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The Effect of Health Education on Knowledge, Attitude and Practice of Folic Acid Supplementation among Periconceptional Women at the Health Clinic in Kuala Lumpur

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ABSTRACT

Background: Neural tube defects (NTDs) are congenital abnormalities of the central nervous system that can be prevented by consuming 400 µg of folic acid daily during conception until the twelfth week of pregnancy. Malaysia is experiencing an increase in NTD cases. Addressing women's knowledge, attitudes, and practices regarding folic acid- and folate-rich foods is crucial to reduce the incidence of NTDs. **Objectives**: This study aimed to evaluate the impact of a health education program on improving knowledge, attitudes, and practices related to folic acid supplementation among periconceptional women in a community clinic. **Methods**: A pre- and post-quasi-experimental study was conducted among 114 periconceptional women in two groups. The intervention group received structured Folic Acid supplementation education, while the control group received routine antenatal care. **Results**: Regarding knowledge, the intervention significantly improved the scores of the intervention group, increasing from 13.40 to 15.39. This improvement was statistically significant, with a mean difference of 1.98 ($p < 0.001$), large effect size of 0.16, and strong statistical power of 0.89. Meanwhile for attitude, the intervention group experienced a more significant increase in scores, from 25.72 to 27.46. Statistically significant effects were observed ($p = 0.031$), along with a large effect size 0.26 and relatively high statistical power 0.99. In terms of practice, the intervention group showed a significant improvement, with scores increasing from 27.68 33.16. The findings were significant, with a mean difference of 5.47 ($p < 0.001$), extreme effect size of 0.74, and strong statistical power of 1.00. **Conclusion**: A comprehensive health education program for pregnant women can significantly improve their understanding, attitude, and adherence to folic acid supplementation. In addition, it is essential to promote the consumption of folic acid-fortified foods.

Keywords: Attitude; Folic Acid; Health Education; Pregnancy Planning; Supplementation, Women

INTRODUCTION

Folate, often known as vitamin B9, is a water-soluble vitamin naturally found in foods such as wheat, cereals, beef, fish, shellfish, and eggs. Folic acid (FA) is a synthetic form of folate that is consumed as a nutritional supplement. Folic acid consumption prior to pregnancy and during the early stages of pregnancy has been proven to prevent neural tube defects (NTDs), an abnormality that affects the fetal spine. Enriched folate micronutrients reduce anomalies in the neural tube (Jamil *et al.* 2017). WHO (2016) recommended that women of reproductive age take 400 g of FA daily two months prior to conception, until 12 weeks of gestation. The high need for folic acid during this period aids in the formation of the fetal spine.

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Zaganjor *et al*. (2016) reported that South-East Asia recorded the world's third-most prevalent region for the incidence of NTD, which ranged from 0.3 to 199.4 per 10,000 newborns. The incidence of neural tube disease in Malaysia is estimated to be 6.5 cases per 10 000, (MOH, 2019). Sahmat *et al*. (2017) reported that the number of spinal bifida cases between 2013 and 2016 in the University of Malaya Medical Centre was 8.9 per 1000 newborns.

The above issues illustrate an increasing trend in neutral-tube defects. Awareness among the community, specifically women of reproductive age, regarding the importance of FA supplementation and consuming folate-enriched food for fetal and maternal health is essential. Keshavarzi *et al.* (2016) revealed that pregnant mothers lacked knowledge, attitude, and practice about FA. Women do not understand the benefits of FA during the periconceptional period (Garcia *et al*., 2018). Therefore, women's knowledge, attitudes, and practices influence supplementation with folic acid and folate-enriched foods. An increased intake of multivitamins and folate before conception and throughout the first trimester of pregnancy can help reduce the occurrence of NTD. Comprehensive guidance, information, and awareness-raising are important for women of childbearing age to avoid or reduce congenital abnormalities.

