

Effect of postpartum self -Instructional Booklet on Attenuating Type 2 Diabetes among Gestational Diabetic Mothers

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Abstract: Pregnant women who developed gestational diabetes mellitus (GDM) have future risk of type 2 diabetes mellitus (T2DM). Despite this window of opportunity, few interventions studied have targeted postpartum women with history of GDM. **Aim of the study** was to investigate the effect of postpartum self - instructional booklet on attenuating type 2 diabetes among gestational diabetes mothers. **A quasi-experimental** research design was used. **A purposive sample** technique was used to recruit 124 postpartum women with prior history of GDM. **Setting**, the present study conducted at postnatal units on maternity university hospital and postpartum women homes. **Four tools** of data collection were used; 1st Self-administered questionnaire, 2ndAnthropometric measurements, 3rd International Physical Activity Questionnaire short form and 4thFood Consumption Frequency Questionnaire (FCFQ). **Results:** there was a highly statistically significant improvement on intervention group knowledge, moderate & vigorous activity, adherence to dietary source of energy, and glucose control after intervention by 6 months and 12 months. In addition, there was reduction on BMI of postpartum women in intervention group more than 5-10%. Furthermore, 89.7% of the studied postpartum women in intervention had exclusive breastfeeding compared to 75.8% of the studied postpartum women in control group. Moreover, 93.1% of the studied postpartum women in intervention had a continuation of breastfeeding for 12 months versus 60.6% of the studied postpartum women in control group. **Conclusion:** postpartum self-instruction booklet has positive effect on attenuating type 2 diabetes among gestational diabetes mothers. **Recommendation:** utilization of postpartum self-instruction booklet on postpartum units for women with prior history of GDM.

Key Words: Postpartum Self -Instructional Booklet, Type 2 Diabetes, Gestational Diabetes Mothers.

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I. Introduction

Diabetes is the main cause of morbidity and mortality. In addition, it is one of the four chronic diseases categorized by world health organization[1]. The International Diabetes Federation (IDF) expected that in 2013, 21.4 million or 16.8% of live births to women had a various form of hyperglycemia in pregnancy. This is in the case of a rapidly rising number of people diagnosed as having diabetes, and the anticipated increase of 55% by 2035. Gestational Diabetes mellitus (GDM) affects approximately 7% of pregnancy worldwide [2].

Gestational diabetes mellitus (GDM) has been described as carbohydrate intolerance of different degrees of severity with its onset or firstly detected during pregnancy on the second or third trimester [3]. GDM is the major population predictor of type 2 diabetes mellitus (T2DM) compared to those with normal pregnancies. Women who have GDM during a pregnancy have a risk by 30% - 50% of developing GDM in another pregnancy [4]. Previous research indicates that many women who have past experienced GDM don't complete or offered adequate follow up for their GDM, especially postpartum diabetes screening [5].

Type 2 diabetesmellitus (T2DM) is strongly linked to obesity and unhealthy lifestyle. Evidence shows that modifying these factors can decrease the risk of developing type 2 diabetes. Moreover, systematic review studies showed that risk of developing type 2 diabetes among women with a history of GDM can be decreased by knowledge and self-care measures such as diet, exercise, breastfeeding and monitoring of blood glucose [6].

As the burden of diabetes, that increase worldwide, preventive actions are urgently needed. Lifestyle modifications have been proved to be efficient in the prevention of diabetes when offered to a high risk group [1].Lifestyle refers to a pattern of individual practices and personal behavioral choices that are related to elevated or reduced health risk[7].Lifestyle modifications are usually implemented during pregnancy for management of gestational diabetes. Meanwhile, women frequently abandon these lifestyle modifications after

pregnancy. Therefore, intervention to foster a healthy lifestyle is essential and must be adapted to the postpartum period [8]. Postpartum women with GDM should be allowed to take care of their own health, including knowledge of health indicators such as weight, waist circumference, and blood glucose levels. Women who have a history of GDM are recommended to have their blood sugar assessed based on postpartum screening guideline for diabetes recommended 2-hour glucose tolerance test after 6 weeks and up to 6-12 months postpartum. However, the major cost-effectiveness diagnostic test of different postpartum screening strategies was screening at 6 weeks postpartum with a 75 g oral glucose tolerance test (OGTT) [9].

According to Orem and Parse, self-care is refers as saving of vital physical, psychological, and social health in the context of the environment, health, and nursing. They believed that self-care activities could be learned through experience and education [10]. Moreover, self-care is self-directed and self-recognized of knowledge and practice on daily basis for maintenance of health and promotion of well-being. It is acquired through interaction with family, friends, peer groups, and health care team [11].

Self-care is the activities that enable people to deal with their impact of a long term condition on their daily lives and adherence to treatment regimes. People with diabetes have better lives when they are supported to take care of their conditions themselves. If they have a clear understanding of their condition and what they can do, they are more likely to take control themselves [12]. Major areas for self-care are education regarding maintaining and enhancing health these include: exercise & physical fitness, nutrition & weight control, stress management, maintenance of social support systems, and environmental control [13].

Lifestyle modification should be the principal strategy to prevent or delay the onset of diabetes in women with a history of GDM. Lifestyle modifications are the focus on decrease caloric intake and increase physical activity in order to reduce body weight and fat, which in turn reduce insulin resistance [14].

There is strong evidence concerning a change to dietary variable propose low calories, low-fat diet with decreasing amount of energy-dense foods as fast food, increasing the amount of fruit and vegetable intake, and controlling portion size. The recommended calories limit varies between 1000-1200 kcal/day [15]. Furthermore, moderate physical activity (e.g., brisk walking) for 30 min per day to achieve a weight reduction of 5% -7% of initial body weight. It is essential to combine the physical activity with a dietary support to improve the effectiveness of an intervention program [4].

