



Effectiveness of a breastfeeding education package on breastfeeding knowledge, attitude, self-efficacy, and breastfeeding practices among women with gestational diabetes mellitus: A randomized controlled trial

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Abstract:

BACKGROUND: Women with Gestational Diabetes Mellitus (GDM) frequently encounter challenges that impede successful breastfeeding, despite its significant benefits for postnatal glycemic control. This study aimed to evaluate the effect of the Breastfeeding Education Package (BFEP) on the knowledge, attitude, self-efficacy, and breastfeeding practices among pregnant women with GDM.

MATERIAL AND METHODS: This Randomized Controlled Trial was conducted in Selangor, Malaysia, randomized 58 pregnant women with GDM into an Intensive Breastfeeding Intervention (IBI) group ($n = 29$) or a control group (CG) ($n = 29$). The IBI group received three individualized dietitian-led education sessions. Knowledge, attitude, and self-efficacy were assessed at baseline and 37 weeks' gestation; breastfeeding practices were monitored for six months post-delivery.

RESULTS: A two-way repeated measures ANOVA confirmed the effectiveness of the intervention, revealing a significant difference between the IBI group and the CG in improving breastfeeding knowledge, attitude, and self-efficacy ($P < 0.005$). The IBI group attained significantly higher mean scores for knowledge (35.76 ± 5.77), attitude (89.91 ± 9.9), and self-efficacy (56.02 ± 8.17) compared to the CG ($P < 0.001$). This was reflected in practice, as the mean duration of exclusive breastfeeding (EBF) was longer in the IBI group (92.41 ± 82.14 days) than in the CG (55.59 ± 74.90 days). Furthermore, a Pearson's correlation within the IBI group identified a small, positive relationship between knowledge and attitude scores and the subsequent length of EBF.

CONCLUSION: BFEP is an effective intervention that significantly improves the antenatal knowledge, attitude, and self-efficacy of mothers with GDM. These psychosocial enhancements, in turn, translate into a longer duration of breastfeeding post-delivery.

Keywords:

Breastfeeding, education, gestational diabetes mellitus, postpartum

Introduction

Diabetes during pregnancy is widely recognized as a well-established risk factor for developing diabetes later in life. Evidence from previous studies

has demonstrated that breastfeeding can support optimal glycemic control in women with GDM and has further recommended its integration with broader lifestyle interventions as a comprehensive management strategy for this population.^[1-3]

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During breastfeeding, the mother's body releases a hormone called prolactin, which encourages the production of milk. Additionally, prolactin also triggers the release of insulin from pancreatic beta cells to normalize blood glucose levels in the body. Research indicates that pancreatic beta cells are capable of synthesizing serotonin when nursing. This hormone functions as an antioxidant and aids in diminishing oxidative stress, thus promoting the well-being of the beta-pancreatic cells of the mother. Research has shown that serotonin promotes the growth of pancreatic beta-cells, increasing the mass cells and aiding in the control of blood glucose levels.^[4] These strategies are feasible, efficient, and cost-effective. They can be implemented throughout pregnancy and early postpartum to prevent the development of pre-diabetes and diabetes in the future.^[5]

Globally, breastfeeding rates remain significantly below the global established target.^[6,7] In high-income countries, fewer than 20% of women continue breastfeeding until 12 months, a rate lower than that observed in low- and middle-income countries.^[8] However, the percentage of newborns exclusively breastfed for six months in low and middle-income countries is only 37%. These findings contrast with data suggesting that higher socioeconomic status is linked to an approximately 10% reduction in the likelihood of discontinuing breastfeeding within the first three months.^[9]

In Malaysia, despite various awareness initiatives and programs promoting breastfeeding benefits, the EBF rate remains below the recommendations set by the World Health Organization's.^[10] The National Health and Morbidity Survey (NHMS) 2016 reported the proportion of infants EBF for up to 6 months remained significantly lower than the global target of 70% projected for 2030. However, an increasing trend was observed, rising from 23.3% in 2011 to 47.1% in 2016. According to the most recent NHMS in 2022, no data were reported on EBF during the first six months of life. However, the survey indicated that 50.5% of women continued breastfeeding their children between 12 and 23 months. Additionally, the report highlighted that 60.4% of children aged zero to 23 months were fed using a bottle.^[11]

