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Impact of Preconception Counseling Program on Knowledge, Beliefs and Self-management practices of University Female Students Having Type 1 Diabetes.

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Abstract: *Diabetes mellitus (DM) is now of increasing concern in the field of women's health and is considered one of the most common preexisting medical condition complicating pregnancy. Uncontrolled diabetes is a major cause of reproductive complications which are potentially preventable by practicing effective reproductive health (RH) behaviors and encouraging preconception (PC) care.* ***Aim of study****is to evaluate the impact of preconception counseling program on knowledge, beliefs and self-management practices of university female students having Type 1 Diabetes. A quasi-experimental research design was utilized. The study was carried out in diabetes clinic at university health insurance clinics affiliated to Damanhour University; the total sample was 110 students having type 1 diabetes. Data was collected through a self-administered questionnaire for female youth students with diabetes, and The Reproductive Health Beliefs/Attitudes and Behavior (RHAB) questionnaire. A total of 110 female students participated in this study, the age of the students ranged from 18 - 24 yrs. Morethan half of the study subjects (54.55%) were mainly non-medical and half of the sample (50.0%) were of middle socioeconomic status.It was surprisingly, that less than three quarters of students at intervention group before program implementation had poor levels of practices compared to one fifth (20.0%) at 3 months after program implementation. More than half of the students stated friends as the main sources of their knowledge aboutpreconceptioncare.* ***Conclusion****: students had knowledge gaps regarding risks and pregnancy planning with diabetes and a minority had sought PC counseling. The preconception counseling program had positive impacts on knowledge, beliefs and self-management practices of female students having Type 1 Diabetes.* ***Recommendations****: firstly, raising public awareness through national and social media to shed the light on and PC care benefits for young people, aiming to promote health and increase community awareness of the impact of PC care on maternal, newborn and child health outcomes, and secondly, empower female youth through PC counseling to make informed choices regarding their and future pregnancy.*

Keywords: *Beliefs, Counseling, diabetes type 1, preconception,self-management.*

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I. Introduction

Women's lifestyle in the period prior to conception, as well as during pregnancy, is an important determinant of healthy pregnancy and normal fetal development. By the time most women have realized that they are pregnant and have taken the first contact with antenatal care, the fetal organs have already been developed [1].

Preconception care (PC) refers to interventions that aim to identify and modify biomedical, behavioral and social risks to women's health or pregnancy outcome through prevention and management [2]. In 1980 PC care was described by Chamberlain for the first time [3] and since 1990 all women of reproductive age were recommended to have PC care integrated into their primary care visits [4].A study done in (2006) estimated the prevalence of risk factors for adverse pregnancy outcomes during the PC period and throughout pregnancy, found that risks for adverse pregnancy outcomes occurred among more than half of women in the PC period and among one-third of women who were pregnant [5].

During adolescence, knowledge and skills are acquired for establishing an adult role [6]. Health knowledge is positively correlated with health-promoting behaviors. Knowledge can create beliefs about consequences of acting on certain health information, which in turn will form an intention to act on that health

information [7]. A previous study was carried out among women with diabetes highlighted that lack of knowledge is a major obstacle to attendance at pre-pregnancy care programs. The lack of awareness of the risks associated with pregnancy and the role of PC care in preventing pregnancy complications impacts on the engagement of women with the behavior [8]. PC care realizes that many adolescent girls and young women will be pushed into motherhood without the knowledge, skills or support they need [9]. So, it must begin long before conception beginning at the onset of puberty and those diabetic girls should educated about the risks of malformations associated with unplanned pregnancies and poor metabolic control as well as the use of effective contraception at all times when preventing a pregnancy [10,11].

Preconception care includes discussing women's reproductive plans and goals, providing appropriate contraceptive counseling, social history, lifestyle, behavioral issues that may affect pregnancy. folic acid supplementation and balanced healthy diet, review genetic and family history, alcohol, smoking and other substance abuse, medical conditions and medications, immunization and screen for rubella, hepatitis B virus and sexually transmitted diseases (STDs), domestic violence and psychosocial issues: Screening for current, recent past, or childhood physical, sexual, or emotional violence and referred to appropriate resources when needed [12,13].

Diabetes mellitus (DM) is currently of expanding worry in the field of woman health and considered one of the most popular pre-existing medical state complicating pregnancy. In the year 2017, International Diabetes Federation (IDF) estimated the worldwide prevalence of diabetes for all age groups to be 415 million people; about 199.5 million of them are women with increasing incidence and prevalence towards younger people [14].

Diabetic girls and women facing many challenges, they experience disturbance in their puberty, menstruation, fertility and menopause [15]. In pregnancy, there is an association between uncontrolled diabetes and high rate of maternal, neonatal morbidities and mortalities [16]. The increased risk of diabetic embryopathy, like microcephaly, congenital heart disease and anencephaly prorated directly to rising the glycosylated hemoglobin (HbA1c) levels during the first 10 weeks of pregnancy [17, 18]. Also fetal death is 3-4 higher in women with diabetes compared to the non-diabetic population plus preterm birth, congenital malformations and fetal macrosomia [19-20]. Women with uncontrolled diabetes have a significant higher rate of developing spontaneous abortion, pre-eclampsia, hypertension, cesarean delivery, cardiovascular disorders, sepsis and a death rate greater than the general population [21, 22].

Preconception counseling is defined as health education and promotion. The goal of preconception care is health education and promotion, risk assessment, and intervention before pregnancy to reduce chances of poor perinatal outcomes [23, 24].

Preconception counseling can significantly and inexpensively minimize hazards of reproductive health complications in diabetic women through providing information and skills to intend a safe pregnancy and improve maternal and child health outcomes [25, 26].

Counseling is a two-way process offering fulfillment for both the client and the nurse. Nurses' effective use of counseling skills to provide and maintain an environment that supports clients' personal development will be facilitative to clients' understanding and responding more competently to their own concerns about their health or illnesses [27, 28]. In light of that, the aim of the study is to evaluate the impact of preconception counseling program on knowledge, beliefs and self-management practices of university female students having Type 1 Diabetes.

Significance of the study:

International guidelines recommend that PC counseling should be given at each clinic visit for all women with diabetes of childbearing age starting at puberty[29]. Though in our culture there is expectation of pregnancy after marriage, the time most women realize they are pregnant, the embryo has already begun to form. Thus, many preventive strategies will be ineffective if initiated at this time. That's why the age category 18-24 yrs. was chosen for this study.

Research hypothesis:-

University female students having Type 1 Diabetes who engage in preconception counseling program demonstrate higher level of knowledge, beliefs and self-management practices than those who are not.

II. Material And Methods

Material:

Research design

A quasi-experimental pre/post–test study was adopted to carry out this study.

Setting

The study was carried out in diabetes clinic at university health insurance clinic affiliated to Damanhour University.

Subjects:

A purposive sample of university female students having Type 1 Diabetes who are attending the previously mentioned setting and fulfilling the inclusion criteria.

The students included in the study fulfilled the following eligibility criteria:

1- Aged 18-24 years old.
2- Diagnosed with diabetes since 1 year or more.
3- Those did not attend any preconception counseling program prior to the study.
4- Students who were not previously or currently pregnant.
5- Willing to participate in the study.

Sampling technique:

Diabetes clinic is working 5 days/week as one shift. The researcher went to the diabetes clinics daily till all eligible students with diabetes completed the questionnaire.

Sample size:

University female students with diabetes have records and regularly attend the clinic for follow up and management. According to medical records (2016), there were 149 female students in the age group 18-24 yrs. A total of 110 students fulfilled eligibility criteria and agreed to participate in the study, and remained after exclusion of the 15 cases for the pilot study. Thus a total of 110 students constituted the study sample, giving a response rate of 80.4%.

The study sample was randomly assigned to one of two groups, either a PC intervention group (IG) (n = 55) or control group (CG) (n = 55). The PC intervention group received preconception counseling program, while the control group received routine care of the clinic that includes: follow up by doctors, periodic assessment of diabetic complications, laboratory blood glucose monitoring, and providing prescribed insulin.

Tools: in order to collect the necessary data for the study, the followingtwo tools were used to collect data:-

Tool I:Female youth diabetic students' self-administered questionnaire: it was developed by the researcher to collect the required data. It includes the following: -

- **Demographic and personal data:** such as age, marital status and types of faculties.
- **Socioeconomic Status Scale (SES);** the updated and validated Fahmy et al scalein 2015 was used to identify the social level of the students[30]. The maximum score for these indicators was 48 points and it was classified into three levels as follows:

 High 33.6- 48 ≥ 70 %
 Middle 19.2 to > 33.6 40 to < 70 %
 Low > 19.2 < 40 %

- **Students' personal history of DM**: duration of DM (in yrs.) and Diabetic status (HbA1c) from medical records.
- **Students' reproductive history**
- **Students' practices related to DM- self management (SM):**that covered students' adherence to different aspects of DM self-care management during the last six months and included: adherence to follow up visits, medicationsand periodic checkup for complications of diabetes, self-monitoring of blood glucose level and consequent medications as well as dietary modification in case of abnormal readings, life style, smoking, adherence to regular blood pressure measurement and physical exercise.

