, nerves, and blood vessels (American Diabetes Association, 2018). Type 1 diabetes mellitus (T1DM) causes many problems for adolescents and their families (Hemmat et al., 2011).

One in every 300 to 400 adolescents has type 1 diabetes (Chao et al., 2014). Type 2 diabetes mellitus can lead to the stunted growth of children. Furthermore, diabetes can trigger the reduction of immune functioning, thus lowering the body's ability to fend off various diseases, and further increasing the risk of illnesses (Cui, 2016). A recent study of incidence and prevalence of T1DM in children and adolescents in three Egyptian governorates (Fayoum, North Sinai, and Suez) showed a prevalence rate of 0.7/1000 and 4.01/100 000 (Salem et al., 2007). The incidence rate of juvenile DM among school-age children in Menoufia governorate was 3.75/1000. It was more predominant in urban areas (4.5/1000) than in rural areas (3/1000) and in boys (66.7%) than in girls (33.3%). Family history of T1DM and consanguinity were highly associated with the occurrence of diabetes (Razavi et al., 2015).

Classic symptoms, typically arising for several days to few weeks preceding to diagnosis, may include polyuria, polydipsia, weight loss, polyphagia, fatigue, and blurred vision from lens swelling of the osmotic effects of chronic hyperglycemia (American Diabetes Association, 2018). Perineal candidiasis is a common symptom in young children and girls (Quinn et al., 2006). Approximately one-third of cases present with

diabetic ketoacidosis. The characteristic biochemical features include hyperglycemia, glycosuria, and ketonemia. Ketonemia usually makes the diagnosis of stage 3 diabetes more obvious (Dabelea et al., 2014).

Increasing prevalence of diabetes and numerous complications require long-term treatment and daily blood glucose control, life style modification and attainment of knowledge about special self-care behaviors are essential throughout life (Diane et al., 2018 & YI-Qing et al., 2016). Proper treatment is needed to control disease and prevent or delay its complications. Controlling anthropometric and metabolic complications, such as body weight, blood pressure, blood glucose, HbA1c levels, and lipid profile play a vital role in controlling diabetes (Lin & Ball, 2007). It is a common belief that children's required instruction and assistance in realizing and understanding their health status, making the decision for health care and changing health behaviors. Today, the focus of comprehensive health care should be on self-care and education rather than treatment and reliance. Also, effort should be directed toward improving children's capabilities, independence and non-reliance (Dickinson, 2018).

The BASNEF model was first designed by John Hubly in 1988. It is a comprehensive scale for the measurement of behavioral alterations in developing societies. This model mainly emphases on the effects of knowledge, attitude, and individual skills on the behavioral changes (Baghianimoghadam et al., 2010). BASNEF model consists of various constructs, such as beliefs, attitudes, subjective norms and enabling factors (Hubly, 1993). This model highlight on the effects of knowledge and attitude of the individual performance, while considering the influence of enabling factors and subjective norms are on behavioral changes (Jeihooni et al ., 2013).

Behavioral attitude is a product of one's belief; in fact, it is the positive or negative assessment of behavior (Tavasoli & Hasanzade, 2010). Subjective norms are one's belief towards influential persons, which depends on the social pressures and reflections. Enabling factors are skills and bases that allow children intention to change their behavior (Rimer &Viswanath, 2013). A complication of diabetes mellitus (DM) is the most important impediment caused from uncontrolled blood sugar. Children should be educated on controlling their blood sugar and changing their behaviors, in order to decrease its complications (Jeihooni et al., 2013).

Giving nursing intervention and education to children will support them, make decisions about their health, get self-confidence and acquire the necessary skills. (Parsinia & Hekmat, 2016). Nurses have an essential role and responsibilities while caring for children with diabetes, such as providing them and their families with education about managing of hyperglycemia, hypoglycemia, comprising insulin administration, dietary regimen and exercise needed. Helping the child and his/her family to adjust to the chronic disease, and prevent short-term and long-term complications of diabetes (Baqiani, 2015). Therefore, applying intervention based on BASNEF model will help diabetic children and their families to increase their knowledge and change their behaviors toward controlling blood glucose levels to prevent complications consequence.

Operational definitions

- **BASNEF Model:** is one of the interventional models, which emphasized on the impact of enabling factors and subjective norms as well as knowledge and attitude in changing children behavior.
- **Blood glucose level:** is the concentration of glucose present in the blood of humans
- **Children:** young individual less than 18 years old.
- **Diabetes mellitus:** is a group of metabolic disorders characterized by hyperglycaemia resulting from defects in insulin secretion, action or both.

1- **Aim of the study:-**

-The aim of this study was to evaluate the effect of BASNEF (Belief, Attitude, Subjective Norm and Enabling Factors) Model on blood glucose level among children with diabetes mellitus.

1.1-**Study Hypotheses**

1- Children with diabetes who will receive intervention based on the BASNEF model will have sufficient information about the disease andits management than children in the control group

2- Children with diabetes who will receive intervention based on the BASNEF model will show control in their blood glucose level than those in the control group.