A similar trend is expected among women with previous GDM in Malaysia. However, there is currently a lack of published data on this topic. In Thailand, the prevalence of EBF among women with GDM has been reported at 23%, which falls below the global target.^[12] To improve breastfeeding rates, healthcare practitioners should offer comprehensive breastfeeding information, guidance on feeding choices, and assistance moms in initiating breastfeeding in order to enhance breastfeeding rates. This study aimed to evaluate the effectiveness of a

Breastfeeding Education Package (BFEP) in improving breastfeeding knowledge, attitude, and self-efficacy, as well as its impact on breastfeeding practices between the experimental and control groups.

Materials and Methods

Study design and setting

This study was a single-blinded, parallel-group, randomized controlled trial conducted at the Meru Mother and Child Health Clinic in Malaysia (Thai Clinical Trial Registry ID: TCTR20220119002). Eligible participants were randomly allocated via unrestricted randomisation to either the Intensive Breastfeeding Intervention (IBI) group, which received a specialized BFEP, or a control group (CG) that received standard clinic care.

Study participants and sampling

The researcher recruited participants who volunteered during the second trimester of pregnancy, at or after 20 weeks of gestation. Participants must be primiparous, Malaysian women aged 18–45 with a singleton pregnancy. Participant's pre-pregnancy BMI >22.9 kg/m², diagnosed with GDM, received antenatal care in Meru Mother and Child Health Clinic, and has the intention to breastfeed their babies. Meanwhile, participants with an illness that prevents them from breastfeeding the infants, who are already diagnosed with GDM and overt diabetes, women carrying a fetus with abnormalities that prevent natural breastfeeding, and women with multiple pregnancies. Before enrolling, participants were required to complete a consent form. They were informed that participation in the study was entirely voluntary and that they could withdraw without any consequences.

Sample size

The sample size was determined using a developed formula to ensure adequate statistical power for the study.^[13] A previous study reported a pooled standard deviation of 0.68, utilizing the mean difference between the high-intensity and non-high-intensity breastfeeding groups, approximately 0.64 HOMA-IR at twelve to fourteen months postpartum.^[14] The required sample size is 80% statistical power at a significance level of 5%. Twenty-seven participants, together with a 10% dropout rate, were recruited per arm. Hence, a total of 60 participants were recruited in this study.

Randomization

Participants' group allocation was based on unrestricted randomization. A computer algorithmically generated the randomization process, employing the concept of iteratively flipping coins. An equitably generated sequence of A and B was produced randomly (ABBAABAB...).

A (IBI) and B (CG) groups were assigned in a 1:1 treatment allocation. Eligible participants successively received the subsequent treatment, with the first participants receiving A (IBI), the second participants receiving B (CG), the third participants receiving B (CG), and so on. The participants' admission was staggered, meaning they entered the study sequentially over time as they became eligible and available. This approach minimized the likelihood of treatment contamination because all participants were blinded. Participants were called project participants in a generic sense, unaware that two distinct groups were undergoing different treatments.

Furthermore, all consultations and interventions were conducted individually in a separate room within the clinic. Due to the nature of the study, the investigators could not be blinded to which intervention group the participants were assigned. However, the investigators ensured fairness and impartiality in the treatment of participants in both groups.

Intervention

The IBI group received a three-session BFEP starting at approximately 20 weeks' gestation. This validated educational package^[15] was developed using an adapted methodology as previously described.^[16] These packages were developed according to the guidelines from the Training Module for Health Professionals on breastfeeding promotion by the World Health Organisation (WHO).^[17] The instructional material was distributed to participants through flip charts, video clips, and leaflets as supplementary visual aids.

Three appointments were strategically scheduled to align with the participants' routine antenatal consultations at the clinic, facilitating the delivery of BFEP. Each session was conducted on an individual basis by a dietitian to ensure consistency in the delivery of content across the study period. The counseling took place in a private room within the health clinic, immediately following the participant's antenatal check-ups. During these sessions, the researcher utilized a laptop to present the educational material. Each session lasted approximately 30 to 40 min.

During the first series of BFEP which is in the form of short video clip, participants were exposed to the process of human milk production adapted from BJC HealthCare, discovering the composition of human milk and how it changes over time to meet the baby's requirements, explaining the benefits of breastfeeding, and detailing breastfeeding preparation before, during, and after delivery. This module was scheduled to be delivered between the 20th and 24th weeks of gestation.