In Malaysia, the healthcare provider at the health clinics provides FA supplementation to the community through pre-pregnancy care services. However, this service only reaches pregnant mothers who are at high risk, while other expectant mothers do not have the opportunity to be exposed to FA Health Education. Therefore, it is essential to provide health education to periconceptional women to enhance their knowledge, attitude, and practice of folic acid supplementation for excellent maternal and child health. Hence, this study aimed to evaluate the effect of a health education program on improving the knowledge, attitude, and practice of folic acid supplementation among periconceptional women in a community clinic.

Study Objective

To evaluate the effect of a health education program on improving knowledge, attitude, and practice of folic acid supplementation among periconceptional women at a community clinic.

Hypothesis

Null Hypothesis

There is no statistically significant improvement in the knowledge, attitude, and practice of folic acid supplementation among periconceptional women following the implementation of the health education program at the community clinic.

Alternative Hypothesis

There is a statistically significant improvement in the knowledge, attitude, and practice of folic acid supplementation among periconceptional women following the implementation of the health education program at the community clinic.

METHODOLOGY

Research Design and Setting

A pre- and post-quasi-experimental study involving the intervention and control groups was conducted. This study was carried out at two different health clinics in the Cheras district of Kuala Lumpur in compliance with the homogeneity of the population. The control group respondents were from the Jinjang Health Clinic, whereas the intervention group respondents were from the Cheras Health Clinic. The study commenced in December 2021 and was completed in May 2022.

Population and Sample

The sample size calculation for a clinical trial (CT) involving the comparison of two means was utilized, as proposed by Sakpal (2010). The significance level was set at 5%, with a desired power of 80% for a two-sided test. The calculated sample size per group was 54, accounting for an anticipated dropout rate of 10%. However, due to the impact of the COVID-19 pandemic, an extra 20% increase in dropouts was considered, which necessitated a total of 64 respondents per group.

Eligibility Criteria

This encompassed women within the reproductive age range of 19 to 49 years, including primigravida and multipara. Eligible candidates were those who had confirmed a positive pregnancy status within the first trimester and completed the registration process at the involved health clinics. Additionally, participants were required to possess a reasonable understanding of both Malay and English and maintain a generally good state of health. Access to either Android or iOS mobile phones is required. However, women hospitalized due to illness were not included in the study.

Instruments and Procedures

A structured intervention program was implemented to provide health education to the intervention group, while the control group received routine services from health professionals. The contents of these health education interventions were derived from the Malaysian Ministry of Health's Folic Acid Guidelines (2017) and the Centers for Disease Control and Prevention's Folic Acid Supplementation Guidelines (CDC 2009). The intervention program was designed to educate women on folic acid supplementation using a multicomponent approach. The central component was a 15- to 20-minute module based on the CDC guidelines. This module covers essential topics, including the importance of folic acid, recommended intake, prevention of deficiency symptoms, prevention of neural tube defects (NTD), folate-rich food sources, consumption tips, and current Malaysian guidelines on folic acid supplementation. Additionally, there was a 3-minute multimedia video about child development and folic acid-fortified foods designed to provide engaging visual content. To enhance understanding, a 5-minute quiz on folic acid supplementation was conducted. Following the quiz, there was a 5-minute question-and-answer session where participants could seek clarification and participate in discussions. In addition, brochures in Malay were provided to participants as supplementary material for reference and information reinforcement. This approach ensures that periconceptional women receive comprehensive education about folic acid supplementation so that they can make informed decisions about their health (Table 1).

A self-administered questionnaire adopted from Tajuddin and Yusof (2020), Knowledge, Attitude, and Practice (KAP) Regarding Folate Intake, was used in this study with the main author's permission. The instrument consisted of sections A (demographic data) with 12 items, B (knowledge of FA supplementation) with 31 dichotomous items, C (attitude towards FA) with 7 items on a 5-point Likert scale, and D (practice of FA supplementation) with 11 items on a 4-point Likert scale.