Moreover, breastfeeding is advised as the best method to feed infants for minimum one year after childbirth, because of its several short and long-term benefits for both infant and mother. However, breastfeeding is a healthy behavior that mixed with improved maternal metabolic profiles to women with a history of GDM in the early postpartum period [16]. In addition, breastfeeding was associated with drop in blood glucose levels at 6-12 weeks postpartum. Exclusive breastfeeding for 6 months or more decrease weight retention at 6 months postpartum regardless pre-pregnancy body mass index [17].

Postpartum women with GDM do not understand the importance of this disorder as a warning sign for type 2 diabetes. Therefore, opportunities to promote women's health and reduce the risk of devolving disease are lost [6]. Moreover, postpartum women are a specific group with a unique set of problems. The major barriers to lifestyle interventions reported by these women were lack of time, insufficient support for childcare, and other family responsibilities. As the amount of available social support is associated with adherence to lifestyle interventions, educational and counseling sessions should be extended to the spouse and the immediate family of these women [14].

The ability to attain lifestyle changes is influenced by women's mental well-being, recognized stress, role expectations, social support and cultural beliefs [18]. Therefore, nurse plays a crucial role on an identification of women who face the subsequent risk of developing T2DM through appropriate health assessment of the risk factors, which can be modified such as high BMI, excess gestational weight gain, and insufficient physical activity [19]. Moreover, nurses are well positioned to apply preventive strategies through an encouragement of early breastfeeding, in addition, to support long-term postpartum breastfeeding that results in lower a woman's risk of T2DM and may be beneficial for long-term health. Furthermore, to initiate health education and counseling about postpartum preventive health approach that motivates women to adapt a healthy lifestyle and support them to adhere these change [20].

II. Significant Of The Study

Women with a history of gestational diabetes mellitus (GDM) have at least seven-fold increased risk for developing type 2 diabetes. The risk can be attenuated by self-care measures. Evidence from clinical trial proves that T2DM incidence decreased by up to 50% for GDM with a postpartum lifestyle change (nutrition, physical activity, in addition to breastfeeding) [4]. Majority of women who have had GDM are rarely committed to the recommended screening schedule for diabetes after childbirth. Moreover, they didn't receive the optimal care concerning diabetes prevention after childbirth. In addition nursing care has concentrated on management of GD during pregnancy to attain positive pregnancy outcome, however evidence demonstrates the significance of nursing care after childbirth as well. Therefore, nursing intervention help postpartum women to prevent or

delay type 2 diabetes and stimulate behavior change to adopt healthy lifestyle behaviors (e.g. weight loss, healthy diet, exercise) and cope with the demands of motherhood is mandatory.

Moreover, diabetes self-care education has been considered an important part of the clinical management of individuals with diabetes through teaching individuals to manage their diabetes. The National Diabetes Association recommends assessment of self-care skills and knowledge of diabetes at least annually, and the provision or encouragement of continuing diabetes education as one of the diabetes-related objectives of Healthy Community 2020.

III. Aim of the study

This study aims to investigate the effect of postpartum self-instructional booklet on attenuating type 2 diabetes among gestational diabetes mothers through the following:

1. Assessing postpartum women's level of knowledge and practices regarding to type 2 diabetes to identify their needs detected.
2. Assessing postpartum women compliance to breast-feeding and healthy lifestyle (diet and exercises).
3. Designing and carrying out self-instructional booklet based on the previously detected needs of the postpartum women.
4. Evaluating the effect of postpartum self-instructional booklet on postpartum women compliance to exclusive breast-feeding and healthy lifestyle (diet and exercises).
5. Investigating the effect of postpartum self-instructional booklet versus routine care on attenuating type 2 diabetes among gestational diabetic mothers.

IV. Research Hypothesis

The current study hypothesized that: postpartum self-instructional booklet has a positive effect on attenuating type 2 diabetes among gestational diabetic mothers than postpartum mothers who receive routine care.

V. Subjects And Methods

Research design:

A quasi-experimental design, pretest-posttest was utilized to meet the aim of the study.

Research Setting:

The present study was conducted in postnatal inpatient units at Ain Shams University Maternity Hospital and postpartum women homes.

Sample type, size and criteria:

A purposive sample technique was used to recruit 160 postpartum women, which represent 10% of the total number of women diagnosed with gestational diabetes who attended at the postnatal inpatient units in the previous year. The rule of sum and sample equation based on information from relevant studies and the last year hospital admission statistics were used to determine the sample size of the study. The sample size was calculated according to the following statistical formula;

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

n = required sample size

t = confidence level at 95% (standard value of 1.96).

p = estimated prevalence of gestational diabetes.

m = margin of error at 5% (standard value of 0.05)

At the beginning of the study; the selected participants were randomly assigned into two groups (80 for each); the first 80 subjects was the control group who received only a usual routine care, while, the next 80 subjects was the intervention group who received the intervention.

During the implementation phase of the study, some of women were dropped out. So, the final sample size reached 124 postpartum women because 14 women were dropped out from both intervention and control groups due to losing at the follow-up time. While, another 8 women were dropped on intervention group due to committed only with one of the self-instruction items (exclusive breastfeeding or physical activity or diet, or follow a schedule of OGTT) at maintenance phase. In addition, other 16 women shared in the pilot study were excluded. The final number was 66 in intervention group, and 58 in the control group.

Inclusion criteria;

- Postpartum women have gestational diabetes during current pregnancy.
- Women have a single fetus.
- Postpartum women who able to read and write.