The novelty of this education package is that it highlights the beneficial effects of breastfeeding among women with

GDM and how breastfeeding can help control postnatal maternal blood glucose. Given that primigravid women are the target population of this study, this education package included the preparation for breastfeeding women throughout the antenatal to post-delivery.

The second series introduced the participants to foremilk, hindmilk, colostrum, transitional, and mature milk. The session was conducted during the gestational period between the 28th and 32nd weeks. They learned about the changes in the milk composition to accommodate the baby's growing needs. They also learned how much food a newborn's stomach can hold from day one and at one month. As new mothers, participants must familiarize themselves with the baby's feeding cues. This education package also included information on signs that the baby is receiving enough milk by monitoring the frequency of diaper changes based on the baby's age.^[18]

Participants are introduced to various breastfeeding positions suitable for both normal and cesarean births. Common problems during breastfeeding, such as inverted or sore nipples, long nipples, breast engorgement, clogged mammary glands, milk rejection by the baby, and milk oversupply, are presented in this education package along with their solutions.^[18] Participants also receive education to help distinguish between breastfeeding myths and facts. By the end of the education package, they are exposed to appropriate latching techniques^[19] to prevent sore nipples or nipple cracks, which are common issues that were delivered via a video clip from the National Health Services.^[20]

Final education package was identifying foods that identified as milk booster or milk suppressor, understanding facts and myths related to food consumption during confinement, recognizing suitable breast pump options available on the market, demonstrating proper techniques for expressing breast milk by hand, learning feeding skills using a cup and spoon, and managing breast milk at the workplace, as outlined by Ministry of Health (MoH) of Malaysia.^[18] At the end of each session, participants in the IBI group received a pamphlet that concisely summarized the topics discussed during the consultation. This pamphlet served as a helpful resource for additional reference at home. This final series of the module was delivered between the 34th and 36th weeks of gestation.

Control group

The participants in the CG received conventional antenatal care, which is currently practiced at the Meru Mother and Child Health Clinics. Breastfeeding teaching sessions were conducted in a group during the maternal glucose tolerance test (MGTT) procedure, scheduled once a month on Fridays. Observations indicated that

some participants could not attend these sessions due to their timing, which did not always align with their MGT appointments. Additionally, participants in the CG were provided with breastfeeding booklets during their prenatal evaluations conducted by the nurses.

The conventional breastfeeding education provided in clinical settings in Malaysia has previously been clearly defined,^[21] where breastfeeding education was delivered during immunization visits, facilitating interaction with lactation counsellors through informational materials or pamphlets received during antenatal or postnatal check-ups, and offering guidance from healthcare professionals, the media, peer counsellors, family members, or friends.

Data collection tools and techniques

Structured infant dietary intake questionnaire

The frequency and intensity of breastfeeding were assessed monthly from the delivery time to the final follow-up at six months. This evaluation was conducted through both face-to-face and telephone interviews. A questionnaire was used to assess breastfeeding practices—specifically duration and exclusivity—based on the methodology of a prior study, conducted with the author's explicit consent.^[22] Experts have validated and reviewed the Malay version of the questionnaire.^[22] The assessment consists of two parts: the first focuses on the mother's feeding practices for her baby, and the second categorizes breastfeeding exclusivity.

Breastfeeding Knowledge and Attitude Questionnaire (KA-BFQ)

Successful breastfeeding requires both strong knowledge and a positive mindset. To evaluate these factors, a tool was used to assess the level of knowledge and attitude towards breastfeeding among participants in the IBI group before and after the intervention and to observe any changes in the CG. This assessment was conducted at enrolment to establish baseline data, then at week 20, and re-evaluated at week 37 of pregnancy before the participants gave birth. The validity of the questionnaire was confirmed by,^[23] with Cronbach's alpha values of 0.85 for knowledge and 0.79 for attitude.

