Original Article

Gestational Diabetes Self-Care Behavior: An Empowerment Educational Intervention Based on BASNEF Model

Abstract

Background: Gestational diabetes is a widespread pregnancy-related health problem. Its associated complications can be minimized by empowering women to enhance their self-care behavior. This study aimed to evaluate the effect of an educational intervention using the Beliefs, Attitudes, Subjective Norms, and Enabling Factors (BASNEF) model on Gestational Diabetes Self-Care Behaviors (GD-SCB) among gestational diabetic woman. **Materials and Methods:** A randomized controlled clinical trial was performed at the outpatient clinic, El-Shatby hospital, Alexandria, Egypt, on 180 gestational diabetic women (91 intervention and 89 control groups). Data were collected from April to November 2019 using an interviewing schedule involving sociodemographic characteristics and obstetrics/medical history, BASNEF model questionnaire, and gestational diabetes self-care behavior scale. **Results:** The findings revealed that an absence of statistically significant differences in sociodemographic characteristics and obstetrics/medical history between the intervention and control groups. Two months post-intervention, all BASNEF model subcontracts and total GD-SCB showed significant improvement in the intervention than the control group; knowledge (F1 = 173.92, $p < 0.001$), personal beliefs ($F_1 = 286.54$, $p < 0.001$), subjective norms ($F_1 = 248.82$, $p < 0.001$), behavioral intention ($F_1 = 235.43$, $p < 0.001$), enabling factors ($F_1 = 59.71$, $p < 0.001$), and total GD-SCB ($F_1 = 775.10$, $p < 0.001$). The effect size showed that 48.60% of the improvement within the intervention group total GD-SCB was due to the intervention. **Conclusions:** Empowerment through education using the BASNEF model for enhancing GD-SCB was effective and beneficial. Therefore, it can serve as a basic framework for constructing and executing educational programs in the field.

Keywords: *Education, empowerment, self care, diabetes, gestational*

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Introduction

Gestational Diabetes (GD) is a health problem characterized by glucose intolerance with onset or first recognition during pregnancy.[1,2] This problem has increased universally, which has negative consequences for mothers and children.[3] It is estimated that 16.6% of all pregnancies worldwide are accompanied by hyperglycemia, and 84% of them are determined as GD.[4] Its prevalence rate in Asia and South Africa was 12.9%.[5] Two most recent studies reported its prevalence in Egypt, one in Menoufia Governorate, with a reported GD prevalence of 8% in 2016, and the other was in El-Minya city and found it 8.86% in 2018.[6,7] Diabetes is a prevalent metabolic disorder during pregnancy that can affect pregnant women and their offspring. Risk factors include high maternal age, race, late gravidity and parity, overweight, positive family history, and glucose intolerance. So, there is an urgent need to control these risk factors to decrease the incidence and prevalence of its accompanying complications.[3,8,9] Numerous maternal complications may be associated with GD as prenatal and postnatal hypertension and continued insulin resistance after delivery with prolonged risk for cardiovascular disease and chronic diabetes (type II) later in life.[10,11] Other fetal complications include: macrosomia, hypoglycemia, asphyxia, infections, newborn respiratory distress, and birth injury.[12] In addition to insulin resistance, hyperglycemia, and obesity in adulthood.[13,14] This, in turn, influences the overall population health through an endless sequence of obesity and subsequent diabetes.[15]

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Prenatal care is very important in preventing risks and promoting positive maternal and fetal outcomes. It can empower pregnant women by providing needed knowledge and skills and enhancing their physical and mental health.[16] Lifestyle intervention during the first trimester helps to empower the women, improves their self-care management activities, and diminishes its adverse outcomes.[17,18] Appropriate diet, insulin regimen, and physical activity are the main pillars for controlling and managing this disorder.[19] Self-care educational activities should be transformed from a solely passive approach to conscious decisionmaking for selfcare empowerment. Therefore, selfcare support should be present with selfcare education as essential for diabetes care.[20] Besides, nurses and other healthcare providers should play an active role in confirming that GD is discussed as a serious illness and not just a temporary condition in pregnant women.[21] Evidence showed that theory/model-based health education is more efficient in developing health education programs. One of the behavioral change models that can empower women for behavioral change is the Beliefs, Attitudes, Subjective Norms, and Enabling Factors (BASNEF) model. It is an acronym that stands for beliefs, attitudes, subjective norms, and enabling factors, which was first declared by John Hubley (1988) grounded on the Theory of Reasoned Action (TRA) and PRECEDE model (incorporating only the enabling factors). TRA is an enactment of the theory of expectancy-value for behavioral change motivation.[22]