3- Children with diabetes who will receive intervention based on the BASNEF model will Show better performance than those in the control group

II. Subjects and Methods

2.1. Design

A quasi-experimental design was used (experimental /control groups).

2.2. Study Setting

The study was conducted in the diabetic center at EL Mogamma EL Teby AL Shamal, Shebin El-Kom city - Menoufia Governorate, Egypt.

2.3. Subjects

A purposive sample of 100 diabetic children in the secondary school from the previously mentioned setting was included in the study. A random assignment used to divide children equally into anexperimental and control group (50 in the experimental group and 50 in the control group) and willing to participate and complete the study.

Group I: The experimental group consisted of 50 children with diabetes. This group enrolled in the intervention based on BASNEF model.

Group II: The control group consisted of 50 children with diabetes. This group received only normal and ordinary diabetics' care of the center.

2.4 Inclusion criteria: 3 criteria were defined:

(1)- Children diagnosed with diabetes and have routine care and treatment.

(2)- Children age between 13-17 years to understand the questionnaire and information, which will be given.

(3)- Children had the ability to participate in the intervention base on BASNEF model to promote normal blood glucose level.

2.5 Exclusion criteria

(1) Lack of consent formto participate in the study and absence of >2 sessions in the training program.

2.6 Tools of data collection:

Three tools were used for data collection

Tool 1: Astructured questionnaires designed based on the BASNEF model. It was adopted from Glanz et al., (2008) and modified by the researcher's to assess a child's knowledge, Beliefs, Attitude, Subjective Norms, and Enabling Factors. It was divided into two parts:

Part One: Demographic characteristics such as age, sex, child's level of education, mother level of education, birth order, place of residence, mother age and occupation (8Qs).

Part two: Structured questionnaires based on of BASNEF model: it included knowledge (15 Questions), beliefs (7 Questions), and attitude toward the action (5 Questions), subjective norms (5 Questions) and enabling factors (6 Questions).

Scoring system: The scoring system for the questionnaire was as follow:

A - Knowledge questions:-

Score	Scoring items
0	Incorrect
1	Correct answers

Total scores: Poor knowledge (< 60%) - fair knowledge (60-75%) - Good knowledge (≥ 75%).

B-In the beliefs part, it was designed in 3-point Likert scale and the score range of each item varied between1 - 3.

Scoring system:

Score	Scoring items
1	I disagree
2	I do not have idea
3	I agree

C. Subjective norms and enabling factors, Questions weredesigned in 3– point Likert scale and the score range of each item varied between 0 - 2.

Score	Scoring items
0	Not done
1	Inadequate done
2	Adequate done

Tool II: -A structured Checklist about child's prophylactic behaviors concerns blood sugar control: It was adopted from Jeihooni et al., (2013) and modified by the researchers. It included six question such as jogging at least 3 times a week and each time 20 minutes, regular medicine consumption based on prescription, having an appropriate prescribed food program, going to clinic for measuring blood sugar and consulting and participating in educational classes. It completed by researcher.

Scoring system:-

Score	Scoring items
0	**Not done**
1	**Adequate done**

Tool III. Biochemical findings of blood test sheet: It was obtained from the child's file by the researchers to assess fasting blood glucose (FBS) level and HbA1C before and after application of BASNEF modal.

Validity & Reliability:

The validity of giving questionnaires was measured by content validity and face validity methods. It was tested for their content validity by a group of three professor experts in pediatric nursing. The reliability of the questionnaires was assessed using Cronbach's alpha test to test the internal consistency. Cronbach's alpha-coefficient was 0.81, 0.90, 0.80, 0.87 and 0.91 for knowledge, beliefs, attitude, enabling factors and subjective norms respectively.

Administrative design:

An official letter requesting permission to conduct the study was obtained before starting the study from the Dean of the Faculty of Nursing, Menoufia University to the Director of the study setting. This letter included the aim of the study in order to get the permission and help for data collection.

Ethical considerations:

A necessary approval from Diabetic Center in EL Mogamma EL Teby AL Shamal was taken after issuing an official letter from the dean of Faculty of Nursing, Menoufia University. An informed consent to participate in the current study was taken after explaining the purpose of the study clearly to the children and their families. Confidentiality of obtaining personal data, as well as the respect of participants' privacy was totally ensured. A summary of the intervention was explained to the children before volunteering to participate in the study and informed that they can withdraw from the study at any time.

Pilot Study

The pilot study was carried out on 10% of the studied sample (6 diabetic children) from the total sample in order to ensure the clarity, applicability of the instruments and the time needed to be completed. According to the results obtained from the pilot study, the required modifications were performed. The sample of the pilot study was excluded from the main study sample.

Procedure for Data Collection:

The researcher reviewed the current local and international related literature to be more acquainted with the problem, to design the study instruments, and to finalize them by using books, articles, magazines and internet. The actual fieldwork was carried out from beginning of December 2018 up to the end of July 2019 of data collection. The researchers were available in the study settings three days/week, at the morning shift from 8.00 Am to 2.00 Pm. the researchers introduced themselves to the medical and nursing staff members in the previous mentioned setting. The researchers explained the nature and the purpose of the study and asked for cooperation.