The questionnaire consists of 47 items that assess knowledge about breastfeeding and 23 items that evaluate attitudes towards breastfeeding. The knowledge component is divided into 10 sub-domains, which cover various aspects of breastfeeding, including its benefits for both the infant and the mother, colostrum, proper feeding techniques, expressing breast milk, introducing complementary foods, duration of breastfeeding, common breastfeeding challenges, breast engorgement, and practical advice for successful breastfeeding. Participants were provided with three response options:

“true,” “unsure,” and “false.” Correct responses were scored as “1,” while inaccurate or uncertain responses were scored as “0.” Items with contradictory statements were assessed accordingly.

The breastfeeding attitude questionnaire comprises 23 items divided into three sub-domains: cognitive, affective, and behavioral. Participants rated their responses using a five-point Likert scale, ranging from “strongly agree” to “strongly disagree.” The scores for the attitudes were assessed based on this scale, with negatively worded statements having their scores reversed. Thus, higher scores on these items indicate a more positive attitude towards breastfeeding. The scores for each item within the knowledge and attitude domains were aggregated to obtain a comprehensive score for each domain.

Outcomes

Breastfeeding knowledge, attitude, and self-efficacy were evaluated for both groups at the beginning of the recruitment and at week 36 before the participants' delivery. Meanwhile, breastfeeding practices were evaluated monthly until six months after delivery.

Ethical consideration

Before commencement, the study protocol obtained ethical approval from the Universiti Teknologi MARA Research Ethics Committee (REC) (ID: REC/08/2021(MR/678)) and was registered with the National Medical Research Register (NMMR) (ID: NMMR-19-4204-52471(IIR)).

Statistical analysis method

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software version 26 (SPSS Inc., Chicago, USA). Statistical significance was determined with a two-tailed P value threshold of less than 0.05. Descriptive statistics were employed to provide an overview of participants' socio-demographic data and maternal characteristics. Numerical data were presented using means and standard deviations. The normality of the data was evaluated using the Shapiro-Wilk test, with $P > 0.05$ indicating that the data were normally distributed. An independent t -test was conducted to confirm the similarity of baseline characteristics between the two groups and to compare baseline values and the endpoint. This test assessed the outcomes of the two groups, with a significance level set at $P < 0.05$. A two-way repeated measures ANOVA was used to assess the effects of two distinct interventions (IBI group and CG) on participants' breastfeeding knowledge, attitude, and self-efficacy scores across two periods. Pearson's correlation was used to assess the length of exclusive breastfeeding (EBF) and breastfeeding scoring in both the IBI and CG. This study used complete case analysis to handle missing

data. Complete case analysis was identified as the most frequently utilized method for managing missing data in primary analyses, accounting for approximately 45% of randomized controlled trials (RCTs).^[24]

Result

At the beginning of this study, 97 primigravid participants were contacted for the study. Twenty-six participants (27%) did not meet the criteria and were excluded from the study [Figure 1]. Reasons for exclusion included medication use and twin pregnancies for 14 participants at Meru Health Clinic. Additionally, 12 individuals were not interested in participating in this study. Seventy-one participants were randomly assigned to either the IBI group ($n = 35$) or the CG ($n = 36$). Of these, 13 participants were excluded due to miscarriage, relocation, withdrawal, or missing data. Ultimately, 29 participants from each group completed the study from March 2022 to August 2023. Given that the attrition rate was 3.3%, below the 5% threshold, the missing data were excluded from the final analysis following the principles of complete case analysis.^[24]

The majority of participants were of Malay ethnicity, with only 6.9% ($n = 2$) of the CG being of Indian ethnicity. There was no significant difference in educational attainment between the two groups. In the IBI group, 16% received secondary education and 13% received higher education. In contrast, 35% of individuals in the CG had secondary education, while 65% had tertiary education. Additionally, a higher proportion of individuals in the IBI group (38%, $n = 11$) were reported as unemployed compared to the CG, where 24.2% ($n = 7$) were unemployed [Table 1].

In terms of monthly household income, more than half of participants (76%) in the IBI group reported incomes between RM 2500 and RM 4849, while 21% had household

income between RM 4859 to RM10 959. Similarly, in the CG, 83% of participants had household incomes between RM 2500 and RM 4849, and 17% fell within having the RM 4859 to RM10 959 range. The majority of participants in this study were categorized under the B40 household group. Only 3% ($n = 1$) of the IBI participants were categorized in the T20 household group, with monthly incomes exceeding RM 10 960. Household income categories were based on the Department of Statistics Malaysia (DOSM). The findings suggest that the socio-demographic and socio-economic characteristics of the participants were similar across groups.