Exclusion criteria;

- Postpartum women have any other chronic diseases.
- Postpartum women previously participate in education program to alleviate type 2 diabetes after gestational diabetes.

I. Tools of data collection:

Four tools of data collection were used as the following;

First tool: Self-administered questionnaire, developed by the researchers based on literature review, and written in simple clear Arabic language named "**Postpartum Gestational Diabetic Women Questionnaire**" consisted of four parts and consisted of (21) questions of open and closed-ended types as the following:

Part one: Designed to collect data about the demographic characteristics of postpartum women. It included data age, educational level, residence and occupation (questions: 1- 4).

Part two: Designed to collect data about postpartum women obstetric & gestational diabetes mellitus history (questions: 5-11) such as; parity, gestational age on current pregnancy, current mode of delivery, previous infant weight, current infant weight, GDM on previous pregnancy and treated with insulin on current pregnancy.

Part three: It was constructed to assess breastfeeding duration, and period of exclusive breast feeding based on [21] (questions: 12- 13).

Part four: Devoted to the postpartum women's knowledge about type 2 diabetes covered areas such as; meaning, types, risk factors, causes, signs and symptoms, complications, treatment and diet regimen (questions: 14- 21).

Scoring system: For knowledge items, the correct answers were predetermined according to literature review, a correct response was scored 2 and the incorrect one was scored 1. For each area of knowledge, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into a percent score. The total score of women knowledge was 10 marks, were graded as (Satisfactory $\geq 60\%$, unsatisfactory $< 60\%$) Cronbach's alpha coefficient was 0.92.

Second tool: Anthropometric Measurements, it was designed to assess postpartum women's anthropometric measurements " height, weight and body mass index (BMI)" that calculated for each postpartum woman then classified according to World Health Organization criteria [22] (underweight (BMI < 18.5), healthy weight (BMI $18.5 < 25.0$), overweight (BMI $25.0 < 30.0$) or obese (BMI ≥ 30.0)).

Third tool: International Physical Activity Questionnaire short form (IPAQ-SF) adapted from [23]. It consisted of (9) items, used to determine the postpartum women's physical activity within the last 7 days. Postpartum women are asked to report time spent on physical activity. According to the IPAQ-SF scoring protocol, total minutes over the previous 7 days spent on "vigorous activity, moderate-intensity activity and walking" are multiplied by (8.0, 4.0 and 3.3 retrospectively) to create metabolic equivalent (MET) scores for each activity level. Vigorous MET scores are calculated as (8.0 \times vigorous intensity activity minutes \times vigorous intensity activity days); moderate MET scores as (4.0 \times moderate intensity activity minutes \times moderate intensity activity days); and walking MET scores as (3.3 \times walking minutes \times walking days). Results are grouped as minimum, moderate or high activity as described in IPAQ-SF guidelines. Cronbach's alpha coefficient was 0.88.

Fourth tool: Food Consumption Frequency Questionnaire (FCFQ); it was adapted from [24] and used to assess postpartum women nutritional status. It cover 80 to 120 foods and beverages for each food or beverage item women provide an answer for the following; 1. A frequency of consumption (with a "never" option as well as options ranging from very infrequent to several times. 2. Portion size information, women translate usual consumption amount to the number of specified units, such as a cup of rice. It was self-administrated by women it took 15-20 minutes. Cronbach's alpha coefficient was 0.84.

Validity and Reliability

Tools of data collection were submitted to and reviewed by a panel of seven experts in the fields of obstetrics and gynecological nursing, community health nursing, obstetrician, and dietitian to test the face and content validity. Each of the experts was asked to examine tools for content coverage, clarity, wording, length, format, and overall appearance. Modifications were done according to the panel's judgment on the clarity of sentences

and content appropriateness as "rephrasing and canceling for two questions" were done. Reliability analysis was conducted to investigate the instrument internal consistency, which used in the study; Cronbach alpha coefficients were calculated to examine the measurement reliability with multipoint items.

II. Ethical Considerations:

An official approval was obtained from Scientific Research Ethical committee in Faculty of Nursing, Ain Shams University before starting the study. Researchers introduced themselves to women who met the inclusion criteria and informed them about the purpose of this study in order to obtain their acceptance to share in this study. Researchers ensured that, the study posed no risk or hazards on their health and their participation in the study is voluntary. Women who were willing to participate in the study and met the inclusion criteria were approached by researchers and asked for verbal consent to confirm their acceptance. Each participant had right to withdrawal from the study at any time and all data that obtained were considered confidential.

III. Pilot study:

After the development of tools of data collection, a pilot study was carried out on 10% of the predicted total sample size (16 postpartum women). The purpose of the pilot study was to ascertain the relevance and content validity of tools, estimating the exact time needed for data collection and detect any problem that might face researchers and interfere with data collection. After conducting the pilot study, the necessary changes were performed; some questions were rephrased, others canceled, the tools were reconstructed and made ready for use. These females were excluded from the study sample.

IV. Field Work:

Data collection for this study was carried out in the period of the beginning of July 2016 to end of December 2017. Researchers first explained the aim of the study to the participants, reassure women that information collected would be treated confidentiality, and that would be used only for the purpose of the research. Data collection procedure has been done through four phases; assessment, implementation, follow up and evaluation phase.

Phase I (Assessment phase); this phase, conducted by researchers on postnatal units where researchers met each participant individually and explaining the purpose of the study after that obtained their informed consent. Researchers then explained to each participant the proper way to fill tools of data collection and importance of accurate data. Tools of data collection require 30-40 minutes to fill by each participant. Researchers recorded women's telephone number and address in order to follow-up them.