BASNEF model is considered a holistic behavioral change model for human behaviors' studying, changing, and understanding the factors influencing their decision-making process. The behaviors' subjective norms are also determined by the attitude of key people toward the specified behavior (such as parents, husband, healthcare staff), which can influence the individuals' decision for behavioral change as a facilitator or inhibitor of such behavior. Individuals' intention for the new behavior was created by combining their attitudes toward the behavior and the subjective norms that should be balanced. Enablers are the resources that facilitate the transformation of the intention to behavior, such as knowledge, skills, material resources, time, money, and health services.[23,24] So, this study aimed to evaluate the effect of an empowerment educational intervention using the BASNEF model; personal Beliefs (PB), attitudes (A), Subjective Norms (SN), Behavioral Intention (BI), and Enabling Factors (EF), on gestational diabetes self-care behaviors (GD-SCB) among gestational diabetic woman.

Materials and Methods

This study was conducted from April to November 2019. It was a randomized, controlled trial registered in the Iranian Registry of Clinical Trial with the number IRCT20210131050192N1. The study was conducted in the outpatient clinic at El Shatby hospital, Alexandria, Egypt. It is the largest maternal and children hospital in Alexandria and El Behira governorates. A convenient sample of pregnant women beyond 20 gestational weeks diagnosed with GD was included in the study. Women complaining of other chronic diseases or pregnancy-induced complications and missing more than two educational intervention sessions were omitted from the study. The sample size was estimated according to the single proportion formula for a population using the highest reported GD prevalence by Zhu and Zhang in Asia and South Africa of 12.90%; therefore, a prevalence of 13% was used in sample size estimation.[5] Where (z) is the desired confidence interval = 1.69, (P) is the GD prevalence = 0.13, (d) is the margin error = 0.05, and (n) is the desired sample size = 175 participants.

A convenience sample of 220 pregnant women was incorporated into the study to compensate for the expected loss of participants. They were randomly assigned to either the intervention or control group using the randomization block technique [Figure 1], which was performed according to five sequential steps. First, a numbers list was prepared in advance, from 1 to 220. Second, these numbers were written on small pieces of paper and rolled to hide the numbers, then mixed in a ball. Third, a random division of the 220 paper pieces into 22 blocks was performed, where each one contained ten pieces of paper. Fourth, five papers were randomly picked from each block to be assigned to the intervention group, and the remaining five papers were assigned to the control group. Fifth, in front of each number in the previously prepared list, the researchers wrote the word "intervention" or "control" according to the randomization block technique results. The prepared list was kept in a closed envelope to be considered during data collection. A total of 110 participants were assigned to each group. The participants were included in the study according to the participants' follow chart [Figure 1].

The data collection instrument was an interview schedule; it was established by the researchers based on recent and relevant literature. It involved three main parts: the first part includes sociodemographic characteristics and obstetrics/medical history such as age, residence, education, occupation, socioeconomic status, numbers of gravidity, parity, abortions, gestational weeks, antenatal visits, and personal and family history of GD. The second part included a questionnaire based on the BASNEF model involving six subscales of knowledge (15 closed-ended questions), personal beliefs (6 items), attitude (8 items), subjective norms (10 items), enabling factors (5 items), and behavior intention (7 items).