During the recruitment process, the average age of participants was 27.03 ± 3.3 years in the IBI group and 28.14 ± 3.0 years in the CG. The pre-pregnancy weight for the IBI group was 73.34 ± 19.76 kg, compared to 64.38 ± 14.46 kg in the CG. The pre-pregnancy BMI was 29.27 ± 7.3 kg/m² in the IBI group and 26.90 ± 5.9 kg/m² in the CG. In the IBI group, 58.6% ($n = 17$) of participants had a family history of diabetes, while 48.3% ($n = 14$) of those in the CG had family members with T2DM. None of the participants were taking medication or undergoing insulin therapy. These findings indicate that the obstetric characteristics were similar among participants during recruitment.

At baseline, the mean score for breastfeeding knowledge in the IBI group was 20.79 ± 6.95 , compared to 21.06 ± 6.20

Table 1: Socio-Demographic and Socio-Economic Background of Participants in the Intensive Breastfeeding Intervention (IBI) Group and Control Group (CG) at Baseline (N=58)

Characteristics	IBI Group $n=29$ n (%)	CG $n=29$ n (%)
Ethnicity		
Malay	29 (100)	27 (93.1)
Indian	-	2 (6.9)
Education Level		
Secondary	16 (55.2)	10 (34.5)
Tertiary	13 (44.8)	19 (65.5)
Participants' Occupation		
Unemployed	11 (38)	7 (24.2)
Government Servants	0 (0)	3 (10.3)
Private Sectors	15 (51.7)	18 (62.1)
Self-employed	3 (10.3)	1 (3.4)
Participants Partners' Occupation		
Unemployed	1 (3.4)	2 (6.9)
Government Servants	0 (0)	0 (0)
Private Sectors	23 (79.3)	24 (82.8)
Self-employed	5 (17.3)	3 (10.3)
Monthly household income		
RM2500- RM 4849	22 (76)	24 (83)
RM4850- RM 10 959	6 (21)	5 (17)
>RM 10960	1 (3)	0 (0)

*IBI=Intensive breastfeeding intervention, CG=Control group, RM=Ringgit Malaysia

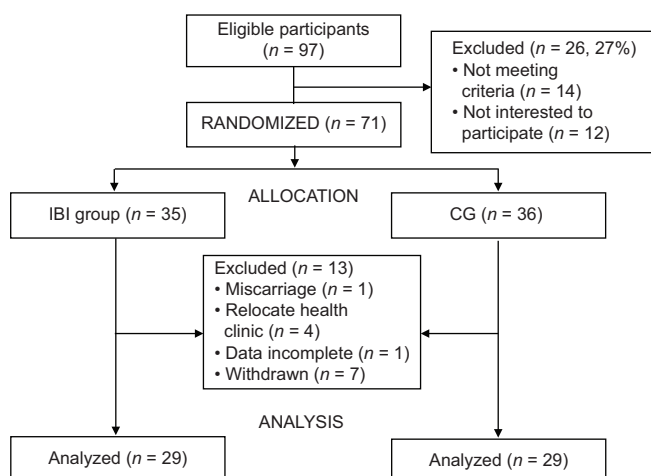


Figure 1: Participant Recruitment and Follow-Up

in the CG. Similarly, there were no significant differences in breastfeeding attitudes and self-efficacy scores. The total score for breastfeeding attitude was 79.90 ± 6.00 in the IBI group and 80.86 ± 6.07 in the CG, indicating comparable outcomes. The total score for breastfeeding self-efficacy was 45.79 ± 8.98 for the IBI group and 44.27 ± 7.36 for the CG. These results suggest that participants in both groups had similar levels of baseline breastfeeding knowledge, attitude, and self-efficacy.

A substantial main effect for time was observed in breastfeeding knowledge scores, Wilk's Lambda = 0.38, $F(1, 56) = 92.8$, $P < 0.005$, partial eta squared = 0.624. The main effect comparing the two types of intervention was also significant, $P < 0.005$, partial eta squared = 0.16, indicating a very large effect size. These results suggest significant differences in the effectiveness of the IBI group compared to the CG in improving breastfeeding knowledge [Table 2].