Phase II (implementation phase)

a. Intervention group

- Postpartum self-instruction booklet was developed by researchers in Arabic language, it divided into eight main parts as follow; objectives of self-instruction booklet, how postpartum woman use booklet, Pre-test, type 2 diabetes instruction, postpartum glucose screening test (OGTT), breastfeeding, diet, and exercise.
- Researchers conducted orientation session plus three follow up sessions.
- Orientation session started on the second day after delivery at postnatal units by explaining the benefits of using this booklet as method to reduce the risk of developing type 2 diabetes.
- Researchers providing clear information for each participant regarding how participant use this booklet (start with pre-test, read instruction of each part carefully, filling schedule of oral glucose tolerance test, breast-feeding related form, weekly dietary form, and weekly physical activity form).
- Researchers instructed each participant to start with answer of pre-test to assess each participant actual level of knowledge, then developed a plan for each woman based on result of pre-test.
- Researchers started with part concerned with type 2 diabetes "the risk of DM after childbirth, associated risk factors of DM (such as family history, use of insulin during pregnancy, sleep duration, obesity, and unhealthy lifestyles), and risk for GD on future pregnancies". After women finished this part researchers instructed women to answer post-test and perform practice related to each part as prepare example of daily meal, perform one type of moderate exercises, and body weight.
- If woman gained the required knowledge and practice relate to this part researchers instructed woman to transfer to next part.
- If woman didn't gain the required knowledge and practice relate to this part researchers instructed woman to repeat this part again.
- Researchers follow the previous steps with each woman till the completion of all parts of self-instruction booklet.
- Researchers conducted a first home visit to each participant at the end of postpartum period (6 weeks) to

ensure that woman continually use of booklet and follow self-instructions. Then researchers conducted another two home visit at third and nine months after delivery this visits aimed at motivate woman to stick to self-instruction till end of the intervention (one year).

- Moreover, the woman informed that they could make contact with researchers through phone or Whats-App if woman had any problem.

b. Control group

- Women in the control group received only routine postnatal care without any instructions.

Phase III (Follow-up phase); in this phase researchers follow up women in both groups for breastfeeding, diet, exercises, and glucose screening at six months, and 12 months after childbirth.

Phase IV (Evaluation phase); was done to determine the impact of postpartum self -instructional booklet has a positive effect on attenuating type 2 diabetes among gestational diabetic mothers. Comparison between two groups control and study were conducted to investigate study hypothesis.

Study outcome Time point measurement

Out come	Definition	Time point measurement		
		Base line	Post intervention	1 year follow up
Postpartum glucose control	Reduction on oral glucose tolerance test	√		√
Decrease of BMI	Increase healthy weight (BMI 18.5 < 25.0)	√	√	√
Breastfeeding (BF)	Exclusive BF for 6 month + sustainability of BF	√	√	√
Diet adherence	Maintain daily allowance requirement	√	√	√
Physical activity (exercises)	Practice aerobic exercises 30 min < five days per week (minimal activity), practice aerobic exercises 30 min ≥ five days per week (moderate activity), practice aerobic exercises 60 min for ≤ five days per week (vigorous activity)	√	√	√

VI. Statistical Analysis

The data were analyzed using SPSS version 18.0. Frequency distributions, arithmetic means and standard deviations were calculated to describe the samples. The chi-square χ^2 tests were employed to compare quantitative and qualitative variables between the groups. Statistical significance was considered at (*P* value < 0.05).

VII. Results

Table (1): Distribution of the studied postpartum women in both groups according to their demographic characteristics.

Items	Control group (n=66)		Intervention group (n=58)		X ²	P value
	No	%	No	%		
Age					0.047	0.829
25-	8	12.1%	6	10.3%		
30-	22	33.3%	20	34.5%		
35-	28	42.5%	25	43.1%		
40-	8	12.1%	7	12.1%		
Residence					1.63	0.721
Rural	14	21.2%	14	24.1%		
Urban	52	78.8%	44	75.9%		
Educational Background					0.396	0.529
Primary	12	18.2%	11	19.0%		
Secondary	30	45.5%	27	46.5%		
University	24	36.3%	20	34.5%		
Occupation					1.329	0.249
House wife	38	57.6%	32	55.2%		
Working	28	42.4%	26	44.8%		

Table (1) shows that 42.5% of the studied women in control group their age ranged between 35 -39 years compared to 43.1% of the studied women in the intervention group. Concerning place of residence, 78.8% of the studied women in control group raise in an urban area versus 75.9% of the studied women in the intervention group. As regards educational background, 45.5% of the studied women in control group have secondary education compared to 46.5% of the studied women in the intervention group. Concerning occupation, 42.4% of the studied women in control group are working women versus 44.8% of the studied women in the intervention

group. In addition, the table clarifies that there is no statistically significant difference between both groups regarding their socio-demographic characteristics.