The knowledge subscale assessed the participants' knowledge about GD definition, signs and symptoms, risk factors, diagnostic criteria, complications, management strategies, and lifestyle modifications. A score of "2" was assigned to the correct and complete answers, the incomplete answers were scored 1, and incorrect answers were scored zero. The total subscale score ranged from 0 to 30, where a higher

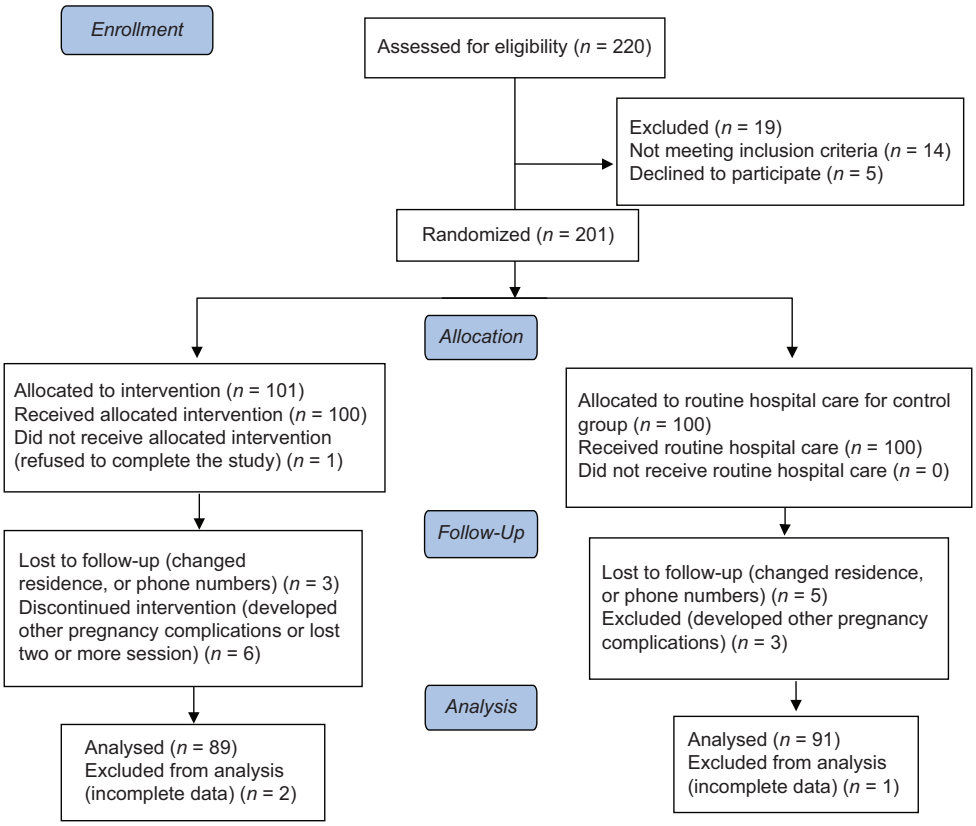

Figure 1: Participants' follow chart

score pointed out a higher level of GD knowledge. The personal beliefs subscale was designed based on a 5-point Likert scale on an agreement scale ranging from (1) to (5). The total subscale score ranged from 6 to 30 scores. The higher the score, the more the belief in the positive outcomes of the advised GD-SCB. The attitude subscale was a 5-point agreement Likert scale ranging from (1) to (5) with a total score ranging between 8 and 40. The higher the score, the more positive the attitude toward the GD-SCB.

The Subjective norms subscale was assessed using a 5points Likert scale: (5) extremely necessary, (4) slightly necessary, (3) neutral, (2) not necessary, (1) extremely not necessary. The total subscale score ranged between 10 and 50. The greater the score, the more effective the subjective norms were on women's adherence to GD-SCB. The behavioral intention subscale was assessed using a 5point Likert scale: never (1), rare (2), sometimes (3), often (4), and always (5). The total subscale score ranged from 7 to 35. The higher the score, the stronger the women's intention to adhere to GD-SCB. Enabling factors subscale was evaluated using 5-points Likert scale: 1 'no,' 2 'minimal extent', 3 'to some extent,' 4 'large extent,' 5 'extreme extent.' The enabling factors include the available resources and facilities, health services, education, family support, and skills. The total subscale score ranged from 5 to 25. The higher the score, the stronger the effect of enabling factors on women's GD-SCB.