There was a significant interaction in breastfeeding attitudes between the two groups over the two time periods (baseline and 37 weeks of gestation), which spanned 12 weeks throughout the pregnancy, Wilk's Lambda = 0.75, $F(1, 56) = 18.5$, $P < 0.001$, partial eta squared = 0.26. The effect size for the interaction between time and group in breastfeeding attitude is very large. A substantial main effect for time in breastfeeding attitude scores was observed, Wilk's Lambda = 0.71, $F(1, 56) = 22.6$, $P < 0.001$, partial eta squared = 0.295, indicating a very large effect size. The main effect comparing the two types of intervention was significant, $P < 0.05$, partial eta squared = 0.089, suggesting a moderate effect size. These findings indicate significant differences in the effectiveness between the IBI group and the CG in improving breastfeeding attitudes.

A significant difference was observed in breastfeeding self-efficacy between the time and group over the 12 weeks of intervention during pregnancy. The results indicated a substantial interaction effect, Wilk's Lambda = 0.71, $F(1, 56) = 22.95$, $P < 0.001$, partial eta squared = 0.291, suggesting a very large effect size. There was also a significant main effect for time in breastfeeding self-efficacy scores, Wilk's Lambda = 0.51,

$F(1, 56) = 55.05$, $P < 0.001$, partial eta squared = 0.496, indicating a very large effect size. The main effect comparing the two types of intervention was significant, $P < 0.05$, partial eta squared = 0.14, which also suggests a very large effect size for the differences between groups. These findings indicate that there were significant differences in the effectiveness of the IBI group compared to the CG in improving breastfeeding self-efficacy.

A significant increase in the mean scores for breastfeeding knowledge, attitude, and self-efficacy in the IBI group over the 12-week intervention period during antenatal care.

In the IBI group, participants achieved significantly higher scores in breastfeeding knowledge, attitude, and self-efficacy, with mean scores of 35.76 ± 5.77 , 89.91 ± 9.9 , and 56.02 ± 8.17 , respectively ($P < 0.001$). In contrast, the CG had lower scores in these areas, with mean scores of 25.10 ± 8.74 , 81.34 ± 7.15 , and 46.51 ± 6.58 , respectively. These results demonstrate that the IBI group had significantly higher scores in breastfeeding knowledge, attitude, and self-efficacy compared to the CG. This suggests that the BFEP was effective in enhancing these aspects among GDM mothers in the IBI group during pregnancy.

Both groups assessed breastfeeding outcomes monthly from delivery until six months postpartum. The IBI group exhibited a longer duration of exclusive breastfeeding, averaging 92.41 ± 82.14 days, compared to the CG's 55.59 ± 74.90 days. However, this difference was not statistically significant (refer to Table 3). Similarly, the overall duration of breastfeeding, including both exclusive and partial breastfeeding, was longer in the IBI group (19.28 ± 6.35 weeks) compared to the CG (16.79 ± 8.38 weeks). This difference was also not statistically significant.

In the IBI group, the relationship between scores for breastfeeding knowledge, attitude, and the length of EBF was found to be small and positive, though not statistically significant. Additionally, there was a small, negative correlation between breastfeeding self-efficacy scores and the length of EBF in the IBI group ($r = -0.17$, $n = 29$, $P = 0.39$).

Table 2: Breastfeeding Knowledge, Attitudes, and Self-Efficacy Between Intensive Breastfeeding Intervention (IBI) Group and Control Group (CG) at Baseline and 37 Weeks of Gestation ($n=58$)

Parameters	Group				<i>P</i>		
	IBI Group ($n=29$)		CG ($n=29$)		Time* Group Effect	Time Effect	Intervention Effect
	Baseline Mean $\pm$ SD	37 week of gestation Mean $\pm$ SD	Baseline Mean $\pm$ SD	37 week of gestation Mean $\pm$ SD			
Breastfeeding Knowledge	20.79 $\pm$ 6.96	35.76 $\pm$ 5.77	21.07 $\pm$ 6.22	25.10 $\pm$ 8.74	<.001*	<.001*	0.36
Breastfeeding Attitudes	80.15 $\pm$ 6.14	89.81 $\pm$ 9.98	80.86 $\pm$ 6.07	81.34 $\pm$ 7.15	<.001*	<.001*	0.26
Breastfeeding Self-efficacy	45.79 $\pm$ 8.98	56.21 $\pm$ 8.17	44.28 $\pm$ 7.36	46.52 $\pm$ 6.58	<.001*	<.005*	0.29