Table (2): Distribution of the studied postpartum women in control and intervention groups according to obstetric & GDM history

Items	Control Group (n= 66)		Intervention Group (n= 58)		X ²	P Value
	No	%	No	%		
Parity					1.08	0.078
Primipara	8	12.1	6	10.3		
Multipara	58	87.9	52	89.7		
Gestational age on current pregnancy					1.65	0.073
Full term 36-40 weeks	48	72.7	43	74.1		
Preterm < 36 weeks	18	27.3	23	25.9		
Current Mode of Delivery					1.83	0.098
Normal vaginal	3	4.5	2	3.4		
Cesarean section	63	95.5	56	96.6		
Previous infant weight	N=58		N=52		2.03	0.072
Normal (2.5 - ≤ 3.5 kg)	50	86.2	45	86.5		
Macrosomic (> 4.0 kg)	8	13.8	7	12.5		
Current infant weight					1.72	0.088
Normal (2.5 - ≤ 3.5 kg)	28	42.4	24	41.4		
Macrosomic (> 4.0 kg)	38	57.6	34	58.6		
GDM on previous pregnancy	N=58		N=52		1.53	0.085
Yes	2	3.4	2	3.8		
No	56	96.6	50	96.2		
Treated with Insulin on current pregnancy	25				2.07	0.467
Yes	41	37.9	23	39.7		
No		62.1	35	60.3		

Table (2) illustrates that 87.9% of the studied women in control group were multiparous compared to 89.7% of the studied women in the intervention group. As regard gestational age 27.3% of the studied women in control group had a preterm baby versus 25.9% of the studied women in the intervention group. Concerning mode of delivery, 95.5% of the studied women in control group had cesarean section delivery compared to 96.6% of the studied women in the intervention group. Regarding infant weight on current pregnancy, 57.6% of the studied women in control group had a macrosomic baby versus 58.6% of the studied women in the intervention group. As regards the previous history of GDM 3.4% of the studied women in control group, had GDM compared to 3.8% of the studied women in the intervention group. Concerning insulin treatment on current pregnancy 37.9% of the studied women in control group had insulin as treatment versus 39.7% of the studied women in the intervention group.

Table (3): Comparison between postpartum women in control and intervention group regarding their knowledge about type 2 diabetes.

Total Knowledge Score	Control group (n=66)			Intervention group (n=58)		
	Pre	After 6 months	After 12 months	Pre	After 6 months	After 12 months
	%	%	%	%	%	%
Unsatisfactory	84.8	83.3	80.3	82.8	15.5	5.2
Satisfactory	15.2	16.7	19.7	17.2	84.5	94.8
Test of significant P value	#X ² = 1.63 P= 0.91 \$ X ² = 11.45 P= 0.001** @ X ² = 13.23 P= 0.001**			® X ² = 11.04 P= 0.001** ¥ X ² = 13.97 P= 0.001** ⊖ X ² = 7.82 P= 0.001**		

#Control group versus intervention group pre-intervention

\$ Control group versus intervention group after intervention by 6 months

@ Control group versus intervention group after intervention by 12 months

® Intervention group (pre-intervention versus after intervention by 6 months)

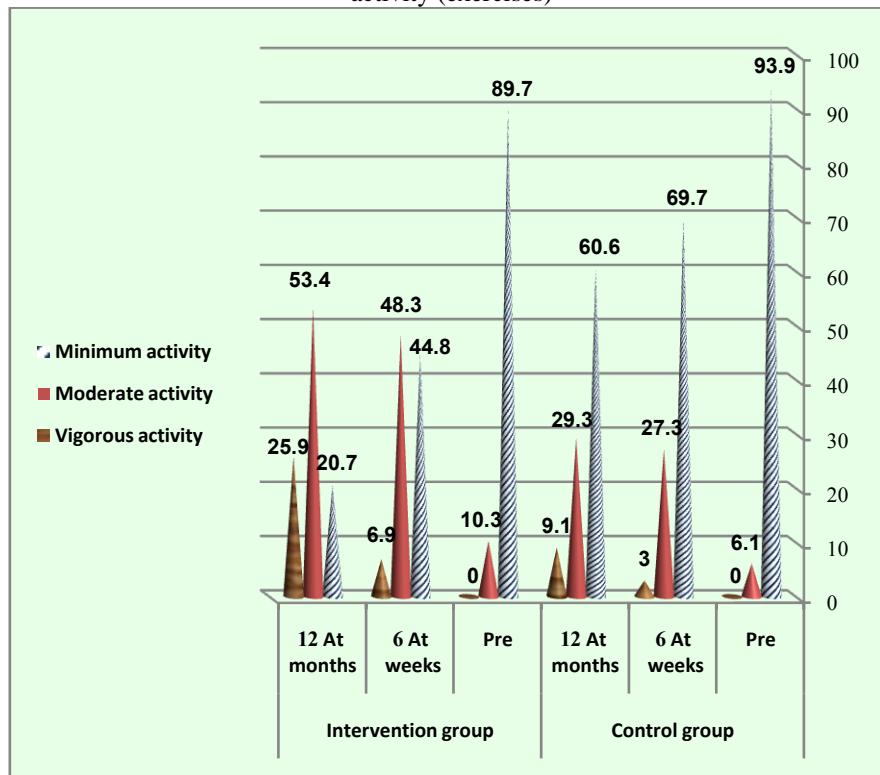
¥ Intervention group (pre-intervention versus after intervention by 12 months)

⊖ Intervention group (after intervention by 6 months versus after intervention by 12 months)

Table (3): shows that there was no statistically significant difference between control and intervention group regarding their knowledge pre-intervention. While there was a highly statistically significant difference between control and intervention group regarding their knowledge after intervention by 6 months and 12 months. In

addition, there was a highly statistically significant improvement on intervention group knowledge after intervention by 6 months and 12 months.