The third part was the GD-SCB scale: it was scored on a 3-point Likert scale: never (1), sometimes (2), and always (3). It contained 28 items distributed over six subscales: dietary control (6 items, overall score ranged between 6 and 18), physical activities (5 items, overall score ranged between 5 and 15), insulin therapy (4 items, overall score ranged between 4 and 12), antenatal follow-up (4 items, overall score ranged between 4 and 12), glucose monitoring (3 items, overall score ranged between 3-9), and management of hypo/hyperglycemia (6 items, the overall score ranged between 6 and 18).

A jury of five experts in the field out of the research team and biostatistics specialist examined the instrument's content and face validity. The Cronbach's alpha coefficient test confirmed the instrument's reliability. The results were statistically acceptable with r = 0.79, 0.86, and 0.84 for knowledge questions, other BASNEF model subscales, and the GD-SCB scale, respectively.

A pilot study was carried out on 10% (22 women) to ensure the data collection instrument's clarity and applicability. The participants of the pilot study were excluded because of instrument modifications.

The researchers visited the outpatient clinic three days per week from 9 am to 1 pm. The gestational diabetic women were identified with the nurse's help; then, the medical records were reviewed to ensure eligibility for the

study. Each woman was interviewed individually to take her consent after explaining the study's aim. After taking consent, the basic data, medical, and obstetrics history were completed then the woman was allocated to either intervention or control group according to the pre-prepared list.

For the intervention group: (The BASNEF model-based empowerment educational intervention was carried out in four sequential phases) needs assessment: A pre-test was conducted to assess the participants' knowledge, PB, attitude, SN, BI, EF, and GD-SCB. The latter included diet, physical activities, insulin regimen, antenatal follow-up, glucose monitoring, and hypo/hyperglycemia management. The needs assessment phase's objectives were to address the participants' educational needs and collect basic data for subsequent comparison. Planning: Based on the needs assessment results, an educational intervention using the BASNEF model was designed in view of the current literature. The intervention is composed of five sessions. The first session was designed to increase the participants' knowledge about GD pathophysiology, sign and symptoms, risk factors, diagnostic criteria, complications, management strategies, and lifestyle modifications. The second session targeted the explanation of GD-SCB, including diabetic diet, physical activities, insulin regimen, antenatal follow-up, glucose monitoring, and hypo/hyperglycemia management. The third session concerned with correcting any misinformation about GD to foster positive attitudes and beliefs among women about GD and SCB. The fourth session aimed to address the SN and EF that affect the women's intention for SCB. The fifth session discussed the participants' questions and addressed their individual needs and problems. PowerPoint presentations, printed booklets, and audiovisual aids were prepared for the intervention. Implementation: The educational sessions were conducted in a private room in the outpatient department, with the nursing staff's cooperation. The educational session was conducted for three to four women at each time. The teaching strategies included but were not limited to lectures, group discussion, and brainstorming. Each educational session lasts from 30 to 45 minutes. At the end of each session, a summary of the content and feedback was provided. Numerous printed materials were used to stimulate knowledge retention and make concepts reinforcement to support desired changes. The participants were accessed through phones to arrange for the sessions. Evaluation: Two months after the intervention, the post-test evaluated the women's knowledge, PB, attitude, SN, BI, EF, and GD-SCB. A telephone interview was conducted to complete the post-test if the women could not attend the antenatal clinic.

For the control group: A pre-test was conducted, then they left for the routine hospital care, and revaluation was done after two months from the pre-test. After finishing the evaluation phase, the printed materials were provided to the control group to maximize the educational intervention benefits.

Data was examined through the Statistical Package for Social Science (SPSS), version 26 (SPSS Inc. Chicago, IL, USA). Arithmetic mean and Standard Deviation (SD) were used for describing numerical variables. Numbers and percentages were used to describe the categorical variables. The differences in categorical demographic variables between groups were evaluated using the Chi-square test. Differences in BASNEF model constructs and GD-SCB among groups before and after the intervention were assessed using Analysis of Covariance (ANCOVA) to adjust the effect size from the pre-test score. A significance level (P) was considered at < 0.05.

Ethical considerations

Ethical approval was taken from the nursing college, Damanhour University. The ethical approval No (13-01-02-2019 EC) was issued on January 10/2019. Another official permission was taken from Al Shatby hospital administration. Oral consent was taken from each woman before data collection and after explaining the study's aim. Each woman had the right to withdraw from the study without any penalties. All data was confidential and used for the research purpose only.

