Enhancing Gestational Diabetes Management in Filipino Patients: Evaluating the Impact of Education on Knowledge, Attitude, and Pregnancy Outcomes at a Tertiary Medical Center

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Abstract

Introduction. Patient education is integral in the management of gestational diabetes mellitus (GDM), a common pregnancy complication that may cause adverse perinatal outcomes. This study evaluated the effect of diabetes education on the knowledge and attitude among patients with GDM, comparing pre- vs post-diabetes session scores and determining pregnancy outcomes.

Methodology. A one-group pre-test and post-test experimental design study was conducted on 75 patients after one-session diabetes counseling using the Gestational Diabetes Mellitus Knowledge Questionnaire (GDMKQ) and the third version of the Diabetes Attitude Scale (DAS-3).

Results. Of the 75 subjects, 84% exhibited adequate knowledge of diabetes. Post-education, a significant increase in the total scores was seen among those less than 35 years of age (p-value: 0.003), both employed and unemployed (p-value: 0.0.026, 0.047, respectively), with a secondary level of education (p-value: 0.014) and multigravid (p-value: 0.015). An overall median positive attitude score of 3.6 was documented. For neonatal outcomes, no adverse events existed. For maternal outcomes, 17.9% had elevated fasting blood glucose while 7.1% had elevated 2-hour post-glucose tolerance test.

Conclusion. Diabetes education improves patient's knowledge but not their attitude. Hence, improvement in attitude interventions should be incorporated into the current diabetes education program.

Keywords: gestational diabetes, diabetes education, knowledge, attitude

Introduction

Gestational diabetes mellitus (GDM) is a subtype of diabetes mellitus (DM) with varying degrees of glucose intolerance diagnosed during the second and third trimesters of pregnancy.[1,2] According to Nguyen et al. its global prevalence varies from 1% to 28%.[2] It is affected by ethnicity, maternal age, genetics, socioeconomic status, body composition, screening methods, and diagnostic criteria. The ASEAN Federation of Endocrine Societies Study Group on Diabetes in Pregnancy (ASGODIP) noted that it is more prevalent among Asians, with an overall prevalence of 7.6% for low-risk pregnancies, and 31.5% for high-risk pregnancies in Southeast Asia.[3] Studies suggest that Filipinos are a high-risk population for developing GDM, with the highest prevalence rate of 14%.[3,4,5]

GDM is associated with serious short-term and long-term complications for both mothers and their newborns. Mothers have an increased risk of caesarian delivery, premature rupture of membranes, preterm birth, spontaneous abortion, stillbirths, perineal tearing, shoulder dystocia, gestational hypertension, preeclampsia, obesity, and development of Type II DM in 20% to 50% of patients in 5 to 10 years after pregnancy.[1-3,6-8] While their offspring may have macrosomia, neonatal hypoglycemia, poor one-minute APGAR score, birth trauma, jaundice, respiratory distress syndrome, hypocalcemia, polycythemia, congenital anomalies, and may be predisposed to childhood obesity, hypertension, hyperlipidemia, impaired glucose tolerance and Type II DM. [1-3,5,7,8]

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Diagnosis of GDM is through a 75g oral glucose tolerance test (OGTT) for high-risk individuals and a 50g oral challenge test (OGCT) for low-risk individuals.[3,9] In the Philippines, the criteria set by the International Association of Diabetes and Pregnancy Study Groups (IADPSG) include a fasting serum glucose of at least 5.11 mmol/L (92 mg/dL), one-hour serum glucose of at least 10.0 mmol/L (180 mg/dL), or two-hour serum glucose of at least 8.5 mmol/L (153 mg/dL).[5]

With proper glucose control, the complications of GDM are significantly reduced.[10] Management requires a thorough understanding of food nutritional values, dietary restraints, compliance with medications, and adequate exercise.[10,11] However, many fail to understand their disease process and the importance of glycemic control. According to Endres et al. functional health literacy is only 50% to 75%.[8] This limited understanding often leads to poor compliance with management, consequently leading to worse maternal and fetal outcomes.[10] Other barriers to effective GDM management are lower socioeconomic conditions, social discrimination, myths, and misbeliefs.[12]

According to a committee of the American Public Health Association, patient education incorporated in the management of diseases must be developed and reassessed periodically depending on the patient's knowledge, attitude, and practices, as program effectiveness is largely dependent on these factors.[13] Several tools, such as Diabetes Self-Management Education (DSME) and Diabetes Self-Management Support (DSMS), are used to aid patients in the self-management of their disease by optimizing metabolic control, managing and preventing complications, and improving their quality of life.[14]

Based on an extensive review of the literature, only studies that investigated the effects of patient education on the knowledge and attitude of those with Type 1 and Type 2 diabetes have been conducted. No local study has been conducted yet looking at those with GDM.