Implementation of the intervention passed into four phases (assessment phase, planning phase, implementation phase and Evaluation phase:

1- Assessment phase:-

The researchers introduced their selves to children and clarified the significance of the study. An initial assessment and familiarity with the groups through greeting, introducing the session facilitator and children to each other, explaining the numbers and the structure of the training sessions as well as getting the informed consent, completing the study instruments and performing the initial measurements. Then the researchers met each child individually interviewed in the Diabetic Center while they were waiting to take diabetic medication and care and collected their demographic data. The researchers assessed eligibility of meeting the inclusion criteria of the research. Before application of model items in the intervention and control groups, the given questionnaires were filled out by the children. The questionnaire and the checklist were completed before application of BASNEF model session for both experimental and control groups (before intervention).Children were referred to the same laboratory for testing HbA1c and Fasting blood sugar (FBS) with an introducing letter (before intervention).

2-Planning phase:-

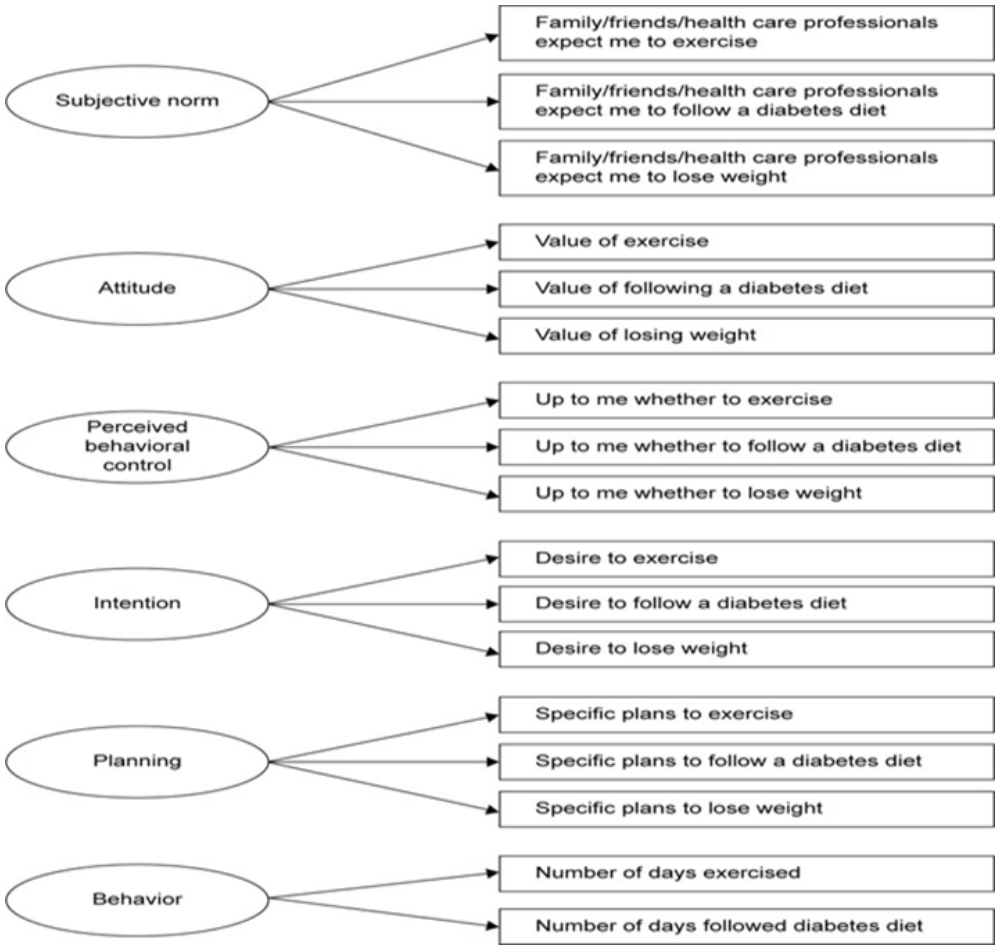
The researchers prepare intervention materials about application of BASNEF model included: definition, importance, components and nurse role of model component.The researcher developed education and intervention session covering the phases of model which start with belief, attitudesnorms, enabling factor about diabetes and ending with scientific knowledge about diabetes. The researchers prepared videos, pictures and power point presentation to be used in study.Colored booklets were developed to be distributed to every child for enforcement and as a reference. The intervention was implemented on a small group basis. The participants divided in to 4 sub-group. Each sub-group was encompassing 12 children. Group from them had 14 children. Each group was attending 6 sessions. These sessions were scheduled as one session per week for duration of

about 28 weeks. Data were collected over a period of 7 months starting from beginning of December 2018 up to the end of July 2019.