Results

A total of 180 participants participated in the research. Chi-square and t-tests showed no significant differences between the intervention and control group concerning all sociodemographic characteristics [Table 1]

Obstetrics and medical history in Table 2 shows the absence of statistically significant differences between the intervention and control groups. The highest percent of the intervention and control group had no personal history of GD 70.79%, 64.84%, respectively. More than one-half (55.06%, 50.55%) of them had a family history of diabetes, respectively. The mean number of gravidity and parity among the intervention (2.66, 1.49) and the control group (2.80, 1.70), respectively. The mean number of abortions among the intervention group was (0.39), and the control group was (0.31). The mean gestational weeks and antenatal visits were (22.60, 1.82) among the intervention group and (22.25, 1.86) among the control group, respectively. Table 3: portrays that after the intervention, the participants' knowledge, personal beliefs, subjective norms, behaviors, intention, and enabling factors were significantly improved when taking the pre-test as a reference ($p < 0.05$) and when taking the group as a reference ($p < 0.001$). Furthermore, ANCOVA results showed a significant improvement in the intervention group's total BASNEF model score ($F = 162.28$, $df = 1$, $p < 0.001$) when taking the pre-test as a reference. Besides, the effect size showed

Table 1: Distribution of the studied women according to their sociodemographic characteristics

Items	*n* (%)		Significance test	*p*
	Intervention Group (*n*=89)	Control Group (*n*=91)		
Age			1.28*	0.256
20-<35	61 (68.54)	55 (60.44)		
≥35	28 (31.46)	36 (39.56)		
Mean (SD)	28.35 (7.48)	28.83 (7.22)	0.43**	0.565
Education			2.57*	0.461
Illiterate/read and write	19 (21.35)	25 (27.47)		
Basic education	23 (25.84)	26 (28.57)		
Secondary education	32 (35.96)	23 (25.28)		
University education	15 (16.85)	17 (18.68)		
Occupation			0.47*	0.490
Housewife	62 (69.66)	59 (64.84)		
Working	27 (30.34)	32 (35.16)		
Residence			0.46*	0.496
Rural	61 (68.54)	58 (63.74)		
Urban	28 (31.46)	33 (36.26)		
Perceived monthly income				
Not enough	52 (58.43)	49 (53.85)	0.39*	0.823
Enough	25 (28.09)	28 (30.77)		
Enough and save	12 (13.48)	14 (15.38)		

* X^2: Chi-square test, ** *t*: independent sample *t*

Table 2: Distribution of the studied women according to their obstetrics and medical history

Items	Intervention Group (*n*=89)	Control Group (*n*=91)	Significance test	*p*
History of gestational diabetes			0.73*	0.393
No *n* (%)	63 (70.79)	59 (64.84)		
Yes *n* (%)	26 (29.21)	32 (35.16)		
Family history of diabetes			0.36*	0.545
No *n* (%)	40 (44.94)	45 (49.45)		
Yes *n* (%)	49 (55.06)	46 (50.55)		
Gravidity Mean (SD)	2.66 (1.31)	2.80 (1.10)	0.77**	0.443
Parity Mean (SD)	1.49 (1.17)	1.70 (1.11)	1.22**	0.222
Number of abortions Mean (SD)	0.39 (0.76)	0.31 (0.66)	0.70**	0.458
Gestational weeks Mean (SD)	22.60 (1.33)	22.25 (1.28)	1.81**	0.072
Antenatal visits Mean (SD)	1.82 (1.05)	1.86 (1.13)	0.30**	0.758

* X^2: Chi-square test, ** *t*: independent sample *t*

that 46.80% of the intervention group's improvement was due to the intervention. Furthermore, when taking the group as a reference, there was a significant improvement in the intervention group total BASNEF model score (F = 674, df = 1, $p < 0.001$), where 71.20% of the differences between the two groups were due to the intervention.