The primary objective of this study was to determine the effect of diabetes education on the knowledge and attitude among patients with GDM by using the Gestational Diabetes Mellitus Knowledge Questionnaire (GDMKQ) and the Diabetes Attitude Score-3 (DAS-3). The specific objectives include the comparison of mean knowledge and attitude scores before and after the diabetes education, comparison of the pre-and post-knowledge scores by age group, educational attainment, occupation, socioeconomic status, and number of pregnancies, assessment of glycemic control post-education and the determination of pregnancy outcomes such as neonatal weight, hemoglucose test, APGAR score and the proportion of those who developed diabetes postpartum.

The results of this study can help clinicians provide the most individualized comprehensive patient education program to decrease the risk of GDM complications.

Methodology

An experimental one-group pre-test and post-test design study was conducted from March 2021 to January 2022 at the outpatient setting of the Chinese General Hospital and Medical Center (CGHMC). The study protocol and the informed consent forms followed the ethical principles based on the Declaration of Helsinki and the National Guidelines for Biomedical Research of the National Ethics Committee (NEC). The Institutional Research and Ethics Review Board approved them.

Pregnant patients aged at least 20 years, diagnosed with GDM using the 75g OGTT in the second to third trimester were selected by purposive sampling technique. Those with pre-existing diabetes were excluded. Alphanumerical codes were assigned to hide their identity. Patient's age, weight, body mass index (BMI), educational attainment, socioeconomic status, comorbidities, family history of diabetes or GDM and obstetric score (gravity and parity) were retrieved from the medical record and documented to avoid recall bias. Their contact numbers were saved to minimize loss to follow-up and address transfer bias. For the pregnancy outcomes, 19 of the 75 subjects were excluded from the analysis because fourteen had not delivered yet at the time of data collection and five had birth delivery outside CGH.

Two questionnaires were used, and permission for the use of these tests was obtained prior to the commencement of the study.

The GDMKQ, developed by Hussain and colleagues, is a 15-item validated tool for knowledge assessment that explores the basic knowledge of GDM, risk factors, food and diet values, management, and complications or outcomes. Each item corresponds to 1 point; the score range was 0 to 15.[15] Inadequate knowledge is indicated by a score ≤ 8 while a score > 8 implies adequate knowledge.[16] This was translated into Filipino and submitted to four healthcare professionals, including two Endocrinologists and two Obstetricians for content validity. A pilot study on 16 patients was executed for face validity. The mean age of the patients was 32.75 ± 5.83 years, ranging from 21 to 42 years and the mean gestational age was 26 ± 4.23 weeks, ranging from 21 to 33 weeks. Reliability analysis yielded a Cronbach's alpha coefficient of 0.70.

The DAS-3, developed by Anderson et al. to measure general diabetes-related attitudes of patients and healthcare professionals, was also used. This consists of 33 questions with five subscales, namely: (1) the need for special training in education (5 items), (2) the seriousness of Type 2 Diabetes (7 items), (3) the overall value of tight glucose control in diabetes care (7 items), the psychosocial impact of diabetes on patients (6 items) and attitude towards patient autonomy (8 items). Each item is scored as follows: 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree; except for A5, which has a reverse score.[17] This was translated into Filipino by the University of the Philippines Manila Sentro ng Wikang Filipino and was utilized and validated by Yao et al. in

Table I. Baseline Demographic and Clinical Profile (n=75)