This part was assessed on 10 frequency rating questions. The response of each practice question was scored as 0 for "Never/first time, 1 for sometimes and 2 for always/completely adherent. A total score for practices related to DM-SM was obtained by summing the scores of these 10 questions which ranged from 0-20 and was then leveled as follows:

 Good DM-SM level (16- 20) ≥ 80 %
 Fair DM-SM level (12- 15) 60 - < 80 %
 Poor DM-SM level (0- 11) < 60 %

- **Students' knowledge about DM, RH and PC care**: it composed of five domains that covered students' general knowledge about diabetes, basic reproductive health knowledge, general preconception care knowledge, Knowledge about diabetes and its effect on reproductive health and pregnancy and knowledge about preconception care care with diabetes.

A scale of five domains with 85 items was designed as (true, false or don't know) format to assess knowledge of the students. For each knowledge item, a score of 1 was given for the correct answer, while a score of 0 was given for the wrong or don't know answer. The scale was evaluated based on correct response (scores were reversed for falsely stated statements). This knowledge scale included the following domains:

☒ **The total knowledge score was calculated for each student by summing up scores of the five domains of knowledge which ranged from (0 – 85) and was then leveled as follows:**

- Good (64- 85) ≥ 75 %
- Fair (43- 63) 50 - < 75%
- Poor (0 - 42) <50%

- **Source of information: students' sources of knowledge about RH and knowledge about diabetes.**

Tool II: The Reproductive Health Beliefs/Attitudes and Behavior (RHAB) questionnaire:

- This questionnaire is a modified version which used to assess students' beliefs and perceptions regarding issues related to diabetes and its effect on reproductive health [32].It was originally developed as a theory-based instrument to assess issues related to RH in female youth with diabetes and designed in English. The researcher translated it into Arabicand for validation of the Arabic version, translation back into English and finally comparison of the back translation with the original English version by two independent translators was done. It consisted of 5 subscales, representative of constructs from one of the major social cognitive models; Health Belief Model [6].

Students' beliefs about diabetes and its effect on RH and pregnancy was assessed via 17 items (excluding cues to action), based on the constructs of the HBM, individual health beliefs total score was calculated for each construct, higher summative scores reflected stronger levels of beliefs.it composed of five domains that covered students' general knowledge about diabetes, basic RH knowledge, general preconception care knowledge, Knowledge about diabetes and its effect on RH and pregnancy and knowledge about preconception care care with diabetes.

- **Perceived susceptibility:** This construct included **(4 items)** describing students' beliefs about their worries regarding the effect of uncontrolled DM on RH and pregnancy. These items were designed using a 5-point Likert-type scale rating responses from not at all worried which was scored as 1 to highly worried which was scored as 5. The total perceived susceptibility score ranged from **"4 – 20"** and was then leveled as follows:

- High perceived susceptibility (15-20) (> 66.6%)
- Moderate perceived susceptibility (10- 14) (33.4% - 66.6%)
- Low perceived susceptibility (4- 9) (0 - 33.3%)

- **Perceived severity:** This construct entailed **(4 items)** that assessed students' beliefs about seriousness of uncontrolled DM and its consequences on RH and pregnancy such as occurrence of health problems during pregnancy for the mother and her fetus, unplanned pregnancy and the effect of pregnancy with DM on social duties. These items were constructed as a 5-point Likert-type scale rating responses from not at all which was scored as 1 to a lot which was scored as 5. The total perceived severity score ranged from 4-20 and was then leveled as follows:
-

- High perceived severity (15-20) (< 66.6%)
- Moderate perceived severity (10 - 14) (33.4% - 66.6%)
- Low perceived severity (4-9) (0 - 33.3%)

- **Perceived benefits:** This construct included **(5 items)**, assessing students' beliefs about how the recommended behavior is beneficial and valuable for their health. These items asked about the benefits of PC counseling, glycemic control and adherence to life style and medical advices. Items were measured using a 5-point Likert-type scale rating responses from not at all which was scored as 1 to "beneficial a lot" which was scored as 5. The total Perceived benefits score ranged from "5- 25" and was then leveled as follows:

- High perceived benefits (19 - 25) (< 66.6 %)

- Moderate perceived benefits (12 - 18) (33.4% - 66.6%)
- Low perceived benefits (5 - 11) (0 - 33.3%)

- **Perceived barriers**: This construct **(4 items includes 13 questions),**described students' subjective evaluations of the difficulties facing them in RH and PC counseling. **Three questions** asked about how much of a problem would it be to seek counseling for current RH problems and how much of a problem would it be to seek PCC with other question on barriers that prevent students to adherence to the key recommendations of PC care. The 3 questions were assessed using a 5-point Likert-type scale rating responses from not at all difficult which was scored as 1 to a lot difficult which was scored as 5. Another **10 questions** elicited potential specific barriers that students may perceive in initiating discussions with their HCPs towards seeking PC counseling (e.g., embarrassed, being not married, poor doctor-patient communication, busy clinic, lack of privacy in clinics and cost). These items were measured using a 5-point Likert-type scale rating responses from not at all which was scored as 1 to a lot which was scored as 5. The higher the score of perceived barriers, the more difficulties and obstacles students face against seeking RH and PC care.

  Therefore the total perceived barriers score ranged from "13-65" and was then leveled as follows:

- High perceived barriers (48- 65) (>66.6%)
- Moderate perceived barriers (31- 47) (33.4% - 66.6%)
- Low perceived barriers (13- 30) (0- 33.3%)

- **Cues to action:** are triggers that activates one's readiness to take health action. This construct included **2 questions** inquiring about resources that were reminders for students to seek RH and PC counseling. Each question had **9 check lists items** (physician, parents, relatives, friends, education, magazines, internet and mass media and other patients who were pregnant with diabetes that encouraged students toward seeking RH and PC counseling). To identify other cues, two questions inquiring about students' history of ever seeking RH and PC counseling (from reproductive history) were added. As regard scoring, each item was developed as two answer choices (yes/no), where yes = 1 and no = zero, with higher scores indicating more cues. The total score for this construct ranged from 0-20. Cues to action construct was not systematically evaluated, particularly considering its fleeting nature [33].
- The Cronbach's alpha as a reliability of this questionnaire was 0.81 for perceived susceptibility, 0.73 for perceived severity, 0.77 for perceived benefits, 0.62 for perceived barriers, 0.65 for cues to action.

Methods:

- The study sample of university female students having Type 1 Diabetes was selected according to the pre-determined inclusion criteria.Accordingly, 110 students were congruent with the criteria of selection.
- The 110 students were divided into two matched groups (intervention and control).
- Preconception counselling program was done on the intervention group (55 students).
- Finally, the intervention group were assessed to evaluate the impact of preconception counseling program on knowledge, perceptions and self-management practices.

- **Data collection methodology:**
  - Approval from the responsible authorities was obtained through official letters from the Faculty of Nursing.
- Tool of data collection was designed based on recent relevant literature.
  - Tool was checked from jury consist of 3 experts at the same field to assess contentsvalidity.
  - Pilot study was carried out in order to ensure the clarity of the tool. After thedevelopment of the tool, a pilot study was carried out on 15 students which was not included in the studysample.

- Data collection: Data was collected during the academic years 2015 – 2016.
  - o**Data collection phase :** The data collection phase took about 10 months from September 2015 till January 2016 to assess diabetes self-management practices and students' knowledge about DM, PC and RH.
  - oFebruary 2016 till April 2016 to implement the preconception counseling program overa period of three months.
  - o Evaluation of the program was conducted until July 2016

1- **Preparatory phase:**

Preparation and organization of preconception counseling program's sessions:

Preparation of sessions:

Preconception counseling program's sessions were prepared by the researcher for theintervention group. The content of the sessions was based on review of literature, results ofassessment as well ascharacteristics of students and their needs.

The aims of the sessions are to:

- Help students to acquire health knowledge which is positively correlated with health-promoting behaviors.
- Help students to create beliefs about PC care
- Improve student's practices in relation to diabetes.

Preconception counseling program strategies

A. Preconception counseling program methods:

Different methods of instructions were adopted as brain storming, group discussion, case study and role play.

B- Teaching aids:

Different aids were used to facilitate and illustrate teaching such as posters, handouts, foodmodels and real natural food stuffs.

1- Implementation phase:

This phase included the implementation of the planned preconception counseling program. Theintervention group (55 female diabetic students) was divided into small groups (5 groups) based on the needs andproblems of each student. Therefore, preconception counseling program were implemented throughthree sessions for each group. Each session lasted approximately 60 minutes. Firstly,discussion ofthe session objectives and content were dedicated. Then, time was available for student'sparticipation and interaction. Different methods of instructions and teaching aids mentioned beforewere used. Sessions includes discussingstudents' reproductive plans and goals, providing appropriate contraceptive counseling, social history, lifestyle, behavioral issues that may affect pregnancy, folic acidsupplementation and balanced healthy diet, review genetic and family history, alcohol, smoking and other substance abuse, medical conditions and medications, immunization and screen for rubella, hepatitis B virus and sexually transmitted diseases (STDs), domestic violence and psychosocial issues. Also includes discussing knowledge about nature of the disease, investigations, self-management practices, complications and its effect on PC and RH. Implementation of the preconception counseling program over a period of three months from February 2016 till April 2016.