Table 4 shows significant improvement in dietary control, physical activities, insulin regimen, glucose monitoring, and management of hypo/hyperglycemia after the intervention when taking pretest as a reference and when taking the group as a reference ($p < 0.001$). Moreover, ANCOVA results showed that when taking pretest results as a reference, there was a significant improvement in total GD-SCB after the intervention (F = 167.38, df = 1, $p < 0.001$), where 48.60% of the improvement was due to the intervention. Simultaneously, a statistically significant difference was observed when taking the group as a reference (F = 775.10, df = 1, $p < 0.001$), where 81.40% of the groups' differences were related to the intervention.

Discussion

GD is an internationally growing pregnancy-related complication that affects pregnant women and their offspring. It can be better managed through proper GD-SCB, which can be best achieved through evidence-based educational intervention, especially theory/model-based health education. Consequently, pregnant women are empowered to combat the disease and save themselves and their children.[25,26] The main problem in this study is a lack of awareness, negative attitude, low subjective norms, and

Table 3: Mean scores of BASNEF* model constructs before and after applying the empowerment educational intervention

Constructs	Intervention group		Control group		ANCOVA** (reference group)				ANCOVA** (reference pre-test)			
	Before the educational intervention Mean (SD)	2 months after the educational intervention Mean (SD)	Before the educational intervention Mean (SD)	2 months after the educational intervention Mean (SD)	*F*	Df	*p*	Effect size	*F*	df	*p*	Effect size
Knowledge	13.79 (2.21)	23.47 (2.43)	13.90 (2.60)	15.81 (2.61)	173.92	1	<0.001***	0.49	17.15	1	<0.05***	0.29
Personal beliefs	18.62 (3.90)	26.51 (2.31)	18.54 (2.77)	19.28 (3.41)	286.54	1	<0.001***	0.61	19.28	1	<0.05***	0.45
Attitude	20.26 (5.10)	34.31 (4.18)	19.89 (4.55)	20.81 (4.61)	375.24	1	<0.001***	0.67	27.98	1	<0.001***	0.13
Subjective norms	21.39 (6.35)	40.05 (6.29)	21.61 (5.02)	24.63 (7.43)	248.82	1	<0.001***	0.58	15.58	1	<0.001***	0.18
Behavioral intention	16.58 (3.99)	25.34 (4.05)	16.63 (3.82)	17.53 (4.35)	235.43	1	<0.001***	0.57	91.20	1	<0.001***	0.34
Enabling factors	14.87 (2.56)	16.83 (2.29)	15.01 (2.48)	15.38 (2.65)	59.71	1	<0.001***	0.25	425.31	1	<0.001***	0.70
Total	105.53 (14.38)	169.74 (12.06)	105.60 (11.15)	113.47 (13.77)	674.10	1	<0.001***	0.71	162.28	1	<0.001***	0.46

*Beliefs, Attitudes, Subjective Norms, and Enabling Factors, **analysis of variance (ANCOVA) ***Significant at $p \leq 0.05$

Table 4: GD-SCB* before and after application of the BASNEF model-based empowerment educational intervention**

Items of GD-SCB*	Intervention group		Control group		ANCOVA*** (reference group)				ANCOVA*** (reference pre-test)			
	Before the educational intervention Mean (SD)	2 months after the educational intervention Mean (SD)	Before the educational intervention Mean (SD)	2 months after the educational intervention Mean (SD)	*F*	df	*p*	Effect size	*F*	df	*p*	Effect size
Dietary control	10.26 (1.29)	14.12 (1.71)	10.60 (1.34)	11.29 (1.52)	325.39	1	<0.001****	0.64	138.52	1	<0.001****	0.43
Physical activities	7.07 (1.84)	10.49 (2.08)	7.05 (1.89)	7.48 (1.86)	120.76	1	<0.001****	0.40	28.86	1	<0.001****	0.14
Insulin regimen	7.57 (1.68)	10.15 (1.29)	7.70 (1.79)	8.32 (1.49)	236.62	1	<0.001****	0.57	324.35	1	<0.001****	0.64
Antenatal follow-up	7.11 (1.14)	9.91 (1.37)	6.96 (1.20)	7.41 (1.25)	180.23	1	<0.001****	0.50	26.04	1	<0.001****	0.12
Glucose monitoring	5.37 (2.01)	7.21 (1.21)	5.26 (2.19)	5.70 (2.12)	103.81	1	<0.001****	0.37	456.73	1	<0.001****	0.72
Management of hypo/ hyper glycaemia	7.83 (2.88)	10.92 (2.27)	7.94 (2.69)	8.20 (2.24)	129.08	1	<0.001****	0.42	191.47	1	<0.001****	0.52
Total	45.23 (4.96)	62.82 (4.15)	45.53 (5.57)	48.43 (5.50)	775.10	1	<0.001****	0.81	167.38	1	<0.001****	0.48