Parameter	n (%)
Age (in years), Mean	31.60 ± 5.905
< 35 years old	49 (65.3%)
≥ 35 years old	26 (34.7%)
Comorbidities, %	
Hypertension	7 (9.3%)
Diabetes mellitus	0
Bronchial asthma	2 (2.7%)
Thyroid disease	2 (2.7%)
Pulmonary tuberculosis	0
Heart disease	0
Stroke	0
Others*	3 (4%)
Family history	
Hypertension	32 (42.7%)
Diabetes mellitus	26 (34.7%)
Thyroid disease	1 (1.3%)
Heart disease	2 (2.7%)
Asthma	2 (2.7%)
Occupation	
Unemployed	45 (60%)
Employed	30 (40%)
Educational attainment	
Elementary level/graduate	0
High school level/graduate	20 (26.7%)
College level/ graduate	54 (72%)
Postgraduate	0
Vocational	1 (1.3%)
Monthly income (in PhP), Mean	14,560 ± 7,109.64
< 10,000	19 (25.3%)
10,000-20,000	45 (60%)
> 20,000	11 (14.7%)
Gravidity, Mean	2 (IQR = 1-3)
Primigravida	22 (29.3%)
Multigravida	53 (80.7%)
Parity	1 [IQR: 0-2]
Nullipara	22(29.3%)
Primipara	22 (29.3%)
Multipara	31 (41.3%)
Age of gestation (in weeks), Median	29 (IQR = 22-33)
BMI (in kg/m^2), Median	29 (IQR = 24.81-30.6
Normal	21 (28%)
Overweight	27 (36%)
Obese	27 (36%)
75g OGTT results	Median (IQR)
Fasting glucose (in mg/dL), Median	96 (IQR = 88-103)
1-hour post (in mg/dL), Median	164 (IQR: 131-183)
2-hour post (in mg/dL), Mean	139 (IQR: 124-159)
Vital Signs	Mean
Systolic BP (in mmHg)	111.33 ± 11.311
Diastolic BP (in mmHg)	74.13 ± 9.457
Heart rate (in bpm), median	82 (IQR = 70-90)

*gastritis=1; dyslipidemia=2

2004.[18] In 2019, Dela Cruz et al. employed this to evaluate rural healthcare professionals in Aklan.[19]

The primary endpoint is the determination of the effect of diabetes education on the knowledge and attitude among patients with GDM through a comparison of total scores. The secondary outcomes were the evaluation of scores by subgroup analysis namely age, educational attainment, occupation, socioeconomic status, and number of pregnancies. In addition, improvement in glycemic control and perinatal outcomes such as the neonate's birth weight, APGAR score, and hemoglucose test, as well as the proportion of patients who developed diabetes postpartum, were determined.

Self-administered questionnaires (GDMKQ and DAS-3) were given. After completion, they were referred to the Diabetes and Endocrine Center (DEC) for a one-session diabetes education activity consisting of an overview of diabetes, medical nutrition therapy, and pharmacotherapy with insulin administration (for those on insulin therapy), lasting for 30 minutes. The same DEC nurse and dietitian conducted this to standardize and limit interviewer bias. Patients were instructed to do a four-point capillary blood glucose monitoring and the results were recorded as fasting plasma glucose (FPG) and two-hour post-prandial glucose (2-hr PPG). Follow-up after four weeks was advised for the reassessment of glycemic control, adjustment of medications (if any), and re-administration of questionnaires. FPG less than 95 gm/dL and 2-hr PPG less than 120 gm/dL indicated well-controlled GDM based on the ADA 2022 guidelines.[20,21] Pregnancy outcomes such as the neonate's weight, APGAR score, hemoglucose test, and persistence of maternal hyperglycemia six weeks postpartum were recorded.

The *OpenEpi*™ calculator was used to compute the sample size with a confidence level of 95% and power of 80%. It yielded a sample size of 62 patients to satisfy all the study objectives. This was increased to 78 to account for 20% potential non-response to avoid self-selection bias. Parameters were based on a previous study by Lim-Uy et al.[3]

Stata MP® version 16 software was used for data processing and analysis. Depending on data distribution, continuous data were presented as mean ± standard deviation (SD) or median with interquartile range (IQR). Categorical data were presented as frequencies and percentages. Pre- and post-education knowledge and attitude scores and changes in CBG were compared using the *Wilcoxon signed rank test* and *McNemar's test*. Comparison of change in knowledge scores by patient characteristics was performed using an independent *t-test* and *One Way ANOVA test*. p values ≤ 0.05 were considered statistically significant.