3- Evaluation phase:

Reassessment was done immediately for both groups after the completion of the preconception counseling program and secondly three months after its completion. Intervention group was assessed to determine the impact preconception counseling program on students' knowledge, perception and self-management practices about preconception care. In addition, compared with control group across the program phases. Evaluation of the program was conducted until July 2016.

Ethical consideration:

Verbal consent was obtained from the students after explanation of the aim of the study. Privacy was maintained during process of data collection. Confidentiality and anonymity of students'response were guaranteed.

Statistical analysis:

After collecting data, responses to each questionnaire item were entered into the Statistical Package for Social Sciences (SPSS) software version 20.0. The level of significance (p-value) was set at ≤ 0.05. The following statistical tests were used:

Descriptive statistics:

Descriptive statistics were used for representation and tabulation of data. Continuous variables were represented as means ± SD while categorical variables were represented as frequencies and percentages. The mean percent scores for knowledge and beliefs were calculated to compare levels with other studies.

Analysis of numeric data:

Although some variables; perceived susceptibility, perceived benefits, attitude and subjective norms didn't show normal distribution, parametric tests were used for better accuracy and power, as with large enough sample sizes (> 30 or 40), the violation of the normality assumption should not cause major problems. Furthermore, the dependent variable to be measured met the assumption of normality. The following statistical tests were used:

i) **Independent sample t-test:** A parametric statistical test was used to compare the mean for twoindependent groups.

ii) **One Way ANOVA test:** Parametric statistical tests were used to compare the means for quantitative data of more than two independent groups and detect significant differences.

III. Result

Figure (1, 2, 3, 4) illustrates that a total of 110 female students participated in this study, the age of the students ranged from 18 - 24 yrs. More than one third of them were more than 22 years old. More than one third were married and more than half of them (54.55%) were mainly non-medical.A high proportion of the sample (50.0%) were of middle socioeconomic status, while 28.1% and 21.82% belonged to the high and poor status, respectively.

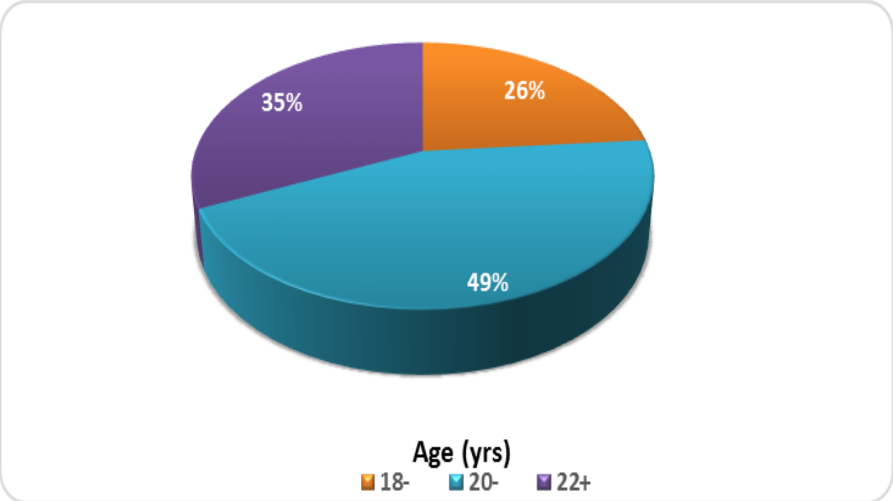

Figure (1): Age of the study sample

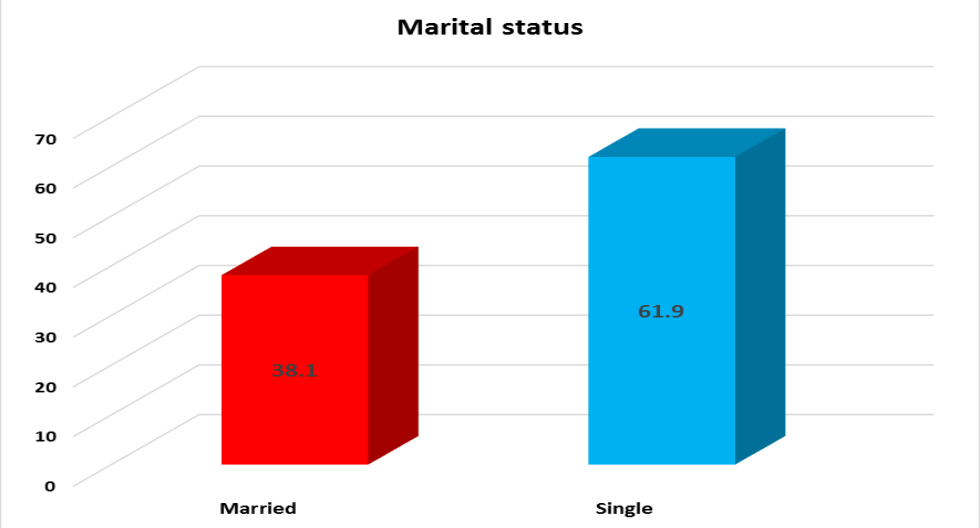

Figure (2): Marital status of the study sample

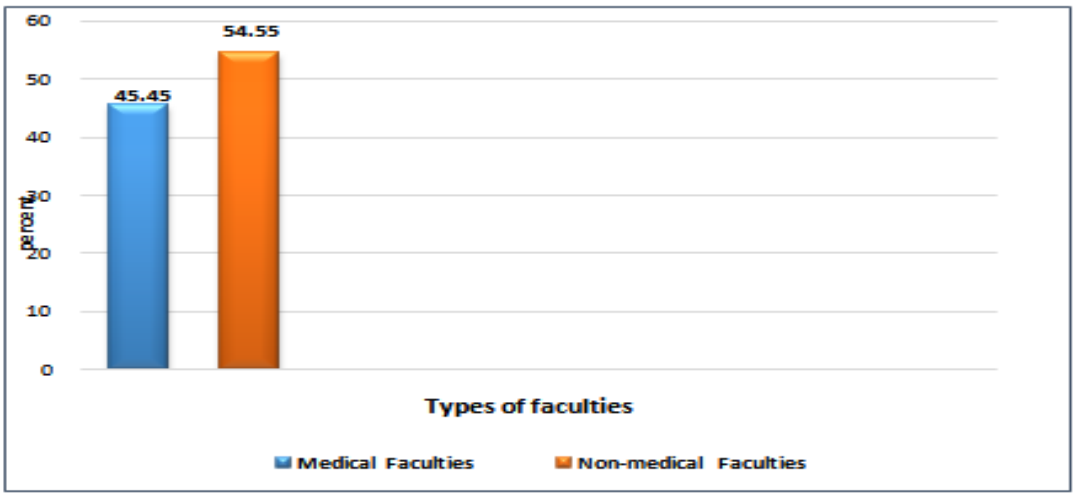

Figure (3): Types of faculties

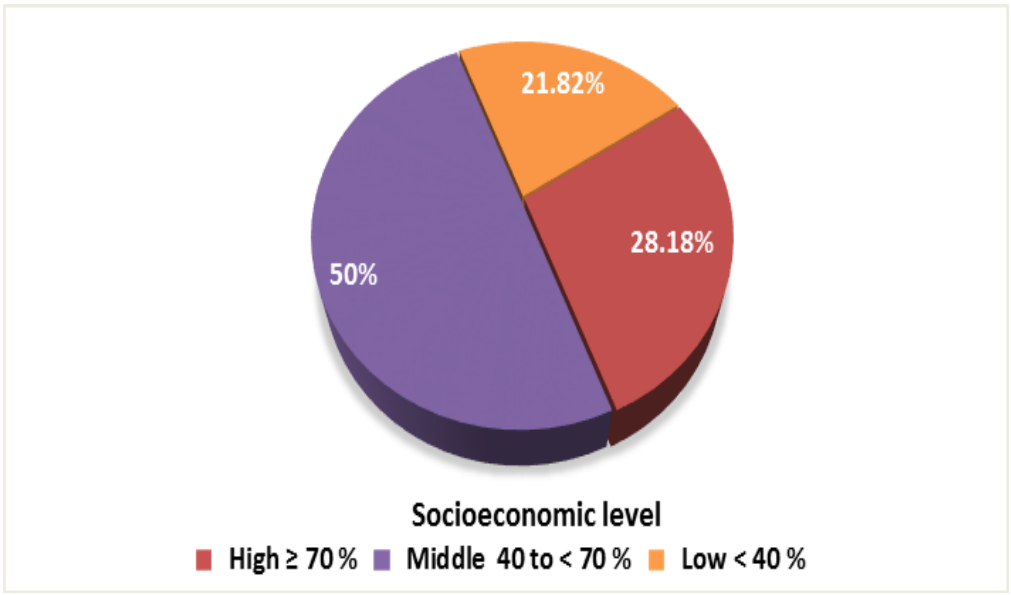

Figure (4): Total socioeconomic score

Table (1) shows the duration of diabetes for female students ranged from (1-14) years for intervention group with a mean of 7.98 ±4.98 yrs. compared to (2-15) years for control group with a mean of 8.2±5.22 yrs. more than one quarter of the students (29.1%) at intervention group had their diabetes uncontrolled according to their recorded HbA1c levels versus to one fifth for those at control group.