*gestational diabetes self-care behaviors, **Beliefs, Attitudes, Subjective Norms, and Enabling Factors, ***analysis of variance (ANCOVA) ****Significant at $p \leq 0.05$

enabling factors toward GD-SCB, which act as the main reasons for developing gestational diabetes complications. It seems that if the BASNEF model-based educational intervention is implemented accurately, effective measures can be taken towards improving pregnant women's knowledge, attitude, subjective norms, enabling factors, and GD-SCB. This study hypothesized that gestational diabetic women who received the empowerment educational intervention using the BASNEF model about GD-SCB exhibited higher scores of all constructs: knowledge, PB, attitude, SN, BI, and EF, along with higher GD-SCB scores than the control group. The current study's findings illustrated significant improvements after applying the intervention in all BASNEF model constructs (knowledge, PB, attitude, SN, BI, and EF) in the intervention than the control group [Table 3]. This highlighted the effectiveness of BASNEF model-based educational intervention in empowering pregnant women by providing the essential knowledge that enhances the development of positive beliefs and attitudes toward GD and its SCB. In addition to improving their perception of the significant others' subjective norms and utilizing the available enabling factors, which further increase their behavioral intention toward GD-SCB.

Three Iranian studies reported similar improvements in all BASNEF model constructs among type II diabetic participants post-intervention in the experimental compared to the control group. First, Jeihooni *et al*. 2019 studied the impact of BASNEF model education on diabetic patient self-medication behaviors. They fostered the efficiency of the BSNEF model as a framework for designing and developing interventions for diabetics.[27] Second, Askari *et al*. recommended using the BASNEF model to foster metabolic control among people with diabetes. They conducted an experiment to investigate the impact of BASNEF model-based education on the elderly diabetic patient's metabolic rate.[28] Third, Tol *et al*. investigated the effect of the BASNEF model-based education on blood pressure control among hypertensive diabetic patients. They hinted that BASNEF model-based educational intervention was also effective in modifying blood pressure among diabetics.[29]

Data analysis in the current study showed that the mean knowledge score significantly increased among the intervention than in the control group [Table 3]. This illustrated the efficiency of the utilized BASNEF model-based educational materials, group discussion, presentation, and booklet content in enhancing the intervention group's knowledge level. Congruent improvement in the knowledge score among the studied gestational diabetic women was proved by other recent studies, which used BASNEF model-based education.[27,30,31]

The personal beliefs' mean score in the current study, after the intervention, was significantly increased among the intervention group than the control group [Table 3]. This enhances the BASNEF model's role in changing women's beliefs that directed their attitude and subsequent GD-SCB based on their judgment of the advised behavior's usefulness. Similar studies revealed improvement of the positive beliefs toward the advised behavior. An Egyptian randomized controlled trial by Tawfik investigated the prevention and early detection of Type II diabetes among gestational diabetic women. They found a significant increase in women's percentages with positive beliefs about GD-SCB in the intervention group at the post-intervention than in the pre-intervention phase.[32] This elaborates that if the women's belief in the importance of GD-SCB was improved, they were more likely to follow it. A healthy lifestyle and good GD-SCB protect pregnant women and their offspring and decrease their future risk for type II diabetes. Moez *et al*. examined the effect of BASNEF model education on Iranian women's contraceptive behavior. They showed that BASNEF model education modified women's beliefs about the safe use of contraception by influencing their evaluation of the associated positive outcomes of preventing unplanned pregnancy.[33]