IBI=Intensive Breastfeeding Intervention, CG=Control group. * $P < 0.05$

Table 4 presents breastfeeding initiation on the first day following birth for each group. Feeding methods included cup, spoon, or direct feeding, ensuring the baby received breast milk. The IBI group initiated breastfeeding at an average of 1.34 ± 0.77 days after birth, while the CG began breastfeeding at 2.93 ± 0.87 days. Direct feeding in the IBI group started approximately 15.86 ± 26.06 hours after delivery, compared to 18.83 ± 28.90 hours in the CG. The average initiation of direct feeding was 1.38 ± 0.77 days for the IBI group and 1.52 ± 1.02 days for the CG. No significant differences were observed between the two groups regarding breastfeeding initiation.

Discussion

The finding that this individualized BFEP significantly improved knowledge, attitude, self-efficacy and practices among women with GDM. The success of this intervention in improving knowledge, attitude, and self-efficacy is consistent with a growing body of evidence from diverse settings. This aligns with previous research in diverse settings, such as Ethiopia and other parts of Malaysia, which also found that targeted antenatal education leads to superior breastfeeding knowledge and higher rates of EBF compared to standard care.^[25,26] The intervention's foundation in self-efficacy theory, enhancing a mother's belief in her capabilities, likely contributed to the positive outcomes, a principle supported by recent trials showing that individualized support boosts maternal confidence and breastfeeding success.^[27]

The effectiveness of this targeted approach is particularly salient in the Malaysian context, where previous surveys have indicated that even with adequate knowledge, mothers' attitudes toward breastfeeding can be suboptimal, suggesting that standard group

education in clinics is insufficient.^[28] The standard care, often delivered in group settings tied to specific clinic appointments, can be inaccessible for many mothers.^[29] This study suggests that an individualized approach, in contrast, effectively addresses personal barriers and enhances maternal motivation.

A unique contribution of this study is its focus on the specific needs of women with GDM, a group at high risk for future Type 2 Diabetes Mellitus (T2DM). Research from other countries, like Japan, has shown that even in developed healthcare systems, education on the protective metabolic benefits of breastfeeding for GDM mothers is often lacking.^[30] This study addresses a similar data gap in Malaysia, providing a validated educational model that not only supports breastfeeding but also serves as a preventive health strategy for this high-risk population. The findings underscore a critical need to communicate the long-term protective effects of breastfeeding better and adapt existing protocols, like the Baby-Friendly Hospital Initiative (BFHI), to meet the specific informational needs of these mothers.^[31]

Despite the intervention's success, there was a decline in EBF rates over the six-month postpartum period in both groups, a trend consistent with findings from other GDM cohorts, such as in Norway.^[3] However, it is noteworthy that the EBF rates in the IBI group were considerably higher than those reported in several other studies, where rates were significantly lower at similar postpartum time points.^[12,32] Nevertheless, the rates still fall short of the global targets set by the World Health Organization (WHO), highlighting the persistent and multifaceted challenges to maintaining EBF.^[33]

Several factors likely explain these challenges. A critical finding from this study was a significant delay in breastfeeding initiation, a factor strongly linked to shorter EBF duration.^[34] This delay appears more pronounced in GDM cohorts compared to the general population in Malaysia.^[21,35] The physiological complications associated with GDM, such as higher rates of caesarean sections, birth trauma, and neonatal complications like hypoglycemia requiring NICU admission, are well-documented barriers that lead to mother-infant separation and interfere with early initiation.^[28,36,37] Furthermore, external factors such as maternal return to work present a significant hurdle to continued breastfeeding, underscoring the need for supportive workplace policies.^[37,38]

This study also sheds light on systemic barriers within the healthcare setting. Mothers with GDM often receive generic breastfeeding advice rather than support tailored to their unique challenges. This may stem from a lack

Table 3: The Comparison of Breastfeeding Duration and Exclusivity between Intensive Breastfeeding Intervention (IBI) Group and Control Group (CG) (n=58)