Results

Seventy-five eligible patients completed the knowledge and attitude questionnaire before diabetes education and after the follow-up session. Most were < 35 years old with a mean age of 31.6 years (± 5.905), college graduates (72%), and unemployed (60%) with a family monthly income of PHP 10,000 – PHP 20,000. The majority were multigravid (80.7%) with a median

Table II. Distribution of Correct Answers, Pre- vs. Post-Education (n=75)

Distribution of Correct Answers	Pre-education Correct, n (%)	Post-education Correct, n (%)
Basic knowledge about GDM		
Q1. Gestational Diabetes Mellitus is the type of diabetes that occurs: **Correct: During pregnancy*	61 (81.3%)	65 (86.7%)
Q2. In uncontrolled Gestational Diabetes Mellitus, the blood sugar level is: **Correct: Increased*	72 (96%)	72 (96%)
Q3. What is the best way for testing blood glucose levels for Gestational Diabetes Mellitus patients? **Correct: Blood test*	64 (85.3%)	64 (85.3%)
Knowledge about risk factors		
Q4. You are at increased risk of developing Gestational Diabetes Mellitus if you are: **Correct: Overweight*	64 (85.3%)	63 (84%)
Q5. You have increased chances of developing Gestational Diabetes mellitus if: **Correct: previously gave birth to a stillborn baby*	4 (5.3%)	14 (18.7%)
Q6. You are more likely to develop Gestational Diabetes Mellitus if you have: **Correct: Family history of diabetes*	60 (80%)	61 (81.3%)
Knowledge about diet/food values		
Q7. If you have Gestational Diabetes Mellitus, you should avoid food containing high content of: **Correct: carbohydrates and fats*	66 (88%)	70 (93.3%)
Q8. Which of the following foods can be eaten without restriction during Gestational Diabetes Mellitus: **Correct: Fresh salad*	65 (86.7%)	65 (86.7%)
Q9. What is the type of nutritional source mainly provided by rice? **Correct: carbohydrates*	71 (94.7%)	71 (94.7%)
Knowledge about the management of GDM		
Q10. The most common sign of hyperglycemia (high blood sugar) is: **Correct: increased thirst*	38 (50.7%)	43 (57.3%)
Q11. The normal value of fasting blood sugar (FBS) is: **Correct: 3.6 – 6.1 mmol/l (64.8 - 109.8 mg/dL)*	39 (52%)	40 (53.3%)
Q12.If you feel the onset of hypoglycemic (low blood sugar) symptoms, you should: **Correct: Immediately eat or drink something sweet*	41 (53.7%)	43 (57.3%)
Knowledge about GDM complications		
Q13. In uncontrolled Gestational Diabetes Mellitus your baby may be **Correct: Larger than usual size*	56 (74.7%)	57 (76%)
Q14. If you have Gestational Diabetes Mellitus you have: **Increased chances of developing diabetes in later life*	53 (70.7%)	62 (82.7%)
Q15. Gestational Diabetes Mellitus is a condition that: **Correct: May affect mother or baby*	74 (98.7%)	75 (100)

Table III. Change in Knowledge Scores, Pre- and Post-Education (n=75)

Change in Knowledge Score	Pre-education	Post-education	P value
Knowledge score, Median	11 (IQR = 10-12)	12 (IQR = 10-13)	0.003*[a]
Inadequate	12 (16%)	9 (12%)	0.317[b]
Adequate	63 (84%)	66 (88%)	

[a]Wilcoxon signed rank test was used, [b]McNemar test was used

gestational age of 29 weeks (22 – 33 weeks). The median BMI was 29 (24.81 – 30.6), and only 28% had a normal BMI. Some reported concomitant hypertension (9.3%), thyroid disease (2.7%), and bronchial asthma (2.7%). None had a history of diabetes, PTB, or cerebrovascular disease (*Table I*).

The median knowledge score significantly increased post-education ($p = 0.003$), and only 12% showed inadequate knowledge (*Table II*). Although there was an increase in the proportion with adequate knowledge, the result was not statistically significant ($p = 0.317$) (*Table III*). The majority still had low knowledge of item 5 even after the education session.