3-Implementation phase:-

Intervention was conducted for the experimental group within six sessions. Each session took about 55-60 minutes in the form of lecture, question and answer, group discussion and practical presentation. Each session discussed one component of the BASNEF model (Belief, Attitude, Subjective Norm and Enabling Factors).

Figure (1): Components of BASNEF Model to promoting normal on blood glucose level among children with diabetes mellitus



Niknami, A. (2002). BASNEF model for Diabetic children. Retrieved from https: //www.ncbi. nlm. nih. gov/ Pubmed

-First session: This session was included orientation, greeting with the children, introduction about the study topics, divided the participants to subgroups, commitment for timetable and meeting time. At the end of this session distributed pretest questionnaires. It lasted for about 60 minutes.

-Second Session: - Beliefs items about diabetes: The researcher asked diabetic children about his/her beliefs about (diabetes diet, treatment, body lose during diseases, the importance of exercises for diabetic, precaution for insulin injection). Moreover, the researchers change children's beliefs a lotduring the session such as (eating a lot of sugar = diabetes, it is not curable, diabetes diseases lead to death).

-Third Session: Attitude of children regarding diabetes diseases: through discuss the value of exercise, following diet, the importance of physical exercise in controlling blood sugar and encouraging jogging at least 3 times a week and each time 20 minutes, losing weight, explaining the appropriate diet to reduce blood glucose, food consumption, HbA1c and FBS examinations, regular medicine consumption based on prescription, going to the clinic for follow up and measuring blood sugar.

-Fourth Session: Subjective norms in the BASNEF model: A meeting was held with a specialist in diabetes and nutritional expert to encourage children to change their norms about wrong habits used in order to prevent

complication of the disease. The researchers help them to maintain ideal body weight, self-monitoring, insulin injection, guided diet for diabetes, and exercise schedule.

- Fifth Session: Enabling factors in the BASNEF model: an educational guide was given to all children to strengthen and to keep the continuity of the training. All children were informed about how to use the services of the health care center and how to receive the necessary care and financial supports if needed.

- Sixth session: This session was included, definition, causes (genetics causes, social causes and environmental causes), subtypes, signs, and symptoms to increase children's knowledge and awareness about diabetes,supported by power point and pictures. It required 30 minutes. By the end of this session children able to define diabetes, causes, subtypes, and manifestation of diabetes. The researchers give children 10 minutes to ask any question, and then give them 20 minutes to summarize all the outlines discussed.

4-Evaluation phase:

After intervention, the questionnaires, checklist and biochemical blood test were reassessed again for both experimental and control groups (after intervention).

Data Analysis:-

The collected data were organized, reviewed, coded, tabulated, analyzed and presented using descriptive statistics in the form of frequencies and percentages for qualitative variables; Means, standard deviations , for quantitative data. Test of significance was used for comparison between the study and the control groups.

III. Results:-

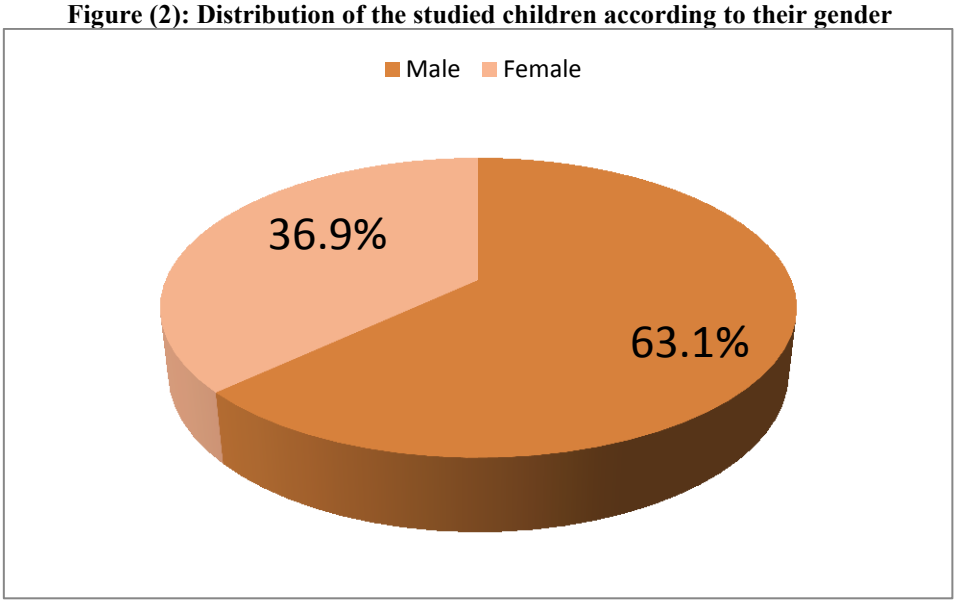
(1): Distribution of the studied children according to their socio -demographic characteristics.