While, more than one fourth of the students (29.1%) at intervention group and more than one third (38.2%) at control group reported history of medical consultation for RH problems. The majority of the students (78.2% and 81.8%) for intervention and control groups respectively had not seek preconception counseling.

Table (1): distribution of the study sample regarding to history of DM and reproductive health

Items	Intervention group (n=55)		Control group (n =55)		Test of significant
	No.	%	No.	%	
History of DM					
Duration of DM (in yrs.)					
1-	22	40.0	20	36.4	
6-	28	50.9	27	49.1	$X^2 = 0.365$
10 - 18	5	9.1	8	14.5	P=0.636
Min-Max	1 - 14		2 - 15		
Mean ±SD	7.98 ±4.98		8.2±5.22		

Diabetic status (HbA1c)					**X2 = 0.265 P=0.712**
Controlled (≤ 7)	39	70.9	44	80.0	
Uncontrolled (> 7)	16	29.1	11	20.0	
Reproductive health history					
Ever seek medical care for general RH problems					**X2 = 0.865 P=0.285**
Yes	16	29.1	21	38.2	
No	39	70.9	34	61.8	
Ever seek preconception counseling					**X2 =0.785 P=0.365**
Yes	12	21.8	10	18.2	
No	43	78.2	45	81.8	

X^2: Chi-Square test ***Significant at P≤0.05**

Table (2) shows that only 6 (10.9%) of students at intervention group and 5 (9.1%) of control group had good levels of practices before program implementation this percent at intervention group increased to 36.4% for intervention group at 3 months after the implementation of program. Moreover, less than three quarters of students at intervention group before program implementation had poor levels of practices compared to one fifth (20.0%) at 3 months after program implementation. The difference was statistically significant between pre, Immediate and 3 months post program in intervention group (X^2= 21.65, P =0.001). Moreover, there were statistical significant differences between intervention and control groups levels of practices at 3 months post program (X^2= 15.6, P =0.002).

Table (2): Impact of Preconception Counseling on the study sample DM-self management practices' scores

Total mean DM-self management practices' scores	**Intervention group (n =55)**						**Control group (n =55)**			
	Pre program		**Immediate post program**		**3 monthspost program**		**Pre program**		**3 monthspost program**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Good DM-SM level ≥ 80 %	6	10.9	6	10.9	20	36.4	5	9.1	6	10.9
Fair DM-SM level 60 - < 80 %	10	18.2	15	27.3	24	43.6	12	21.8	15	27.3
Poor DM-SM level < 60 %	39	70.9	34	61.8	11	20.0	38	69.1	34	61.8
X^2 P1	**21.65 0.001***						**0.895 0.2365**			
X^2 P2	**----------**						**0.785 0.311**		**15.6 0.002***	
Mean score	**12.65± 4.03**		**17.22±3.56**		**15.6±3.98**		**11.96±4.25**		**12.10±4.12**	

P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time.
X^2: Chi-Square test *Significant at P≤0.05

Table (3) reveals descriptive statistics of knowledge of female students with diabetes about DM and its effect on RH and pregnancy.Five domains of knowledge were assessed in the table;a) Basic knowledge about diabetes, b) Basic RH knowledge, c) General PC knowledge, d) RH and pregnancy risks of diabetes and, d) PC care with diabetes. As for RH knowledge domains, the highest mean percent score before program implementation for general PC knowledge was 45.6±14.6 compared to 72.1±12.6 scores at3 months post program. The same was observed at the control group where the PC knowledge was 46.8±10.9 scores before program implementation versus to 45.9±11.8 scores at 3 months post program. The difference was statistically significant between intervention and control group at3 months post program regarding general PC knowledge (X2= 5.01, P =0.003). While preconception care with diabetes was the lowest (2.22±1.85) for students at the intervention group before program implementation compared to 5.89±1.98 scores for students at the intervention group at 3 months post program. The mean score percent for RH and pregnancy risks with diabetes was 3.98±2.32 and 7.41±3.01 scores for students at the intervention group before and at 3 months post program respectively.

Table (3): Impact of Preconception Counseling on the study samples' mean of the five domains of knowledge about DM and its effect on RH and pregnancy

Knowledge domains	**Intervention (n =55)**			**Control (n =55)**	
	Pre program	**Immediate post program**	**3 monthspost program**	**Pre program**	**3 monthspost program**
	Mean±S.D	**Mean±S.D**	**Mean±S.D.**	**Mean±S.D**	**Mean±S.D**
General diabetes	26.2±8.25	36.2±10.3	32.6±14.5	25.8±8.45	25.3±10.2
F P1	**17.65 0.002***			**1.32 0.103**	

t-test **P2**				**1.265** **0.2360**	**4.77** **0.002***
General RH knowledge	2.31±0.74	6.2±0.89	5.98±0.66	2.22±0.61	2.31± 0.58
F **P1**	**19.5** **0.001***			**0.895** **0.221**	
t-test **P2**				**0.77** **0.311**	**4.25** **0.006***
General PC knowledge	45.6±14.6	75.8±16.2	72.1±12.6	46.8±10.9	45.9±11.8
F **P1**	**16.85** **0.003***			**0.689** **0.468**	
t-test **P2**				**0.405** **0.4122**	**5.01** **0.003***
RH and pregnancy risks with diabetes	3.98±2.32	7.98±2.98	7.41±3.01	3.65±2.01	3.96±2.11
F **P1**	**15.2** **0.001***			**16.5** **0.001***	
t-test **P2**				**0.66** **0.221**	**3.15** **0.004***
PC care with diabetes	2.22±1.85	6.01±2.36	5.89±1.98	2.35±1.74	2.82±1.77
F **P1**	**18.25** **0.001***			**0.871** **0.426**	
t-test **P2**	----------			**0.699** **0.385**	**4.81** **0.004***

t: Independent sample t-test F: One Way ANOVA test *Significant at P≤0.05

P1 comparison between pre, immediate and 3 months post program implementation in each group.

P2 comparison between intervention and control group at the same time.

Table (4) shows the female students with diabetes according to their knowledge about DM and its management. One fifth ofstudents at the intervention group before program implementation (20.0%) responded correctly that diabetes is a chronic disease against to less than three quarters (70.9%) of them immediately after program implementation and 60% at 3 months after program implementation. With regards to complications of diabetes, less than one fifth of students at the intervention group before program implementation correctly identified complications of diabetes this percent increased to be 52.7% at 3 months after program implementation, however, about one fifth of control group (16.4%, 20.0%) were aware of diabeties complicationsbefore andat 3 months after program implementation respectively.

When asked about investigations of diabetes, nearly two thirds (65.5%) of students at the intervention group at 3 months post program implementation stated the correct answer (normal values, knew the average period of HbA1c test) compared to less than one fifth (18.2%) of the control group at the same phase.

With regards to knowledge about symptoms of hyperglcemia, about two thirds (65.5%) of students at the intervention group at 3 months post program implementation correctly stated fatigue, blurred vision, nausea/vomiting and leg cramps as symptoms of hyperglycemia versus to 20.0% of students at control group. Concerning the causes of hyperglycemia, 29.1% and 12.7% of the students of intervention and control groups before program immplementation respectively were aware by the role of insufficient insulin/oral hypoglycemics dosage, and knew that infection is a cause compared to 63.6% of the students of intervention group at 3 months post program implementation.

When questioned about symptoms of hypoglycemia, more than two thirds (69.1%) of students at the intervention group at 3 months post program implementation correctly identified tremors/shivering, profuse cold sweating, palpitation and blurred vision as relevant symptoms compared to 14.5% of students at control group. As for causes of hypoglycemia, many of students (72.7%) at the intervention group at3 months post program implementation knew that increasing insulin/tablet dosage is a possible cause, a great proportion of the sample agreed that delaying snacks and increasing physical effort could lower blood glucose levels as compared to 12.7% of students at control group. As for management of hypoglycemic reaction; the majority of the sample (20.0%) at the intervention group before program implementation knew that it is correct to take some sugary drink versus 74.5% of students at 3 months post program.

As for students' knowledge about management of infection with diabetes, the majority of them (80.0%) at the intervention group at 3 months post program implementation knew correctly that they should check their blood glucose level more often and shouldn't stop their treatment versus to (20.0%) of students at control group.Regarding basic nutritional knowledge about diabetes, many of the students (72.7%) at the intervention group at 3 months post program implementation recognized the correct number of meals and snacks required per day and a sugar free diet is not correct versus 10.9% of students at the intervention group before program imlementation.

Knowledge about diabetes and exercise revealed that most (69.1%) of students at the intervention group at 3 months post program implementation recognized the benefits of regular exercise and knew the correct duration against 21.8% of students at control group. The difference was statistically significant between pre, post and 3 months post program implementation in intervention group (X2= 17.85, P =0.001). Moreover, there were statistically significant differences between intervention and control groups correct answers of detailed general knowledge about DM and its management at 3 months post program implementation (X2= 14.22,P = 0.0065).