Figure (1): Comparison between postpartum women in control and intervention groups according to physical activity (exercises)



$X^2 = 0.98$ $P = 0.72$ ® $X^2 = 12.88$ $P = 0.001^{**}$
 ¥ $X^2 = 11.18$ $P = 0.001^{**}$ Ө $X^2 = 8.56$ $P = 0.001^{**}$

Control group versus intervention group pre-intervention

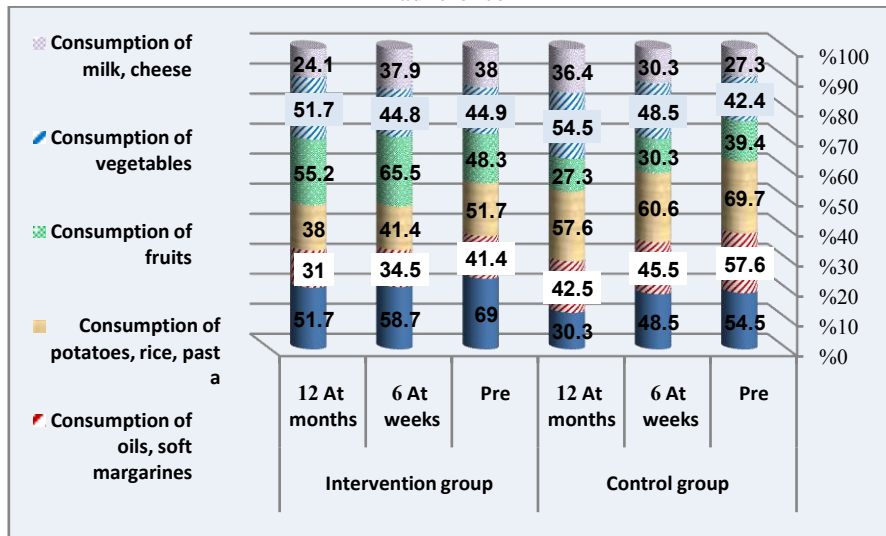
® Intervention group (pre-intervention versus after intervention by 6 months)

¥ Intervention group (pre-intervention versus after intervention by 12 months)

Ө Intervention group (after intervention by 6 months versus after intervention by 12 months)

Figure (1) reveals that there was no statistically significant difference between postpartum women in control group and intervention group regarding their total physical activity pre intervention. While, there was a highly statistically significant difference between postpartum women in control and intervention group regarding their total physical activity after intervention by 6 months and 12 months. Furthermore, there was a highly statistically significant improvement on moderate and vigorous activity of postpartum women on intervention group.

Figure (2) Comparison between postpartum women in control and intervention groups according to dietary adherence



#X² = 1.59 P= 0.68 @ X² = 11.35 P= 0.001**
 ¥ X² = 13.04 P= 0.001** ⊖ X² = 10.47 P= 0.001**

#Control group versus intervention group pre-intervention

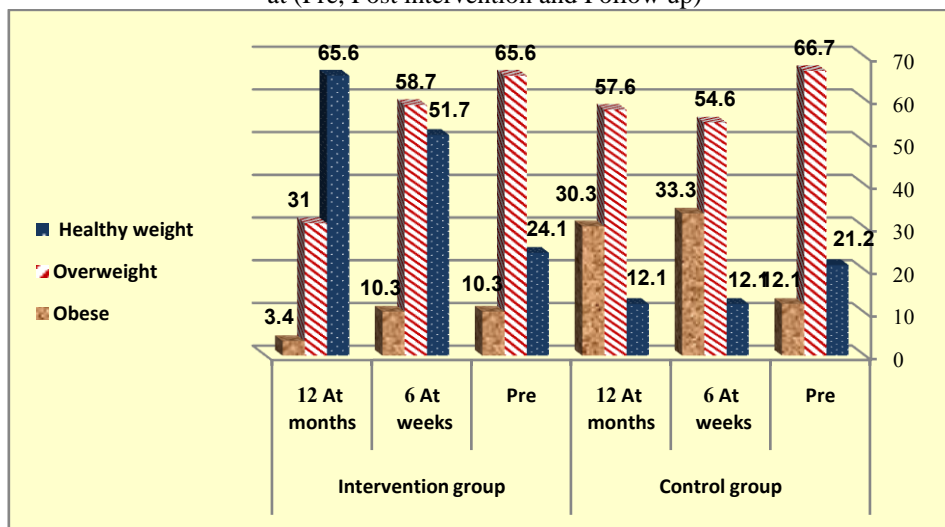
@ Intervention group (pre-intervention versus after intervention by 6 months)

¥ Intervention group (pre-intervention versus after intervention by 12 months)

⊖ Intervention group (after intervention by 6 months versus after intervention by 12 months)

Figure (2) shows that there was no statistically significant difference between postpartum women in control group and intervention group as regard their adherence to dietary source of energy pre intervention. While, there was a highly statistically significant difference between postpartum women in control group and intervention group regarding their adherence to dietary source of energy after intervention by 6 weeks and 12 months. Furthermore, there was a highly statistically significant improvement on adherence of postpartum women on intervention group to dietary source of energy after intervention by 6 weeks and 12 months.

Figure (3): Comparison between postpartum women in control and intervention groups according to their BMI at (Pre, Post intervention and Follow up)



@ X² = 1.329 P=0.249 #X² = 1.82 P= 0.47 \$ X² = 12.388 P= 0.001**

@ Before intervention control group versus intervention group

#Control group 6 months versus 12 months

\$ Intervention group 6 months versus 12 months

Figure (3) shows that there was no statistically significant difference between postpartum women in both groups (control and intervention) before intervention. While, there was a highly statistically significant improvement on healthy weight among postpartum women in intervention group ($P= 0.001$). Conversely, there was no statistically improvement on healthy weight among postpartum women in control group ($P= 0.47$). In addition, there was reduction on BMI of postpartum women in intervention group more than 5-10%.

Figure (4): Comparison between postpartum women in control and intervention groups according to breastfeeding.