Demographic Characteristic	Experimental group (n =50)		Control group (n =50)		χ 2	P-value
	No.	%	No.	%		
1-Children Age: Mean ± SD	13.3 ±0.6		13.3 ±0.7			
2-Child's level of education:						
Preparatory	3	6.0	0	0	0.07	**0.78NS**
Secondary	47	94.0	50	100.0		
3-Birth order:						
First	20	40,0	22	44.0		
Second	19	38.0	12	24.0	0.26	**88NS**
Third	6	12.0	6	12.0		
The last	5	10.0	10	20.0		
4-Place of residence						
Rural	44	88.0	41		8.1	**.004***
Urban	6	12.0	9	82.0 18.0		
5-Mothers Age groups (Years)						
< 30	2	4.0	6	12.0		**0.000****
30-	17	34.0	23	46.0	17.88	
35-	21	42.0	14	28.0		
40 & more	10	20.0	7	14.0		
6-Mother's Occupation						
Housewives	39	78.0	4	78.0	8.8	**0.005 ***
Workers & farmers	2	4.0	7	8.0		
Employee	9	18.0	50	14.0		

NS: P>0.05, no statistically significant difference*P<0.01, highly statistically significant difference.

Table 1: displayed distribution of the studied children according to their socio-demographic characteristics.In the experimental group, the mean age of children was 13.3 ± 0.6 years. The majority of them (94.0%) had a secondary level of education, 40.0% was the first child in their family. Regarding the mother's age and occupation, 42% of them aged between 35 <40 years old and the majority (78.0%) are house wives. While, in the control group, the mean ± SD was 13.3 ±0.7 years. All studied children had a secondary level of education and 44% of them were the first birth order. Regarding mother's occupation, the majority (78.0%) were housewives and 46.0% aged between 30- <35 years old. The highest percentage of mothers in experimental and control group lived in a rural area (88.0% and 82%) respectively.

Figure (2): Distribution of the studied children according to their gender



Figures 2: showed distribution of studied children according to their gender, it was revealed that 63.1% of children were male and the rest of them were female (36.9%).

Figure (3): Distribution of mothers according to their level of education.

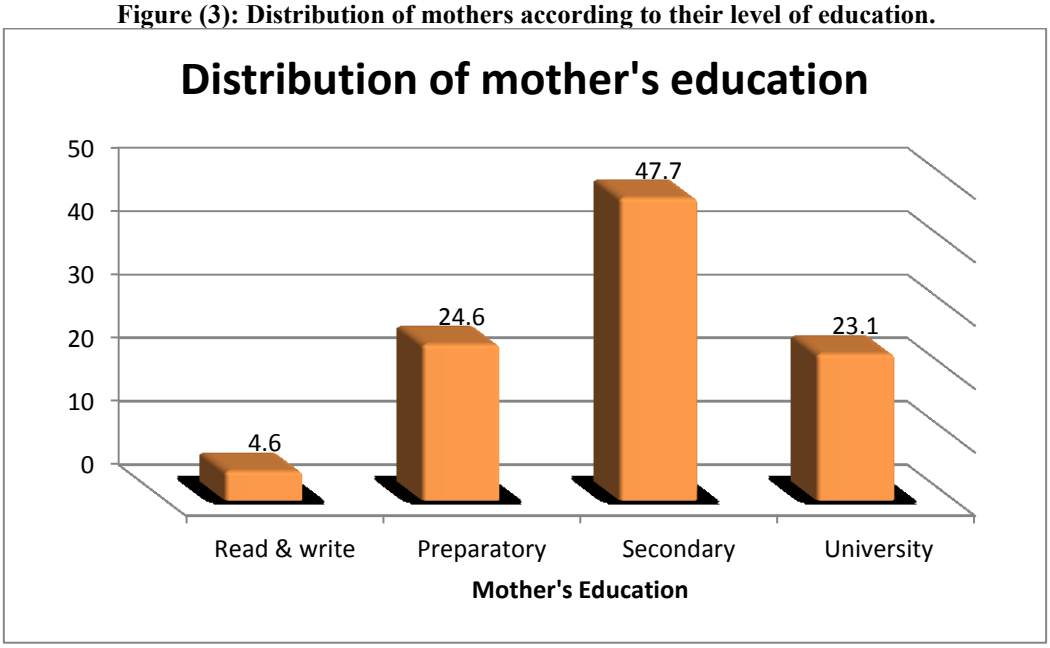


Figure 3: showed distribution of mothers according to their level of education. It was revealed that 47.7% of mothers had secondary education and the minority of them had preparatory and bachelor degree (24.6% and 23.1% respectively).

Table (2): Knowledge levelsamong the studied children before and after Intervention in both experimental and control groups.

Knowledge level	Experimental group (n =50)		Control group (n =50)		x^2	P-Value
	No.	%	No.	%		
1-Pre intervention						
Poor	47	94.0	50	100.0		
Fair	3	6.0	0	0.0	3.1	0.07ns
Good	0	0.0	0	0.0		

2-Post intervention						
	0	0.0	50	100.0		
Poor	11	22.0	0	0.0	100	0.000**
Fair	39	78.0	0	0.0		
Good						

ns : P>0.05, no statistically significant difference
*P<0.01, highly statistically significant difference.