Table (4): Distribution of the study sample according to their correct answers of detailed general knowledge about DM and its management

General knowledge about diabetes	Intervention (n =55)						Control (n =55)			
	Pre program		Immediate post program		3 monthspost program		Pre program		3 monthspost program	
	No.	%	No.	%	No.	%	No.	%	No.	%
Nature/pathophysiology	11	20.0	39	70.9	33	60.0	12	21.8	12	21.8
Diabetes investigations	9	16.4	45	81.8	36	65.5	11	20.0	10	18.2
Complications of diabetes	8	14.5	34	61.8	29	52.7	9	16.4	11	20.0
Symptoms of hyperglycemic attack	12	21.8	38	69.1	36	65.5	10	18.2	11	20.0
Causes of hyperglycemia	16	29.1	41	74.5	35	63.6	7	12.7	16	29.1
Symptoms of hypoglycemic attack	6	10.9	37	67.3	38	69.1	6	10.9	8	14.5
Causes of hypoglycemia	8	14.5	44	80.0	40	72.7	12	21.8	7	12.7
Management of hypoglycemic reaction	11	20.0	45	81.8	41	74.5	13	23.6	12	21.8
Management of infection with diabetes	7	12.7	50	90.9	44	80.0	12	21.8	11	20.0
Knowledge about nutrition	6	10.9	42	76.4	40	72.7	10	18.2	10	18.2
Knowledge about exercise	8	14.5	40	72.7	38	69.1	10	18.2	12	21.8
X^2 P1	**17.85 0.001***						**0.758 0.365**			
X^2 P2	----------						**0.825 0.412**		**14.22 0.0065***	

X^2: Chi-Square test ***Significant at P≤0.05**
P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time.

Table (5)shows the distribution of female students with diabetes according to their correct answer of detailed knowledge about RH and PC care with diabetes. With respect to knowledge about RH risks with diabetes, the majority of students (61.8%) correctly identified that women with diabetes should get medical advice and control their diabetes before getting pregnant at the intervention group at 3 months post program implementation compared to less than one fourth (21.8%) of the control group also, 60.0% and 20.0% of students at the intervention and control groups at 3 months post program implementation respectively recognized theimportance oftake folic acid tablets before getting pregnant to decrease the risk of congenital anomalies. Moreover, about one tenth of students at the intervention group before program implementation correctly knew that women with diabetes should postpone pregnancy if they have renal impairment this percent increased to be 76.4% at 3 months after program implementation compared with 25.5% of students at control group. The difference was statistically significant for intervention group at pre, immediate and 3 months post program implementation regardingdetailed knowledge about RH and PC care with diabetes (X2=22.1, P =0.001).

Concerning knowledge about diabetes and pregnancy risks, about two thirds of the students (69.1%) reported correctly that it is possible for a woman with diabetes to have a healthy baby at the intervention group at immediate post program implementation compared to nearly one fourth (23.6%) of the control group and nearly two thirds of them (65.5%) were aware of uncontrolled DM can decrease fertility at the intervention group at 3 months post program implementation. As regard specific maternal complications of uncontrolled DM, most of the students (70.9% and 67.3%) were aware of the increased risk of high blood pressure and repeated miscarriage during pregnancy respectively at the intervention group at 3 months post program implementation compared to 23.6% ,10.9% of the control group. Meanwhile, 60.0% of students at the intervention group at 3 months post program implementation compared to less than one fourth (20.0%) of the control group knew that women with diabetes can safely breastfed their babies.

Regarding knowledge of the effect of DM on the baby, majority of the students (63.6. %) became aware of the risk of having high blood glucose level before pregnancy on the baby's health at the intervention group at 3 months post program implementation compared to less than one fourth (21.8%) of the control group.

With respect to students' knowledge about PC care, most of students at the intervention group before program implementation (61.8%) correctly responded to the importance of seeking medical advice before pregnancy versus 21.8% of control group, moreover there was a notable gap in awareness of taking folic acid tablets before pregnancy to decrease the risk of congenital anomalies, where only (10.9%) of students at the intervention group before program implementation recognized its importance compared to 76.4% immediately post program. The majority (80.0%) of the students at the intervention group at immediate post program implementation knew that it's safe to use insulin during pregnancy against 21.8% before program. More than two thirds of students of the intervention group at post program implementation (67.3%) were aware of the importance of measuring thyroid functions before pregnancy and the majority (83.6%) considered correctly the necessity of postponing pregnancy if having renal impairment compared to 12.7% of students before program. It was noticed that the majority of students (81.8%) at the intervention group at immediate post program implementation correctly identified the importance of seeking medical advice before discontinuation of family planning methods for any woman with diabetes planning to become pregnant and nearly two thirds (67.3%) of them correctly knew that women with diabetes can safely use family planning methods versus 16.4% and one

fifth (20.0%)of students at control group. The difference was statistically significant for intervention group at pre, immediate and 3 months post program implementation regardingdetailed knowledge about RH and PC care with diabetes (X2=26.54, P =0.001).

Table (5): Distribution of the study sample according to their correct answers of detailed knowledge about RH risks and PC care with diabetes.

Items	Intervention (n =55)						Control (n =55)			
	Pre program		Immediate post program		3 monthspost program		Pre program		3 monthspost program	
	No.	%	No.	%	No.	%	No.	%	No.	%
Knowledge about RH risks with diabetes										
High blood glucose levels may cause menstrual irregularities	12	21.8	42	76.4	40	72.7	13	23.6	15	27.3
High blood sugar may cause recurrent reproductive tract infection	10	18.2	40	72.7	37	67.3	11	20.0	12	21.8
Uncontrolled DM can decrease fertility	9	16.4	39	70.9	36	65.5	10	18.2	14	25.5
Pregnant woman with diabetes can have a healthy baby	11	20.0	38	69.1	34	61.8	10	18.2	13	23.6
High blood sugar levels during pregnancy do not affect the health of the mother *	13	23.6	41	74.5	38	69.1	12	21.8	14	25.5
Woman with diabetes have an increased risk of having a large baby, making delivery more difficult	12	21.8	42	76.4	40	72.7	10	18.2	12	21.8
Pregnant woman with diabetes have increased risk of increased blood pressure during pregnancy	10	18.2	43	78.2	39	70.9	9	16.4	13	23.6
Pregnant woman with diabetes have increased risk of recurrent miscarriage	8	14.5	41	74.5	37	67.3	8	14.5	6	10.9
High blood sugar levels during pregnancy do not increase the risk of problems for the baby *	9	16.4	39	70.9	36	65.5	10	18.2	9	16.4
High blood sugar levels before pregnancy can affect the baby's health	11	20.0	38	69.1	35	63.6	12	21.8	12	21.8
High blood sugar levels during early pregnancy increase the risk of congenital anomalies for the fetus	14	25.5	37	67.3	34	61.8	13	23.6	10	18.2
Breastfeeding is contraindicated for women with diabetes *	12	21.8	36	65.5	33	60.0	14	25.5	11	20.0
The risk of genetic transmission of type 1 diabetes to the baby is…%	10	18.2	35	63.6	32	58.2	12	21.8	10	18.2
X^2 P1	22.1 0.001*						0.865 0.2545			
X^2 P2	----------						0.698 0.256		14.65 0.004*	

#False statement **X^2: Chi-Square test** ***Significant at P≤0.05**

P1 comparison between pre, immediate and 3 months post program implementation in each group.

P2 comparison between intervention and control group at the same time.

Table (5) Cont.:

Items	Intervention (n =55)						Control (n =55)			
	Pre program		Immediate post program		3 monthspost program		Pre program		3 monthspost program	
	No.	%	No.	%	No.	%	No.	%	No.	%
Knowledge about PC care and diabetes.										
Women with diabetes should get medical advice and control their diabetes before getting pregnant	9	16.4	39	70.9	34	61.8	10	18.2	12	21.8
Woman with diabetes should take folic acid tablets before getting pregnant to decrease the risk of congenital anomalies	6	10.9	42	76.4	33	60.0	11	20.0	11	20.0
Insulin is not safe during pregnancy #	12	21.8	44	80.0	38	69.1	10	18.2	13	23.6
Women with diabetes should postpone pregnancy if they have renal impairment	7	12.7	46	83.6	42	76.4	9	16.4	14	25.5
Women with diabetes (type 1) who are planning for pregnancy should measure thyroid function before getting pregnant	10	18.2	38	69.1	37	67.3	8	14.5	10	18.2
Women with diabetes cannot use family planning methods #	11	20.0	37	67.3	33	60.0	8	14.5	9	16.4
Women with diabetes should get medical advice before stopping family planning methods	13	23.6	45	81.8	41	74.5	7	12.7	9	16.4
X^2 P1	26.54 0.001*						0.745 0.3652			
X^2 P2	----------						0.785 0.452		0.65 0.005*	

#False statement **X^2: Chi-Square test** ***Significant at P≤0.05**

P1 comparison between pre, immediate and 3 months post program implementation in each group.

P2 comparison between intervention and control group at the same time.

Figure (5) reveals the distribution of female students with diabetes according to their types of sources of knowledge about PC care with diabetes. The figure shows that students obtained information from a wide range of sources, the highest percentage of students mentioned the friends (54.55%), parents (53.64%), as the source of knowledge, followed by mass media (39.1%), internet (24.55%) and nurse (27.27%). Lower proportions were reported from others' experiences (19.1%). A minority received information from education (10.0%) and physician (9.1%).