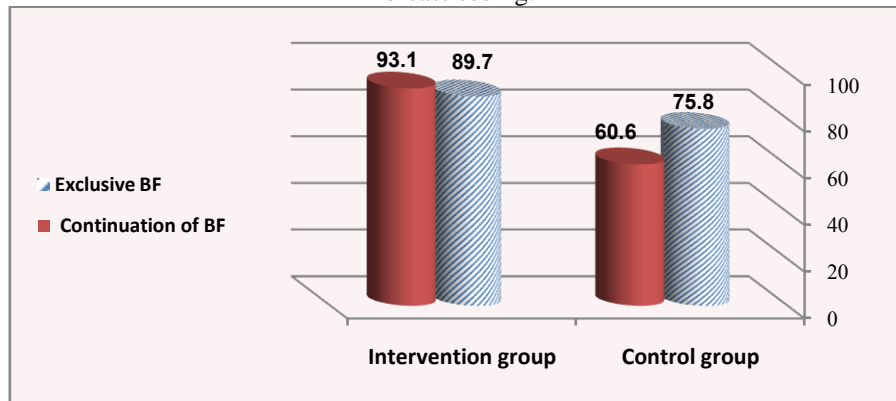


Figure (4) reveals that 89.7% of the studied postpartum women in intervention had exclusive breastfeeding compared to 75.8% of the studied postpartum women in control group. Furthermore, 93.1% of the studied postpartum women in intervention had continuation of breastfeeding for 12 months versus 60.6% of the studied postpartum women in control group.

Table (4) Comparison of postpartum women in control and intervention groups according to blood glucose level.

OGTT postpartum	Control group (n=66)			Intervention group (n=58)		
	Pre	At 6 weeks	After 12 months	Pre	At 6 weeks	After 12 months
Glucose intolerance	54.5	59.1	63.6	50.9	34.5	6.9
Normal	45.5	40.9	33.4	49.1	65.5	93.1
Test of significant P value	# $X^2 = 1.99$ P= 0.86 \$ $X^2 = 12.03$ P= 0.001** @ $X^2 = 11.67$ P= 0.001**			® $X^2 = 13.02$ P= 0.001** ¥ $X^2 = 12.82$ P= 0.001** © $X^2 = 8.05$ P= 0.001**		

OGTT oral glucose tolerance test

#Control group versus intervention group pre-intervention

\$ Control group versus intervention group after intervention by 6 weeks

@ Control group versus intervention group after intervention by 12 months

® Intervention group (pre-intervention versus after intervention by 6 weeks)

¥ Intervention group (pre-intervention versus after intervention by 12 months)

© Intervention group (after intervention by 6 weeks versus after intervention by 12 months)

Table (4) indicates that there was no statistically significant difference between postpartum women in control group and intervention group regarding their OGTT pre-intervention. While there was a highly statistically significant improvement in postpartum women glucose control after intervention by 6 weeks and 12 months.

VIII. Discussion

Gestational diabetes mellitus (GDM) is a life-threatening event in the woman life of reproductive age that represents risks to both mothers and their offspring for future development of type 2 diabetes mellitus (T2DM) and other complications. Therefore, lifestyle management through diabetes self-management education, proper nutrition, physical activity, psychological care is crucial to prevent or delay the future onset of type 2 diabetes in mothers and their offspring, timely detection, optimum treatment, and preventive postpartum care and follow-up is necessary[25]. In the light of the previous concept researchers conducted this study to investigate the effect of postpartum self-instructional booklet on attenuating type 2 diabetes among gestational diabetes mothers.

The results of the present study pointed out that nearly half of the studied postpartum women in both groups their age ranged from 35-39 years old. Moreover, more than three quarters of the postpartum women in both groups were from urban areas. In addition, about half of women in both groups had secondary education and were housewives. Furthermore, there is no statistically significant difference between both groups related to characteristics. Regarding postpartum women's knowledge about type 2 diabetes. The present study results showed that majority of postpartum women had unsatisfactory knowledge in (control and intervention groups) with no statistically significant difference pre-intervention. While, there was a highly statistically significant improvement in intervention group knowledge after intervention at 6 months and 12 months. This finding was in agreement with [6] who carried out a retrospective descriptive study to assess the postpartum education and lifestyle changes on Turkish women with prior GDM and reported that 83.8% received no education from health professionals about the importance of exercise. Similarly, 40.5% received no patient education about the importance of diet in reducing diabetes risk. By contrast, 68.5% reported that they had been informed about the need for glucose control after pregnancy. Concerning physical activity the current study findings revealed that there is no statistically significant difference among postpartum women in (control and intervention groups) regarding their total physical activity pre-intervention. Meanwhile, there is a highly statistically significant difference between both groups regarding their total physical activity after intervention at 6 months and 12 months. This current findings was in accordance with [26] who conducted a pilot study to examine the effectiveness of an individualized program on enhancing women physical activity in the early postpartum period they reported that there were no significant difference between the study groups (supported care and usual care) as regard their demographic characteristics, physical activity or insulin resistance at baseline assessment. While, after intervention the planned physical activity increased by 60 minutes/week in the supported care group (intervention group) versus 0 minutes/week in the usual care group (control group) ($P = 0.234$). Walking was the predominant physical activity. This improvement on intervention group could be explained by effectiveness of self-instructional booklet on empowerment of postpartum women for seeking knowledge, making informed decision regarding self-care, and change their lifestyle behavior in order to promote health and well-being.