Table 2: illustrated knowledge levels among the studied children before and after Intervention in both experimental and control groups, as clarified from the table, in the experimental group, the majority (94.0%) had poor knowledge on pre intervention, while 78% had good knowledge post intervention compared to control group (100% had poor knowledge on pre and post study). Also, there was a statistical significant difference between experimental and control groups regarding the knowledge level at 0.000.level of statistical significance.

Table (3): Biochemical findings of blood tests (fasting blood sugar, postprandial blood sugar, and glycosylated Hb) before and after intervention in both experimental and control groups.

Laboratory Data	Experimentalgroup (n= 50)		Controlgroup (n= 50)		x2	P-Value
	No,	%	No.	%		
1-Fasting Blood Sugar						
-Before intervention						
Normal	5	10.0	0	0.0	5.3	0.02*
Abnormally high	45	90.0	50	100. 0	5.7	0.001*
Mean ± SD mg/Dl	165.7 ±28		156.1 ±42			
-After Intervention:						
Normal	23	46.0	2	4.0	23	0.000**
Abnormally high	27	54.0	48	96.0	9.1	0.000**
Mean ± SD mg/dL	121.6±31		145.2 ±47			
2-Postprandial blood sugar:						
-Before Intervention						
Normal	0	0.0	0	0.0	5.5	0.0001*
Abnormally high	50	100.0	50	100.0		
Mean ± SD mg/dL	24 1.2 ±55		320.5 ± 85			
-After Intervention:						
Normal	17	34.0	2	4.0	14.6	0.000*
Abnormally high	33	66.0	48	96.0	8.9	
Mean ± SD mg/dL	166 ±42		299 ± 95			
3-Glycosylated Hb:-						
-before Intervention:						
Poor diabetic control	41	82	49	98	7.4	0.000*
Fair diabetic control	5	10	1	2	6.3	0.0001
Good diabetic control	4	8	0	0		
After Intervention:						
Poor diabetic control	11	22.0	43	86.0	41. 3	0.000*
Fair diabetic control	14	28.0	3	6.0	6.3	0.0001*
Good diabetic control	25	50.0	4	8.0		

(*) statistically significant at p <0.05 (**) highly statistically significant at p <0.01

Table 3: represented biochemical findings of blood tests (fasting blood sugar, postprandial blood sugar and glycosylated Hb) pre and post intervention on both experimental and control groups. In the experimental group, 90 % of children had abnormal fasting blood sugar compared to 54.0% post intervention. While, all children (100.0%) had abnormal postprandial blood sugar on pre intervention and decreased to 66.0% post intervention. The minority of them (8.0%) had good diabetic control on pre intervention and increased to 50.0% post intervention. Therefore, there were statistically significant differences in the experimental group before and after intervention at 0.02 and 0.001level of statistical significance.

Table (4): Self-measurement scores of blood glucose level among children on pre and post intervention in both experimental and control groups.

	Experimental group (n =50)		Control group (n =50)		x^2	P- Value
	No	%	No.	%		
1-Pre intervention						
-Bad	40	80.0	42	84.0	0.27	-0.7ns
-Good	10	20.0	8	16.0	0.4	0.71ns

Mean ±SD	11.7 ±2.4		11.8±1.8			
2-Post intervention						
-Bad	0	0.0	42	84.0	71.4	0.000**
-Good	50	100.0	8	16.0	28	0.000**
Mean ± SD	25.3 ± 2.8		11. 9 ±2.2			

ns : P>0.05, no statistically significant difference**P<0.01, highly statistically significant difference.

Table 4: revealed the self-measurement score of blood glucose level among children before and after the intervention in both experimental and control groups, it was revealed that 80 % of children in the experimental group had bad scores on pre intervention, while all of them (100%) had good scores post intervention compared to control group (16%). Also, there were statistically significant differences between pre and post intervention regarding self-measurement score of blood glucose levelatthe 0.000 level of statistical significance. While, in the control group there were no statistical significant difference between pre and post intervention regarding self-measurement score of blood glucose level (p = 0.72).

Table 5: Mean total scores of BASNEF model components before and after intervention in the experimental and control groups.

BASNEF components	Groups (n=50)	Before intervention (Mean ±SD)	After intervention (Mean ±SD)	P^1	Mean Differences (Mean ±SD)	P^2
-Knowledge	Experimental	40.13±18.37	61.52±18.88	<0.001	21.38±14.48	<0.001
	Control	43.26±18.51	45.17±18.72	0.1	1.9±8.1	
-Normative beliefs	Experimental	58.47±9.74	75.41±8.92	<0.001	16.94±13.95	<0.001
	Control	61.63±11.18	63.12±10.97	0.14	1.49±6.97	
-Evaluations of behavioraloutcomes	Experimental	66.38±11.58	76.94±10.55	<0.001	10.55±11.81	0.001
	Control	68.02±9.52	68.57±11.54	0.41	0.54±9.11	
-Subjective Norms	Experimental	41.14±27.52	68.75±15.03	<0.001	27.6±26.91	<0.001
	Control	46.93±26.82	48.97±25.49	0.49	2.04±20.93	
Enabling Factors	Experimental	34.72±20.58	64.58±20.23	<0.001	29.86±27.49	<0.001
	Control	39.45±21.16	41.49±18.97	0.26	2.04±12.56	

P^1 = the differences between pre and post study in each group and are resulted from the paired sample T-test. P^2=the differences between the twogroups and are resulted from the independent sample T-test.