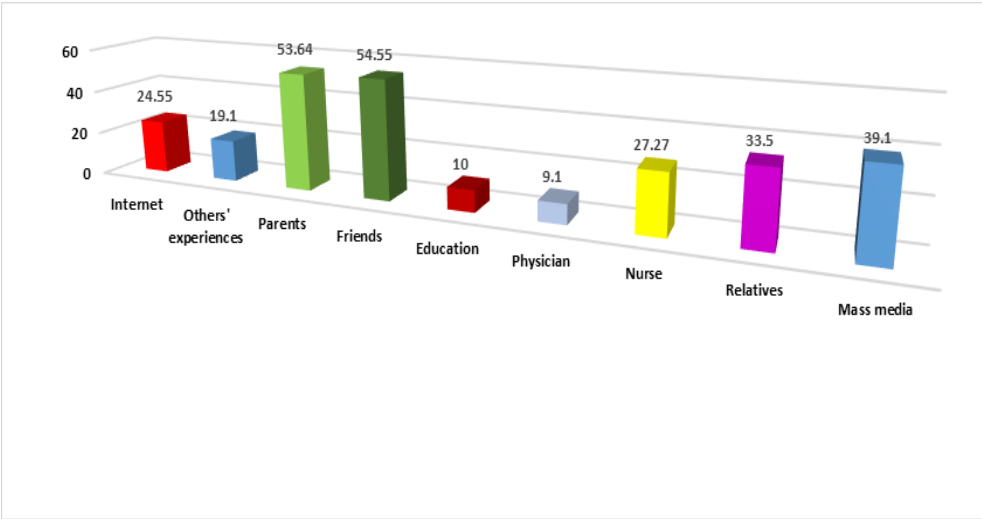

Figure (5): Sources of knowledge about PC care.

Table (6) describes the distribution of female students with diabetes according to their detailed perceived susceptibility and severity regarding RH and PC counseling across program phases. The majority of the students at the intervention group before program implementation (76.4%) were not and a little pit perceived susceptibility of RH and pregnancy risks with DM compared to nearly one fourth (23.6 %) at 3 months post program implementation.

About two thirds of the students at the intervention group at 3 months post program implementation (29.1%) were moderately and a lot perceived severity of pregnancy risks with DM, versus (9.1%) before program. The difference was statistically significant between pre, immediate and 3 months post program implementation in intervention group regardingdetailed knowledge about RH and PC care with diabetes (X2=32.69, P =0.001). Moreover, there were statistically significant differences between intervention and control groups at 3 months post program implementation (X2=17.42, P =0.004).

Table (6): Distribution of the study sample according to their detailed perceived susceptibility and severity of complications of DM on RH and pregnancyacross program phases

HBM constructs#	Intervention (n =55)															Control (n =55)									
	Pre program					Immediate post program					3 monthspost program					Pre program					3 monthspost program				
	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)
Perceived susceptibility of RH and pregnancy risks with DM[a]																									
	47.3	29.1	18.2	3.6	1.8	7.3	12.7	9.1	32.7	38.2	9.1	14.5	27.3	30.9	18.2	45.5	30.9	18.2	1.8	3.6	36.4	29.1	25.5	5.5	3.6
Perceived severity of pregnancy risks with DM[b]																									
	54.5	21.8	14.5	3.6	5.5	10.9	10.9	18.2	40.0	20.0	12.7	25.5	32.7	18.2	10.9	50.9	23.6	12.7	9.1	3.6	49.1	21.8	18.2	7.3	3.6
X^2 P1	32.69 0.001*															0.921 0.256									
X^2 P2	----------															0.698 0.524					17.42 0.004*				

X^2: Chi-Square test *Significant at P≤0.05

 # Higher grade of a HBM construct reflects higher perception of that construct

[a] Score was from not at all worry = 1 to worry a lot = 5

[b] Score was from not serious at all = 1 to very serious = 5

Table (7)reveals the distribution of female students with diabetes according to their detailed perceived benefits and barriers (general and specific) of seeking RH and PC counseling across programphases.About three quarters of students of the intervention group 3 months post program implementation (72.7%) moderately and highly perceived the benefits of RH and PC counseling with as, controlling blood sugar level before pregnancy, seeking PC counseling when planning pregnancy as well as following its recommendations, use of family planning methods after marriage to delay unplanned pregnancy versus (9.1%) of students at the same group before program implementation.

Regarding students' agreements of the underlying constraints they faced in seeking RH and PC counseling (perceived barriers). Nearly two thirds of the students at the intervention group before program implementation (61.8%) believed about barriers of RH and PC counseling is a little or not at all a problem for them and decreased to (30.9%) of them immediately after program implementation. Students were asked about their state of agreement towards certain specific barriers that could hinder them from seeking PC counseling,the most common barriers as "being not married, embarrassment and lack of awareness of whom to contact and Lack of privacy" asmore than half (29.1%)of the intervention group studentsat 3 months post program implementation strongly agreed that it represented a barrier for them for initiating counseling versus (5.5%) of students at control group. The difference was statisticallysignificant between intervention group at pre, immediate and 3 months post program implementation (X2=24.54, P =0.001). Moreover, there were statistically significant differences between intervention and control groups to their detailed perceived benefits and barriers (general and specific) of seeking RH and PC counseling at 3 months post program implementation (X2=17.58, P =0.0032).

Table (7): Distribution of the study sample according to their detailed perceived benefits and barriers (general and specific) of seeking RH and PC counseling acrossprogram phases

HBM constructs#	Intervention (n =55)															Control (n =55)									
	Pre program					Immediate post program					3 monthspost program					Pre program					3 monthspost program				
	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)	Not at all (%)	A little (%)	Somewhat (%)	Moderate (%)	A lot (%)
Perceived benefits of RH and PC counseling [c]																									
	32.7	40.0	18.2	5.5	3.6	7.3	12.7	7.3	40.0	32.7	10.9	20.0	32.7	10.9	25.5	29.1	40.0	18.2	7.3	5.5	34.5	32.7	20.0	5.5	7.3
Perceived General barriers of seeking RH and PC counseling[d]																									
	29.1	32.7	21.8	7.3	9.1	10.9	20.0	3.6	41.8	23.6	14.5	27.3	21.8	14.5	21.8	30.9	45.5	21.8	0.0	1.8	25.5	34.5	23.6	9.1	7.3
Perceived Specific barriers of seeking PC counseling [c]																									
	30.9	27.3	23.6	10.9	7.3	9.1	18.2	10.9	32.7	29.1	10.9	18.2	27.3	14.5	29.1	27.3	47.3	20.0	3.6	1.8	29.1	43.6	18.2	3.6	5.5
X^2 P1	24.54 0.001*															0.798 0.3652									
X^2 P2																0.412 0.526					17.58 0.0032*				

X^2: Chi-Square test ***Significant at P≤0.05**
[c]Score was from not at all beneficial = 1 to beneficial a lot = 5
[d] Score was from not at all a problem = 1 to a big problem = 5

As regards levels of perceptions of HBM constructs **Table (8)**shows thatless than half of the students (40.0%) of the intervention group at 3 months post program implementation perceived themselves to be highly susceptible to RH related risks and pregnancy complications with DM, and more than half (47.3%) of them had high perceived severity to pregnancy related complications compared to (14.5%, 14.5%) for control group students respectively. The difference was statistically significant between intervention group at pre, immediate and 3 months post program implementation (X2=19.85, P =0.0013, X2=19.8, P=0.0065) respectively. Moreover, students had high perceived benefits of seeking PC counseling were more than half of the sample (41.8%) at the intervention group at 3 months post program implementation against (16.4%) of them before program implementation. As for perceived barriers, the majority of students at the intervention group before program implementation (70.9%) indicated they did not have problems that could prevent them from seeking PC care against to 41.8% of them highly perceived barriers of seeking RH and PC counseling at 3 months after program implementation with statistically significant difference between intervention group at pre, immediate and 3 months post program implementation (X2=30.89, P=0.0011).Moreover, statistically significant difference between intervention and control groups those perceived barriers of seeking RH and PC counseling at 3 months post program implementation (X2=26.5, P= 0.001).