Table II shows the distribution of correct answers in pre- and post-education knowledge examinations. Comparing the scores by subgroup analysis, a significant increase in the median scores post-education was observed in patients under 35 years of age, both unemployed or employed, with a secondary level of education and multigravid (*Table IV*). However, the change in knowledge score by each category, namely age group, occupation, educational attainment, monthly income, and the obstetric score, did not significantly differ.

For the attitude assessment, the participants showed an overall positive median score of 3.65 and 3.6, pre- and post-education, respectively (*Table V*). In decreasing order, the post-education median scores are as follows:

Table IV. Within and Between Group Analysis of Change in Knowledge Scores Pre- vs Post-Education (n=75)

Parameter	n	Pre-education Median (IQR)	Post-education Median (IQR)	Within-group (Pre vs. post) p value	Change in score Mean ± SD	Between-group (By category) p value
Age						
< 35 years old	49	12 (10-13)	13 (11-13)	0.003*	0.71 ± 1.307	0.283[b]
≥ 35 years old	26	11 (9-13)	11 (10-13)	0.271	0.42 ± 0.987	
Occupation						
Unemployed	45	11 (9-12)	12 (10-12)	0.047*	0.67 ± 1.187	0.646[b]
Employed	30	11 (10-13)	12 (11-13)	0.026*	0.53 ± 1.252	
Educational attainment						
High school	20	11 (9-13)	12 (10-13)	0.014*	0.3 ± 0.801	
College	54	12 (10-12)	12.5 (10-13)	0.083	0.7 ± 1.312	0.116[b]
Vocational	1	8	11	0.317	2	
Monthly income						
< 10,000 pesos	19	11 (9-12)	11 (10-13)	0.085	0.63 ± 1.342	
10,000-20,000 pesos	45	11 (10-12)	12 (11-13)	0.053	0.71 ± 1.272	0.916[c]
> 20,000 pesos	11	11 (11-12)	11 (10-12)	0.157	0.18 ± 0.405	
Gravidity						
Primigravida	22	12 (11-13)	12.5 (11-14)	0.094	0.59 ± 0.959	0.908[b]
Multigravida	53	12 (10-13)	13 (10-13)	0.015*	0.62 ± 1.304	

[a]Wilcoxon signed rank test was used; [b]Independent t-test was used; [c]One Way ANOVA was used.

Table V. Change in Attitude Score Pre- vs Post-Education (n=75)

	Pre-education Median (IQR)	Pre-education Mean (± SD)	Post-education Median (IQR)	Pre-education Mean (± SD)	*p value*
Need for special training	4.6 (4.2-5)	*4.37 ± 0.80*	4.4 (4-5)	*4.29 ± 0.82*	0.3924[a]
Seriousness of type 2 diabetes	3.14 (2.88-3.57)	*3.14 ± 0.48*	3.14 (3-3.43)	*3.18 ± 0.41*	0.6517[a]
Value of tight glucose control	3 (2.57-3.43)	*2.93 ± 0.51*	2.86 (2.71-3.29)	*2.89 ± 0.49*	0.4080[a]
Psychosocial impact of diabetes	3.67 (3.5-4)	*3.77 ± 0.40*	3.83 (3.33-4)	*3.65 ± 0.52*	0.1377[a]
Patient autonomy	3.88 (3.5-4)	*3.77 ± 0.39*	3.75 (3.5-4)	*3.75 ± 0.42*	0.9130[a]
Overall	3.65		3.6		

Legend: Very positive: 4.21 – 5.00; Positive: 3.42 – 4.20; Neutral: 2.61 – 3.40; Negative: 1.81 – 2.60; Very Negative: 1.00 – 1.80
[a]Wilcoxon signed rank test was used

"Need for Special Training" (4.4), "Psychosocial Impact of Diabetes" (3.83), "Patient Autonomy" (3.75), "Seriousness of Type 2 Diabetes" (3.14), and "Value of Tight Glucose Control" (2.86).

A very positive response was documented on the subscale "Need for Special Training" while the "Seriousness of Type 2 Diabetes" and "Value of Tight Glucose Control" only garnered a neutral response. Across all subscales, no significant difference was seen pre- vs. post-education (*Table V*).