Table 5 showed the Mean total score of BASNEF model components before and after the intervention in the experimental and control group. The Meantotal score of the BASNEF model component showed significant improvement in the experimental group after intervention compared to control group. Moreover, independent-sample T-test showed a significant difference between the experimental and control groups in mean score of knowledge, normative beliefs, evaluations of behavioral outcomes, subjective norms and enabling factors (p<0.001 for all).

Table (6):- Dietary Management Behavior among the studied children before and after intervention in both experimental and control groups.

Dietary Management Behaviors	Experimental group (n=50)		Control group (n=50)		x^2	P-Value
	No.	%	No.	%		
1-before intervention						
-Normative beliefs	10	20.0	20	40.0		0.000**
-Attitudes	6	12	20	40.0	75.4	
-Subjective Norms.	34	68.0	10	20.0		
P1	0.000		0.85			
2-After intervention						
-Normative beliefs	0	0.0	19	38.0		
-Attitudes	34	68.0	17	34.0	92.8	0.000**
-Subjective Norms	16	32.0	14	28		
P2	0.000		0.81			

(**) highly statistically significant at p <0.001.
P1: Comparison between the experimental and control groups before the intervention.
P_2: comparison between the experimental and control groupsafter the intervention.
P value - Comparison between experimental and control groups before and after intervention.

Table 6: showed dietary management behavior among the studied children before and after intervention in both experimental and control groups**.** 68%in the experimental group had Subjective Norms about changing their dietary behavior before intervention compared to 32% after the intervention. Also, 68% changed their

attitude in the experimental group compared to 34% in the control group. Therefore, there was a statistically significant difference between the experimental and control groups before and aftert he BASNEF model application at 0.000 level of statistical significance.

IV. Discussion

The present study revealed that children with diabetes who participatedin the intervention based on BASNEF model gain high knowledge about the disease and had better performance post intervention compared to control group as well as control their blood glucose level. The finding displayed that, in the experimental group, the mean age of children was 13.3 ± 0.6 years while, in the control group, the mean ± SD was 13.3 ±0.7 years. This was consistent with MacLeish et al., (2013) who mentioned that mean age was 12.2 ± 3.2 years. On the other hand, this finding disagrees with Hezang et al., (2017) who mentioned that the mean age of children was 9.8 ± 1.3. This young age clarified that they in need for ongoing application of educational model to improve their knowledge in order to control the disease

Concerning level of education, the majority of them (94.0%) had secondary education in the experimental group and 40.0 % was the first child in their families. While, in the control group, 100% of children had secondary education and 44% was the first birth order. In relation to sex, it was revealed that 63.1% of children were male and the rest of them were female (36.9%). This was disagreeing with Razavi et al., (2015) who reported that the overall male-to-female ratio of children was similar. In this respect Dabelea et al., (2014) mentioned that diabetes affects all sex, age, and race/ethnic subgroups. Also, Amankwash (2019) reported that more than half of the study sample (54.5%) was females. The majority of mothers in both experimental and control group lived in a rural area (88.0% and 82% respectively). Therefore, there is an intense need for intensive health education programmes targeted at rural communities in order to prevent and control the disease. This was supported by Alphonsus and Okundia, (2015) who recommended that there is a crucial need for intensive health education and community surveillance programmes in rural communities in order to prevent and control the diseases.

The present study revealed knowledge score among the studied children in pre and post Intervention, in the experimental group the majority of them (94%) had poor knowledge level on pre intervention, while more than two third of them (78%) had good knowledge level post intervention. This was consistent with Baqiani et al., (2015) who mentioned that the application of the model was effective in increasing the mean grade of knowledge post intervention in the study group. This would help them to control and manage the disease.This clarified how the education can make a difference in creating awareness and improving knowledge.

Regarding control group, all of them had a poor knowledge level on both pre and post intervention. This finding was consistent with Dizaji et al., (2014) who reported that most of the children had poor knowledge. Therefore, there is a need for application of educational intervention based on BASNEF model to increase the awareness about methods of prevention, treatment, and control diabetes among children. This was consistent with Rajab (1993) who emphasized that education is the cornerstone of diabetes care to improve the condition of the children. Also, Prez et al., (1995) announced that education of diabetic patients is the treatment itself. Therefore, there were statistical significant differences between the experimental and control groups regarding the knowledge level at 0.000.This was corresponding with Baqiani et al., (2015) who mentioned that there were statistical significant differences of increasing knowledge between pre and post intervention.