	Group		P
	IBI Group n=29	CG n=29	
Length of Exclusive Breastfeeding (Days)	92.41±82.14	55.59±74.90	0.08
Length of Breastfeeding (Weeks)	19.28±6.35	16.79±8.38	0.21

IBI=Intensive Breastfeeding Intervention, CG=Control Group

Table 4: The Comparison of Breastfeeding Initiation between Intensive Breastfeeding Intervention (IBI) Group and Control Group (CG) (n=58)

Breastfeeding Initiation	Group		P
	IBI Group n=29	CG n=29	
Initiate Breastfeeding (Day)	1.34±0.77	2.9±8.71	0.33
Initiate Direct Feeding (Hours)	15.86±26.06	18.83±28.90	0.68
Initiate Direct Feeding (Day)	1.38±0.77	1.52±1.02	0.56

IBI=Intensive Breastfeeding Intervention, CG=Control group

of specialized training among healthcare providers regarding GDM, poor interprofessional collaboration between obstetric and pediatric departments, and insufficient time and personnel to provide comprehensive guidance.^[28] These findings call for enhanced training for healthcare professionals and a more integrated, collaborative approach to lactation support for this specific population.

This study appears to be the first randomized controlled trial in Malaysia to provide a comprehensive breastfeeding intervention for women with GDM, tracking outcomes from the antenatal period through six months postpartum. The study provides strong evidence that a targeted, theory-based educational package is superior to standard care. This validated module can be implemented in clinical practice to improve maternal health literacy and breastfeeding outcomes, offering a crucial preventive strategy to reduce the long-term risk of T2DM in this high-risk population. It is essential that such interventions are tailored to the specific needs of mothers with GDM and involve crucial support from spouses and family members.^[39]

Limitations and recommendations

One notable limitation of this study was that many participants returned to their hometowns during the period of confinement, making them inaccessible for breastfeeding support during the first few months postnatal. To address this challenge, the researcher developed a short instructional video demonstrating proper latching techniques. This resource was made available to participants in the IBI group, allowing them to access breastfeeding guidance remotely and at their convenience.

The findings confirm that the IBI group exhibited superior improvements in breastfeeding knowledge, attitude, self-efficacy, and practices. However, several considerations are warranted to enhance the robustness and generalizability of these results. Subsequent studies should employ larger cohorts and extended intervention periods to validate the long-term effects of such support. Critically, future research must also include participants from more diverse backgrounds to address the current lack of data regarding breastfeeding practices among Malaysian women with GDM from Indian, Chinese, and other ethnic groups.

Conclusion

These findings demonstrate that the BFEP significantly improved breastfeeding knowledge, attitude, and self-efficacy among pregnant women with GDM. The scores in the IBI group showed a statistically significant improvement in breastfeeding knowledge,

attitude, and self-efficacy ($P < 0.005$). Furthermore, it has been proven to improve the rate of EBF, length of EBF and mixed feeding, and the breastfeeding intensity of women with GDM in the IBI group. The study revealed that the length of EBF positively correlated with breastfeeding knowledge, attitude, and intention, although these findings were not statistically significant.

Nevertheless, the IBI was not effective in encouraging early breastfeeding initiation immediately after birth and sustaining the higher rate of breastfeeding for the 6 months following childbirth. It is worth noting that while the BFEP appeared to improve certain breastfeeding outcomes among participants in the IBI group, the intervention did not sustain breastfeeding frequency, duration, or intensity within the first six months after delivery. Both groups experienced a significant decrease in breastfeeding frequency, duration, and intensity during the six-month postnatal period ($P < 0.001$).

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Author's contributions

FAS: Conception and design. FAS: Analysis and interpretation of the data. FAS: Drafting of the article. SB and AS: Critical revision of the article for important intellectual content. SB and AS: Final approval of the article. FAS: Provision of study materials or patients. SB and AS: Statistical expertise. FAS: Obtaining of funding. FAS: Administrative, technical, or logistic support. FAS: Collection and assembly of data.

Declaration of artificial intelligence assistance

The authors acknowledge the use of artificial intelligence tools to support language editing and writing enhancement during the preparation of this manuscript. All ideas, content, analyses, and interpretations are entirely the authors' own and remain their sole responsibility.

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Conflicts of interest

There are no conflicts of interest.

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