The change in capillary blood glucose levels after diabetes counseling is shown in *Table VI*. The majority have good glycemic control even at the start of the study. Although the median CBG values decreased post-education, no significant difference was observed pre- vs. post. The proportion of patients with controlled CBG levels also did not show a significant difference at post-education.

Of the 56 patients who delivered, two gave birth to twins, having a total sample size of 58 neonates. The mean neonatal weight was 2865.71 grams. The median APGAR at one minute was 8 and, at five minutes was 9. The median hemoglucose test on the first hour of the neonate's life was 60 gm/dL (IQR = 52-69). For the maternal outcomes, only 28 patients came back for the 75g OGTT. The fasting glucose was 105.86 ± 54.067 gm/dL and the mean value for the two-hour post-prandial was 157.39 ± 33.166 gm/dL (*Table VII*).

Discussion

We observed high pre-education knowledge scores which we attributed to counseling by the endocrinologists even before the DEC referral. Hence, the change in the median knowledge score post-education was not statistically significant because of the already high proportion of patients with adequate knowledge pre-counseling. Among the different domains, the distribution of correct answers was highest in the knowledge about diet and food values, and lowest in the GDM management category. This was similar to the study done in Malaysia by Hussain.[15] The high literacy on diet and food values in both studies may be explained by the more significant number of diet-controlled patients requiring no medication. On the other hand, the low knowledge scores on GDM management may be because of the lockdown implementation due to the surge of COVID-19, which limited the patients' follow-up consults.

Regarding demographic variables, a significant difference in knowledge scores was observed in those under 35 years ($p = 0.003$) and multigravid patients (p =

Table VI. Change in CBG Result Pre-vs Post-Education (n=75)

CBG	Pre-education Median (IQR)	Post-education Median (IQR)	p-value
Pre-breakfast	92 (IQR84-98)	89 (IQR83-97)	0.467[a]
Uncontrolled	1 (1.3%)	1 (1.3%)	1.000[b]
Controlled	74 (98.7%)	74 (98.7%)	
2-hrs post breakfast	108 (IQR99-120)	106 (IQR95-119)	0.221[a]
Uncontrolled	12 (16%)	10 (13.3%)	0.267
Controlled	63 (84%)	65 (86.7%)	
2-hrs post lunch	113 (IQR105-120)	111 (IQR100-120)	0.629[a]
Uncontrolled	10 (13.3%)	11 (14.7%)	1.000[b]
Controlled	65 (86.7%)	64 (85.3%)	
2-hrs post dinner	118 (IQR110-126)	116 (IQR106-122)	0.937*[a]
Uncontrolled	20 (26.7%)	7 (9.3%)	0.152[b]
Controlled	55 (73.3%)	68 (90.7%)	

[a]Wilcoxon signed rank test was used; [b]McNemar test was used

Table VII. Pregnancy Outcomes Post-Education

Neonatal Outcomes (n=58)	
Neonatal weight (in grams), Mean	2865.71 ± 585.676
APGAR score at 1 minute, Median	8 (IQR = 8-8)
APGAR score at 5 minutes, Median	9 (IQR = 9-9))
HGT at 1 hour of life (in mg/dl), Median	60 (IQR = 52-69)
Maternal Outcomes (n=28)	
Fasting glucose (in mg/dl), Mean	105.86 ± 54.067
< 126 mg/dl	23 (82.1%)
≥ 126 mg/dl	5 (17.9%)
2-hour post (in mg/dl), Mean	157.39 ± 33.166
< 200 mg/dl	26 (92.9%)
≥ 200 mg/dl	2 (7.1%)

0.015). Though a previous history of GDM was not elicited, the obstetric scores (gravidity and parity) assume that a higher knowledge level is attained from an increased frequency of interaction with a healthcare professional. Also, this was observed in those who received a higher level of education, i.e., secondary and tertiary education ($p = 0.014$, and $p = 0.083$, respectively), since they have a greater opportunity to access health-related literature, books, and internet sources.[15] This is consistent with the data presented by Steele et al.[22,] wherein individuals with the lowest educational attainment have an increased risk of developing Type 2 diabetes and its complications.