The behavioral intention is shaped by one's attitude and the key people's attitude toward the specified behavior (subjective norms). The subjective norms can develop a form of social pressure on the individuals' decisions and as predictive factors of their intention to participate in a particular behavior. In this study, subjective norms such as women's parents, mothers-in-law, husbands, healthcare staff, and friends were found to affect the woman's decision to adopt GD-SCB. As observed after the intervention, the attitudes and subjective norms scores were significantly upgraded among the intervention than the control group [Table 3]. The educational experience transmitted to the pregnant woman's significant others can significantly influence their attitude toward GD-SCB. This was supported by the study conducted by Askari *et al*. 2018. They portrayed a significant improvement in diabetics' attitudes toward dietary and physical activity behaviors and the subjective norms of key personnel in their lives as family members, peers, and health personnel.[28]

Enabling factors also were essential for the transformation of intentions into actions. The EF investigated by the current study was seeking family assistance for insulin therapy and diet, earning crucial knowledge and skills acquired through the educational intervention for GD-SCB, and complying with SCB guidelines as instructed by health personnel. The current study revealed a significant increase, after the intervention, in the mean score of enabling factors in the intervention group than the control one. Identical findings were presented by three studies evaluating BASNEF model based-educational programs and indicated a significant increase in enabling factors mean score after the intervention.[34-36] Numerous studies have been conducted worldwide concerning the effectiveness of the

BASNEF model based-educational intervention on SCB for type 1 and type 2 DM. However, this approach is still not recognized in managing GD. The current study results indicated a significant improvement in GD-SCB in the intervention than in the control group two months after the educational intervention, specifically, diet, physical activity, insulin regimen, glucose monitoring, antenatal follow-up, and hypo/hyperglycemia management [Table 4].

Identical findings were reported in various studies. Ahmadzadeh conducted nutritional education for Iranian type 2 diabetics using the BASNEF model. He reported improvement in nutritional behaviors and glycemic parameters among the participants three months after the intervention.[37] In addition, a randomized controlled trial was conducted by Kolivand *et al*. to explore the effectiveness of the GD-SCB educational package on GD outcomes for both women and neonates. They concluded that using a self-care educational package had a definite impact on woman's self-efficacy and monitoring behavior of blood glucose level.[38] Beside, Al-Hashmi *et al*. carried out a comparative pre-post study in Oman to examine the impact of a self-efficacy intervention on gestational diabetic women's health behaviors adherence. They reported significant improvement in self-efficacy and adherence behaviors four weeks post-intervention in the self-efficacy group than in the control one.[39] Furthermore, a quasi-experimental study by Ko and Lee examine the effect of a coaching intervention on modifying lifestyles among women with GD. They proved the coaching intervention's effectiveness in enhancing GD-SCB, decreasing fasting blood glucose, and depression in the experimental than in the control group.[40] Moreover, Viswanath and Jose assessed the impact of a self-care-enhancing intervention on women with GD. They noticed a significant variation in the overall self-care score and its four domains: diet, physical activity, insulin use, and blood sugar self-monitoring after the intervention.[41] Yet, using health education models and theoretical frameworks has a more valuable effect on improving SCB among gestational diabetic women. Although GD is a temporary pregnancy-related complication, it could have serious consequences for women and their offspring. It needs to be properly managed through effective SCB that needs numerous interrelated elements to be applied. BASNEF model is considered an ideal collection for all factors that may enhance GD-SCB. Therefore, it is considered an ideal model that nurses can use for diabetic women's education.

Limitations of the study, first, the study reflects only one geographic region in Egypt. Therefore, additional studies should include larger samples from different geographical regions. The second, time of the educational sessions were not suitable for all the participants leading to the withdrawal of some participants.

Conclusion

The current research findings revealed that the empowerment educational intervention grounded on the BASNEF model for gestational diabetic women could significantly increase their knowledge, create positive beliefs and attitudes, and improve their enabling factors and subjective norms, leading to improvement in GD-SCB. Therefore, the BASNEF model can serve as a framework for constructing and executing similar educational programs. The healthcare team needs more information and facilities to apply the BASNEF model to help women with GD to take appropriate selfcare behaviors and reduce the negative consequences of this disease.

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Conflicts of interest

Nothing to declare.

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