Table (8): Distribution of the study samples' perception levels of susceptibility, severity, benefits and barriers about RH and PC counseling across program phases according to HBM

HBM constructs		Intervention (n =55)						Control (n =55)			
		Pre program		Immediate post program		3 monthspost program		Pre program		3 monthspost program	
		No.	%	No.	%	No.	%	No.	%	No.	%
Perceived susceptibility to complications of DM on RH and pregnancy											
Levels											
	High	5	9.1	25	45.5	22	40.0	8	14.5	8	14.5
	Moderate	12	21.8	20	36.4	21	38.2	14	25.5	12	21.8
	Low	38	69.1	10	18.2	12	21.8	33	60.0	35	63.6
X^2 P1		**19.85 0.0013***						**1.42 0.236**			
X^2 P2		----------						**1.47 0.236**		**19.87 0.005***	
Perceived severity of complications of DM on RH and pregnancy											
Levels											
	High	10	18.2	30	54.5	26	47.3	8	14.5	8	14.5
	Moderate	15	27.3	14	25.5	12	21.8	14	25.5	10	18.2
	Low	30	54.5	11	20.0	17	30.9	33	60.0	37	67.3
X^2 P1		**19.8 0.0065***						**1.22 0.241**			
X^2 P2		----------						**1.74 0.108**		**15.42 0.0036***	
Perceived benefits of seeking RH and PC counseling											
Levels											
	High	9	16.4	28	50.9	23	41.8	9	16.4	10	18.2
	Moderate	12	21.8	20	36.4	18	32.7	18	32.7	8	14.5
	Low	34	61.8	7	12.7	14	25.5	28	50.9	37	67.3
X^2 P1		**20.65 0.001***						**1.254 0.1077**			
X^2 P2		----------						**1.85 0.123**		**21.4 0.001***	
Perceived barriers of seeking RH and PC counseling											
Levels											
	High	6	10.9	29	52.7	24	43.6	10	18.2	9	16.4
	Moderate	10	18.2	20	36.4	18	32.7	12	21.8	10	18.2
	Low	39	70.9	6	10.9	13	23.6	33	60.0	36	65.5
X^2 P1		**30.89 0.0011***						**0.875 0.207**			
X^2 P2		----------						**0.741 0.336**		**26.5 0.001***	

X^2: Chi-Square test ***Significant at P≤0.05**

 # Higher grade of a HBM construct reflects higher perception of that construct

[a] Score was from not at all worry = 1 to worry a lot = 5

[b] Score was from not serious at all = 1 to very serious = 5

Table (9)displays the mean and SD values of HBM constructs scores among female students with diabetes according to their age and socioeconomic status. With respect to students' perceived susceptibility, severity, benefits and barriers assessed in the present study. There were no significant differences in the mean total scores of the four constructs of the HBM in relation to age, and socioeconomic status.

Table (9): Mean and SD of the total scores of HBM constructs among female students have diabeteswiththeir age and socioeconomic status

Variable	Susceptibility $\bar{x}$ (SD)	Severity $\bar{X}$SD)	Benefits $\bar{X}$ (SD)	Barriers $\bar{X}$SD)
Age				
18 –	13.2±4.65	13.6±5.21	17.01±5.01	42.6±11.8
20 –	14.22±5.01	14.6±3.85	15.6±4.1	40.3±9.25
22+	14.1±4.98	15.8±4.01	16.22±5.41	44.6±10.2
Test of significance	**F = 0.69 P =0.332**	**F = 2.14 P = 0.107**	**F =1.69 P = 0.365**	**F = 1.42 P = 0.465**
SES				
High	14.75 ± 4.17	14.57 ± 3.79	24.25±1.75[c]	29.09± 7.22
Medium	15.57± 3.57	14.17±3.69	23.29± 2.48[c]	30.02± 7.03
Low	13.25± 4.43	13.50± 3.0	23.75± 2.50	27.25± 5.56
Test of significance	**F = 1.328 P = 0.27**	**F = 0.29 P = 0.75**	**F = 3.03 P = 0.05***	**F = 0.52 P = 0.59**

F: One Way ANOVA test ***Significant at P≤0.05**

[c]Significant difference between high and middle socioeconomic groups

Table (10) shows the mean and SD values of the total scores of HBM constructs of female students with diabetes according to their glycemic control. There were statistically significant differences in the mean scores of students' perceived susceptibility (t = 2.65, P = 0.013), benefits (t = 2.31, P = 0.026) and barriers (t = 1.92, P = 0.042) with regards to their diabetic status.

Table (10): Mean and SD values of the total scores of HBM constructs among female students have diabetes and glycemic control ofDM

t:

Variable	Susceptibility $\bar{X}$ (SD)	Severity $\bar{X}$ (SD)	Benefits $\bar{X}$ (SD)	Barriers $\bar{X}$ (SD)
Diabetic status (HbA1c)				
Controlled (≤ 7)	15.65±3.98	13.8±3.98	18.22±4.21	46.9±10.8
Uncontrolled (> 7)	13.2±2.98	14.9±4.01	16.02±5.01	40.2±9.65
Test of significance	**t = 2.65 P = 0.013***	**t = 1.05 P = 0.107**	**t= 2.31 P = 0.026***	**t = 1.92 P = 0.042***

Independent sample t- test ***Significant at P≤0.05**

Table (11) demonstrates the mean and SD of the total scores of HBM constructs among female students with diabetes and their history of ever seeking of RH and PC counselling. Students who had ever sought counselling for RH complications with DM showed statistically significant with mean scores of perceived susceptibility (t=2.33, P=0.016), Benefits (t=2.64, P= 0.016) and barriers (t=2.07, P=0.011). It was found a significant difference among students who had previous counselling for PC with respect to their perceived susceptibility (t=1.93, P=0.046), severity (t=1.91, P= 0.045), Benefits (t=2.09, P= 0.046) and barriers (t=2.33, P=0.0107).

Table (11): Mean and SD of the total scores of HBM constructs among female students have diabetes with their history of RH and PC counseling.

Variable	Susceptibility $\bar{X}$ (SD)	Severity $\bar{X}$ (SD)	Benefits $\bar{X}$ (SD)	Barriers $\bar{X}$ (SD)
History of RH counseling				
Yes	15.98±3.02	14.9±4.01	17.95±3.98	48.9±11.02
No	12.07±4.01	13.9±4.15	15.8±4.85	42.8±10.6
Test of significance	**t = 2.33 P = 0.016***	**t =1.74 P = 0.078**	**t = 2.64 P = 0.016***	**t = 2.07 P = 0.011***
History of PC counseling				
Yes	14.9±4.08	15.1±3.98	18.39±4.12	49.1±10.7
No	12.65±3.98	13.2±3.98	15.21±5.01	40.8±11.32
Test of significance	**t = 1.93 P = 0.046***	**t = 1.91 P = 0.045***	**t = 2.09 P = 0.046***	**t = 2.33 P = 0.0107***

t: Independent sample t-test ***Significant at P≤0.05**

IV. Discussion

Prevalence of diabetes is increasing worldwide. IDF (2017) estimated that, approximately 199 million women live with diabetes which is projected to rise to 313 million by 2040 [14]. Multiple studies revealed that diabetes in pregnancy is associated with high maternal and neonatal morbidities and mortalities[16, 34].It appears that these adverse pregnancy outcomes can have its origins during periods of fertilization, gametogenesis, and early embryo development, periods of epigenetic influences that translates into downstream long-term health impacts[35]. That's whyinternational clinical guidelines [11] recommend preconception care education from adolescence for all women with DM as an effective strategy to facilitate behavior change and improve pregnancy outcomes.

One of the challenges of providing PC education to adolescents with diabetes is finding the most effective way to influence their health behavior. Therefore, the purposes of this study was to evaluate the impact of preconception counseling program on knowledge, beliefs and self-management practices of university female students having Type 1 Diabetes. One theory guided this study Health Beliefs Model which used in the public health field and provide useful information regarding factors that may deter or attract adolescents to a variety of health actions.

Difficulties in glycemic controls frequently observed during puberty intensify at the end of the growth period, especially in girls. Preconception care should include educating women about the impact of diabetes on pregnancy outcomes and optimizing glycemic control [15]. Thecurrent study revealed that more than half of the students at the intervention group (29.1%) and one fifth of those at the control group had their diabetes uncontrolled (HbA1C ≥ 7). A recent international comparison of glycaemic control among people with T1DM

highlighted that age group (15–24) yrs. were most likely to have HbA1c values > 7.5 [36].Teenage girls with Type 1DM have poorer metabolic control than boys and face more complications in early adulthood[37].

Female adolescents may hesitate to discuss reproductive health problems especially due to shame and embarrassment, these problems are shrouded in a culture of silence [38, 39].This is in line with findings of thepresent study whereless thanthree fourth of the students at the intervention group (70.9%) and nearly two thirds of those at the control group didn't sought medical advice for their reproductive morbidities. Egyptian youth like many other counterparts throughout the world experience social, cultural and economic barriers to the information and health services they need to protect themselves against reproductive health diseases. This observation highlights the importance of health education programs focusing mainly on menstrual hygiene and RH among adolescent girls.

Although preconception counseling services introduced in Egypt a decade ago, but still limited in Egypt and concerned mainly with married women [41]. The current study revealed that more than one fifth (21.8%) of students at the intervention group and 18.2% of control group had initiated discussions with their health care providers regarding preconception care and diabetes. As almost two thirds of students in this study were single, they may find it too early to discuss these issues, the high social and religious value placed on virginity in most Arab countries put young unmarried women at risk of stigma or negative reactions from health care professionals if they try to obtain reproductive health advice [40].This finding go in line with many studies from different cultures where women with diabetes didn't initiate discussion with their HCPs about pregnancy planning and diabetes [42,43]. This mayreveal that cultural values and traditions influenced utilization of services.

Self-management of type I diabetes is key to good physical and psychosocialoutcomes of the disease, yet little is known about how youth and their parents share responsibility for illness management[44]. The current study showed that less than one fifth (18.2%) of the students inthe intervention group before program implementation had fair diabetes management score level compared to less thanhalf(43.6%) of students at 3 months post program. This could be explained by the fact that, during the transition from childhood to adulthood, adolescents struggle to make lifestyle choices. In addition, a number of health risk behaviors begin in this period that can affect their current and future health[45]. Aprevious study was done among university students in Alexandria, Egypt reported that the majority of students (81.9%) had fair level and 16.3% had good level of DM self-management. So, adolescents and young adults with diabetes need to be advised that DM self-management is essential for attaining glycemic control which is necessary for planning their future pregnancies [46].