As for socioeconomic status, all participants regardless of employment, had a higher knowledge score post-counseling. The same finding was noted in those with lower family monthly income (*Table IV*). The drive to succeed may be the reason for such improvement. However, the demonstrated change in knowledge score in each category did not significantly differ. Therefore, diabetes education impacts knowledge advancement, but the change in knowledge score is not comparable by demographics.

The diabetes-related attitude of the 75 subjects was also evaluated and garnered an overall positive response. Among all the five subscales, the "Need for Special Training" had the highest score which portends patients' recognition of the importance of training among healthcare professionals in conveying an efficient technique for diabetes counseling. As stated by Dela Cruz, proficiency in this aspect will allow the healthcare professionals to effectively communicate the basic knowledge on diabetes, which will rectify patient's notions and misconceptions.[7]

The other subscales, "Psychosocial Impact of Diabetes" and "Patient Autonomy," have mean scores that yielded a generally positive response. This finding indicates that their health condition has emotional and psychological impacts which can affect their involvement in DM management. Nevertheless, the awareness of active participation and self-decision-making is perceived. With compassionate and competent individualized care, this subscale can be further strengthened.

Lastly, the "Seriousness of Type 2 Diabetes" and "Value of Tight Glucose Control" only garnered a neutral response. Perception improvement on these subscales is important since misguided information, such as diabetes complications, is inherent to the disease and not related to glycemic control. The linkage of hypoglycemia with medical treatment leads to poor management and impacts adherence to medical care.[18,19] Landmark studies and their follow-up proved that the incidence of both microvascular and macrovascular complications has been significantly reduced with tight glycemic control.[20] The subscales that garnered the highest and lowest scores (need for special training and value of tight glucose control, respectively) were similar to Dela Cruz's study. These findings emphasize the reinforcement of patient education to improve their diabetes-related attitude.

Regarding glycemic control, more than half met the target goal (FPG < 95 gm/dL, 2-hour PPG < 120 gm/dL) even before the diabetes session. The increased proportion of subjects with sufficient understanding of their disease at the start of the study likely elucidates this observation. Because of better disease knowledge, patients are more likely to involve themselves in management strategies to avoid the implications of poorly managed GDM, demonstrated by better median CBG values post-education, although they are not significantly different statistically.

With pregnancy outcomes, only a limited analysis was achieved since several participants were lost to follow-up. Despite this, the persistence of maternal hyperglycemia was still seen in 25% which is congruent with reports stating that Type 2 diabetes will develop in at least 20%, years after pregnancy.[1,3] Henceforth, focused maternal care including diabetes counseling should be provided for every patient to avoid such sequelae.

Strengths and Limitations. This is the first local study to investigate the effect of diabetes education on the knowledge and attitude among Filipino patients with GDM. The strengths include the experimental study design and the documentation of outcomes post-education. However, the researcher acknowledges that there are still notable limitations. First, this is only a single-centered trial and only one group was evaluated. It is recommended that a multi-center study be done to reflect the overall patients' characteristics and to include a control group for better evaluation. Second, the diagnostic studies were from multiple laboratories which could misclassify the outcome. Though a four-week interval between pre- and post-education testing was advised, some could not follow up on the assigned date. In addition, the target sample size was not met and there was a poor response rate in identifying persistent maternal hyperglycemia.

This arose because of the surge of COVID-19 in September and December, which resulted in a national lockdown that affected subjects' enrollment. Even if an online consultation was promulgated, there was a limit in the follow-up, likely due to technology illiteracy and financial reasons. Future studies with extensive study populations and demonstration of the long-term impact of diabetes education with unexposed and exposed groups (those who received education and those who did not) are recommended.

Conclusion

Poor knowledge of GDM and its consequences can result in detrimental fetal and maternal complications. With knowledge assessment, clinicians will be able to provide an individualized, comprehensive diabetes educational plan deemed fit to the needs of every patient. As such, the best patient outcome will be achieved.

Diabetes education enhances patients' knowledge and perception of their clinical condition, as shown by the increase in knowledge scores, but does not change attitude. Modification in the current diabetes education program and incorporation of interventions to address the non-significant changes in attitude and glycemic control are recommended since good knowledge does not necessarily translate to better attitude and clinical outcomes.

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