The previous study finding was also in agreement with [27] who conducted an intervention study to assess the efficacy of a Diabetes Prevention Program on decreasing diabetes and cardiovascular risk in Latinas women with history of GDM. They found that statistically significant enhancements were observed for aerobic exercise ($P=0.02$), flexibility/strength training ($P=0.04$) after comparing baseline assessment with 3 months and 6 months. As regard adherence to dietary regimen the present study findings illustrated that there is no statistically significant difference between postpartum women in control group and intervention group regarding their adherence to a dietary source of energy pre-intervention. While there is a highly statistically significant difference between postpartum women in control group and intervention group regarding their adherence to a dietary source of energy after intervention by 6 weeks and 12 months. Furthermore, there is a highly statistically significant improvement in adherence of postpartum women on intervention group to a dietary source of energy after intervention at 6 weeks and 12 months as consumption of saturated fat and carbohydrates were decreased after intervention while, consumption of fruits and vegetables were increased. This finding was in the same line with [28] who carried out a web-based pregnancy and postpartum lifestyle intervention to improve the GDM Management System (GooDMomS), and assess the viability of the intervention. They reported that daily fat intake dropped from baseline; while, fruit and vegetable intake increased during the intervention period.

The current study finding was in accordance with [29] who conducted an intervention study for rural women with history of GDM utilizing motivational support to examine the effect of phone-based lifestyle instruction on positive lifestyle change. They mentioned that at follow-up, the intervention group compared to the control group significantly decreased total fat intake by 19 g/d (95%CI: -37 to -1), total carbohydrate intake by 42 g/d (95%CI: -82 to -1), and glycaemic load by 26 units (95%CI: -48 to -4). The adherence to dietary regimen among postpartum women in intervention group could be explained by improvement on women knowledge related to effect of diet on reducing risk of type 2 diabetes that motivate them to follow-up the recommended dietary regimen.

In relation to breast feeding, the current study finding pointed out that most of the studied postpartum women in intervention group had exclusive breastfeeding compared to three-fourths of women in control group. In addition, most of the women in the intervention group had a continuation of breastfeeding for 12 months versus two-thirds of the studied postpartum women in control group. This finding was in agreement with [28] who mentioned that 75% of participants were exclusively breastfeeding to the 6-week postpartum. The difference between both group regarding continuation of breastfeeding could be explained by nearly one third of the studied women on control group were obese that impacted on decrease duration of breast-feeding.

The study findings indicated that there is a highly statistically significant improvement in healthy weight among postpartum women in the intervention group. While, there is no statistical improvement in

healthy weight among postpartum women in control group. This finding was consistent with [30] who conducted a prospective controlled randomized interventional for 36 months to study if lifestyle modification can lessen the development of type 2 diabetes mellitus among Chinese women who had a prior history of GDM. Women were followed up twice at 3-monthly interval, then every 6 months until a total of period of 36 months. They found that there was no difference in maternal BMI at baseline assessment. While, BMI was significantly lower in visit 4 ($p = 0.007$) and visit 5 ($p = 0.023$) when compared with the control group.

This insignificant improvement in healthy weight, physical activity, and adherence to dietary regimen among postpartum women in control group could be justified by [31] who found that lack of adherence to healthy lifestyle among women with prior GDM were time constrain, care of child, lack of motivation and social support. In addition to most of the studied women in control group had unsatisfactory knowledge regarding type 2 diabetes that encourage them to adhere healthy lifestyle at postpartum period.

As regards, follow up of OGTT screening the current study findings illustrated that there is no statistically significant difference between postpartum women in control group and intervention group regarding their OGTT pre-intervention. While there is a highly statistically significant improvement in postpartum women glucose control after intervention at 6 weeks and 12 months. This study finding was in accordance with [32] who carried out a retrospective study to investigate the impact of lactation duration on insulin and glucose response among women with prior GDM and reported that Comparing women who lactated for < 10 months, women who lactated for ≥ 10 months had improved insulin sensitivity-secretion index, lower fasting and 2-h post-OGTT insulin concentrations as well as lower incidence of impaired glucose intolerance ($P < 0.05$ for all).

Finally, the current study findings showed that utilization of self-instruction booklet had positive effect on improving women knowledge regarding type 2 diabetes that reflected upon motivating women to maintain healthy lifestyle behavior through practicing a healthy diet, controlling BMI, physical activity and a continuation of exclusive breastfeeding that result on glucose control at 6 weeks and 12 months with a highly statistically significant difference between the groups (control and intervention groups). This finding was consistent with Studies have demonstrated that lifestyle modifications including weight loss, healthy diet, and moderate exercise can reduce the risk of developing type 2 DM in high-risk subjects and in women with a history of GDM [30]. Furthermore, this study had strength point which is self-instruction booklet helped postpartum women to overcome barriers for lifestyle modification at postpartum period through motivation at intervention period, prioritize of women needs, and adjust lifestyle modification plan based on their health promotion and well-being.

IX. Conclusion

The result of this study concluded that postpartum self-instruction booklet has positive effect on attenuating type 2 diabetes among gestational diabetes mothers. Glucose control was statistically improved among intervention group than control group. Furthermore, there was reduction on BMI of postpartum women in intervention group more than 5-10%. In addition, there was a significant improvement on moderate and vigorous activity of postpartum women on intervention group. Moreover, there was a highly statistical significant improvement on adherence of postpartum women on intervention group to dietary source of energy after intervention by 6 weeks and 12 months.

X. Recommendation

In the light of the study findings, the researchers recommend that:

- Utilization of postpartum self-instruction booklet on postpartum units for women with prior history of GDM.
- Further research still needed to compare the effect of self-instruction booklet on attenuating type 2 diabetes among gestational diabetes mothers with other method as web-based postpartum lifestyle intervention.

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