Accurate diabetic knowledge could motivate self-care by giving youth and parents an important long-term goal and induce some them to talk about avoidance of complications in a positive and optimistic manner. Results of the present study revealed that many students at the intervention group before program implementation (20.0%) responded correctly that diabetes is a chronic disease against to 60% at 3 months after program implementation. With regards to complications of diabetes, less than one fifth of students at the intervention group before program implementation correctly identified complications of diabetes this percent increased to be 52.7% at 3 months after program implementation.A worrying aspect is that students had areas of shortage concerning knowledge about diabetes managements which posits the need for more education at this age group for better management and early detection of complications. DM is a disease where knowledge is a critical component of care, not only knowledge, but up to date knowledge is needed.

Regarding general knowledgedomain,the present study assessed general issues that are prevalent in the community of adolescents; one fifth of students at intervention group (16.4%) correctly identified that women with diabetes should get medical advice and control their diabetes before getting pregnant at the intervention group.Also, 10.9% and 20.0% of students at the intervention and control groups before program implementation respectively recognized the importance of take folic acid tablets before getting pregnant to decrease the risk of congenital anomalies. The lack of knowledge among youth has been reported in many developing countries even among educated persons[47]. Knowledge gaps regarding general among female youth students have been reported in previous studies in Egypt, [48] Saudi Arabia [49] A study by Charron-Prochownik et al. (2014)[50]among adolescents with diabetes demonstrated thatyoung women particularly often face scarcity of basic knowledge about sexuality andservices.

Most studies explored general preconception care knowledge from different angles, about one fourth of the students (20.0%) reported correctly that it is possible for a woman with diabetes to have a healthy baby. Only few percentages of the students were aware of the increased risk of high blood pressure and repeated miscarriage during pregnancy. This lack of knowledge may be attributed to insufficient basic information previously obtained through formal education in relation to this specific area of knowledge and the absence of designed educational program provided to female youth about PC counseling. Moreover parents and health care

providers always hesitate to discuss these issues. This result also agrees with studies conducted among female adolescents without diabetes in Lebanon [51].

A possible explanation for these findings is that PC education provision is almost nonexistent for many women in the developing world who have increased risk of adverse maternal and fetal outcomes[52] and preconception issues are not discussed between parents and adolescents due to sensitivity of the topic. Fischl et al. (2010)[53] found comparable figures regarding adolescents knowledge about diabetes and pregnancy. Previous studies were conducted in USA bycharron-pochownik et al. (2013 - 2015) among adolescents with diabetes showed lack of adequate knowledge about risks and PC counseling [42,54] These differences could be attributed to culture differences between both countries and the lack of Sexual reproductive health education and provision in our country.

A Meta analytic review depicted that lack of knowledge was among the most frequently identified barriers for seeking PC counseling[55].Though PC care has been beganfrom long period in our country, it is not yet known as a routine care similar to prenatal care [41] Furthermore, it is rare that a woman asks for preventive care.

One theory contributed to the framework of the current study; HBM[6]. This framework was utilized to analyze the data and formulate the recommendations for future studies. More than three quarters of the students at the intervention group at 3 months post program implementation (78.2%) had moderately and highly perceived susceptibility of and pregnancy risks with DM versus (30.9%) before program. These findings could be interpreted by two reasons. First, the long experience with diabetes being a chronic disease and the fear of developing complications may greatly affect students' lives and make them feel vulnerable to any complications that would affect their health status. Second, globalization is bringing a new dimension into people's lives, particularly those of young people, who have an enormous capacity to learn about and embrace new trends and technologies. A study by Rasmussen et al. (2007)[55] established that young women with diabetes have a high sense of vulnerability particularly to pregnancy complications. These findings highlight the necessity for increasing awareness of PC counseling among health care providers who interact with female youth having diabetes on regular basis to provide them with correct information about the effects of diabetes on and pregnancy but at the same time, assuring them that most women with diabetes today have healthy babies.

The WHO emphasized the benefits of PC care in reducing child and maternal mortality, thus reaching the Millennium Development Goals, and stated that all women should have access to proper care before pregnancy until 2015[52].At the current study, more than one third of students in the intervention group at 3 months post program implementation (36.4%) moderately and highly perceived the benefits of and PC counselling. Although students had high perceived benefits, only few percentages (21.8%) of intervention group and less than one fifth (18.2%) of control group had sought PC counselling. These findings were consistent with previous literature showing that young adults sometimes do not behave consistent with their beliefs [56]. According to the HBM, participation in healthy behaviours is affected by beliefs about the probability of an action's role in a perceived benefit[57]. Thus, the benefits of seeking and PC counselling should be introduced to female adolescents with diabetes with explaining that family planning and contraception do not prevent future pregnancy but provide the mother with more time to plan it safely.

As for perceived barriers the present study illustrated thatthe majority of students at the intervention group before program implementation (70.9%) had low level of perceived barriers. This unexpectedly changed to43.6% of students became highly perceived barriers of seeking and PC counseling after 3 months post program implementation with statistically significant differences. Perhaps the experience of the behavior may serve to accurately inform the students of these barriers, meaning that these questions were interpreted as a personal opinions rather than actual barriers which resulted in underestimation. Wang et al. (2006)[58]in their study among female adolescents with diabetes in the USA showedsimilar though lower perceived barriers. This was expected due to different cultures between both countries where sexual and reproductive health education and services in USA are provided in school and colleges and many adolescents are sexually active whereas talking about these issues or about sexuality in general is often considered a taboo in our culture.

Though, there is a wide agreement on the effect of socioeconomic level in shaping health beliefs in general. In the current study socioeconomic level showed significant effect on HBM constructs with respect to students' perceived benefits of and PC counselling.

Cues to action was introduced by Rosenstock based on the assumption that certain cues would stimulate an individual's perception of threat from certain health condition by influencing the perceived severity, susceptibility, or both. With more powerful cues or accumulation of cues, a person is stimulated to take action[32]. In the current study, external cues for students included HCPs, parents, friends, relatives, education, internet and media. They represent sources of information and support for providing resource and guidance that female youth need to initiate PC counseling. Despite the fact that students identified multiple sources, they didn't actually utilize them, a similar result was found by Collin LC, et al. (2016) [59] in their study of PC care with American adolescents. Thepresent study indicated that the internet represented also one of their sources of

information of the students' knowledge about one fourth of the students. In a study by Spence et al. (2010), [60] the internet was a source for those particularly interested to learn more, or who had expressed negative feelings with regard to health professionals or the healthcare system. People are now proactive in seeking health information and increasingly prefer to do things in the privacy of their homes and in their own time[61]. Internet and media if well directed, could widen access to PC counseling and provide health-care professionals with an alternative route to ensuring that women with diabetes receive essential pre-pregnancy counseling [54].

Health care providers representedone of the main important sources for information of students about PC care, yet, nurses and physician were mentioned by more than one fourth of students (27.27%) and 9.1% respectively. Studies by Schwarz et al. (2010)[62] demonstrated that despite relatively frequent contact with HCPs, adolescent women with diabetes rarely identified a doctor or nurse as a major source of information about PC and contraception. Therefore, health care providerswho routinely interact with women with diabetes, including counselors, social workers, nurses, pharmacists, internists, obstetrician/gynecologists, and pediatricians should be encouraged to make every effort to provide PC counseling.

V. Conclusion and recommendations

Results of the current study showed that small proportion of students had sought medical advice. Furthermore, students had knowledge gaps regarding risks and pregnancy planning with diabetes and a minority had sought PC counseling. Nevertheless, it's an issue of concern to note that many students perceived the threat of uncontrolled diabetes on and pregnancy, had positive attitude and strong perceived benefits of seeking and PC counseling. Students in the current study reported wide range of sources of information about and PC counseling with diabetes, friends was the most common source of information. The internet has emerged as a popular source of health care information replacing face-to-face consultations.

Based on findings of the present study, it could be concluded that results of this study confirmed the hypothesis as University female students having Type 1 Diabetes who engage in preconception counseling program demonstrate high level of knowledge, perceptions and self-management practices than those who are not. It was clearly that implementation preconception counseling program had positive impacts on knowledge, perceptions and self-management practices of female students having Type 1 Diabetes.

Based on the current study findings the following recommendations could be made:

1- Establishing National campaigns to promote knowledge about the benefits of folic acid in the prevention of congenital anomalies.
2- The integration of youth friendly clinics within the organization of a clinical program is helpful in meeting the specialized needs of youth with diabetes and services provided should be accessible, acceptable, equitable, appropriate and effective for youth.
3- Raising public awareness through national and social media to shed the light on and PC care benefits for young people, aiming to promote health and increase community awareness of the impact of PC care on maternal, newborn and child health outcomes.
4- Ensure training of health workforce on PC care. Health care providers need to be aware of problems during a consultation with an adolescent and provide confidential services that adolescents can trust.
5- Contents related to PC care should be including in educational curricula of schools and universities,
6- Empower female youth through PC counseling to make informed choices regarding their and future pregnancy.

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