Regarding biochemical findings of blood tests (fasting blood sugar, postprandial blood sugar and glycosylated Hb), for the studied children in pre and post intervention. In the experimental group, 90 % of children had abnormal fasting blood sugar compared to 54.0% post intervention. While, all children (100.0%) had abnormal postprandial blood sugar at pre intervention and decreased to 66.0% post intervention. The minority of them (8.0%) had good diabetic control results on pre intervention and increased to 50.0% post intervention. This was supported by Dalewitz et al., (2017) who indicated that there was a significant reduction in the mean of serum HbA1c concentration after intervention. This was consistent with Pimentel et al., (2018) who reported that biochemical indices of glucose level was decreased significantly in the intervention group, while changes were not significant in the control group. Also, Baqiani et al., (2015) reported that glucose level dropped down in the case group after the intervention. This indicates that educational intervention IS effective in controlling their disease.

In addition, there was a reduction in the mean serum of fasting and postprandial blood sugar concentrations after the intervention period. These Findings were consistent with Borzoo (2016) who reported that FBS levels have been increased in the control group than that in the experimental group before the educational intervention, but the FBS levels significantly decreased among the experimental group compared to the control group after the educational intervention. This was in line with Hezang et al., (2017) who mentioned that in the experimental group, 84.44% had normal blood glucose level and 80 % had normal blood lipids. This could be due to implementation of educational intervention that brought improvements in the health outcomes. Therefore, it is recommended to start ongoing educational diabetic programs to reduce the burden and

complications of diabetes. Also, there were statistically significant differences in the experimental group before and after intervention at 0.02 and 0.001 level of statistical significance.

Regarding self-measurement scores of blood glucose level among children before and after the intervention in both groups, it was revealed that 80 % of children in the experimental group had a bad practice score regarding self-measurement of blood glucose level on pre intervention, while post intervention all of them (100%) had a good practice score. Concerning control group, the majority of them (84.0%) had a bad practice score at both-pre and post intervention. This finding was supported with Kargar (2015) who reported that the mean score of the experimental group was remarkably increased compared to the control group. This was consistent with Baqiani et al., (2015) who mentioned that after intervention the practice of case group with diabetes was increased after the intervention. This may be rendered to the effect of the BASNEF model on social skills after educational intervention. Therefore, there was statistically significant difference between pre and post intervention phases regarding practice score at 0.000.

Concerning mean and standard deviation of beliefs, attitudes, subjective norms, and enabling components of the BASNEF model before and after the intervention, as indicated in the table, there were no significant differences between the two groups regarding beliefs, attitudes, subjective norms, and enabling of study variables pre intervention. While, the mean score of BASNEF model component showed significant improvement in the experimental group after intervention compared to control group. This finding was supported by Hazavehei et al., (2017) who stated that the mean scores of the attitude toward the results of behavior immediately after intervention increased in experimental and control group. But the mean variations have been considerably higher in the experimental group than in the control group.

In addition, Chapman et al., (2015) reported that immediately after the intervention, the experimental group obtained significantly higher mean score in enabling factors compared to the control group. This illustrated the need for enhancing awareness of enabling factors and accesses the required information and instructions concerning blood sugar control that helps children to perform the required behaviors including medicine taking according to prescription, observing an appropriate diet and physical exercises. Moreover, independent sample T- test showed a significant difference between the control and intervention groups in mean change of knowledge, behavioral beliefs, evaluations of behavioral outcomes, enabling factors and subjective norms ($p<0.001$ for all).

Regarding dietary management behavior among the studied children before and after an intervention on both groups, most of the experimental group (68%) had Subjective Norms about change their dietary management behavior before intervention compared to 32% after the intervention. In addition, 68% changed their attitude and values in the experimental group compared to 34% in the control group. This finding was supported by Kasaeyan et al., (2016) who reported that the norms, attitudes of the dietary management had changed after application of BASNEF model. This illustrated the effect of diet on blood sugar. This reveals that using the BASNEF model is effective on blood sugar control among the diabetic children. Therefore, there was a statistically significant difference between the experimental and control group after the application of the BASNEF model.

V. Conclusion:

Based on the current findings, it can be concluded that the research hypothesis is accepted and applying the BASNEF Model controlled children blood glucose level and changed their behavioron the experimental group than in the control group.

VI. Recommendation:

Based on the findings of the present study, the following recommendations can be suggested:

1- Using the BASNEF model is effective on blood glucose level control among the diabetic children and it is highly recommended to apply the model in educating the diabetic children for blood glucose level control.
2- Nutrition education program for diabetic children to improve self-management of behavior intentions.
3- Training should be repetitive and involve actual practice to gain the required skills.
4- Further studies on a larger scale should be conducted to generalize the findings over the whole population and not only those attending diabetic centers. Besides, follow up education on controlling and monitoring is highly recommended.

Acknowledgment:

The researchers would like to extend their great appreciation to the children who accepted voluntarily to take part in this study. Finally, we would like to express sincere gratitude to the diabetic center in EL Mogamma EL Teby AL Shamal at Shebin El-Kom that serves Menoufia Governorate who allowed us to conduct this study.

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