Table 1: Structured Folic Acid Health Education Program

Intervention	Content	Duration
Module CDC Guideline Sixth printing – April 2009	i. Introduction to Folic Acid ii. The importance of Folic Acid supplementation iii. The recommendation of Folic Acid supplementation by the Recommended Nutrition Intake (RNI) 2017 for women in the periconceptional period. iv. Folic Acid supplementation deficiency. v. Prevention of Neural Tube Defect (NTD). vi. Describe the food enriched in folate. vii. Tips to consume enough Folic Acid supplementation. viii. Current policy of Folic Acid supplementation in Malaysia	15 – 20 minutes
Multimedia video	Child development Food enriched folate	3 minutes 3 minutes
Quiz	Folic Acid supplementation	5 Minutes
Question & Answer	Open to audience	5 minutes
Pamphlets	Folic Acid supplementation in the Malay version	

Validity and Reliability

Tajuddin and Yusof (2020) reported that the questionnaire on knowledge, attitude, and practice had good internal consistency, with a Cronbach's alpha coefficient ranging from 0.80 .94. In this study, Cronbach's alpha coefficient was 0.879 for knowledge, 0 .906 for attitude, and 0.925 for practice.

Data Collection

With regards to the inclusion and exclusion criteria, a baseline screening of the respondents was performed to identify their eligibility to participate in this study. Informed consent was obtained prior to the study, and the participants were emphasized on the voluntary aspects and withdrawal with no penalty. The data were collected at two time points, the pre- and post-tests, using an online questionnaire. The pre-test phase of data collection was completed before the intervention program. The intervention group received a structured health education program on folic acid supplementation, whereas the control group continued to receive the usual health clinic services. The post-test phase of data collection was performed four weeks post-intervention. Informed consent was obtained from all the respondents before their participation, highlighting the voluntary nature of their participation in the study. Importantly, all personal information collected during the study was treated with the utmost confidentiality to protect the privacy and rights of participants. These ethical measures were strictly adhered to throughout the research process to ensure the integrity and ethical soundness of the study.

Data Analysis

Data analysis for this study was conducted using the Statistical Package for Social Science (SPSS) version 26.0. To evaluate the impact of the intervention on KAP (knowledge, attitude, and practice) scores related to folic acid consumption, several statistical tests were used. First, an independent sample t-test was used to compare the mean KAP scores before and after the intervention within each of the two different groups. Descriptive statistics, including numbers and percentages, were used to summarize and present the categorical data in the context of participants' sociodemographic characteristics. In addition, a repeated measures ANOVA was conducted to examine the overall effect of the intervention on KAP scores and any differences between groups. This analysis was also supported by partial ETA squared and power calculations to provide a comprehensive understanding of the impact of the interventions on the measured variables. A *p*-value below 0.05 indicated statistical significance.

Ethical Consideration

The study was carefully reviewed and approved by the ethical committee of Faculty of Health Sciences Research Ethics Committee on the 17th August 2021 with the reference number UiTM (REC/08/2021 (MR/684)), and the National Medical Research Register (NMRR) in collaboration with the Medical Research and Ethics Committee approved on 12th November 2021 with the reference number (MREC) (NMRR-21-1827-60208 (IIR)).

RESULTS

Sociodemographic Characteristics of Respondents

This study involved 114 periconceptional women who attended community clinics. In the intervention group, the majority of the women were between 21 and 30 years of age (57.9%) with a mean age of 29 years (SD:5.08), Malay (73.7%), had secondary school education (36.8%), were multiparous (56.1%), employed (73.7%), had unplanned pregnancy (56.1%), were overweight (43.9%), and had a household income between RM 2,500 and RM 4,999 (45.6%).

In the control group, the majority of the women were between 21 and 30 years of age (57.9%) with a mean age of 29 years (SD:5.50), Malay (73.7%), had secondary educational level (45.6%), multiparous (61.4%), employed (50.9%), unplanned pregnancy (82.5%), overweight (38.6%), and had household incomes less than RM 2,500 (50.9%).

There were no significant differences between the intervention and control groups for most sociodemographic variables, except for occupation (*P* value = 0.022) and pregnancy status (*P* value = 0.002) (Table 2).

Table 2: Sociodemographic Characteristics of the Periconceptional Women (n=114)

Variables	Intervention Group (n=57)			Control Group (n=57)			*p*-value [b] *
	n	%		n	%		
Age (Year)							
< 20	4	7.0		4	7.0		1.000
21 – 30	33	57.9		33	57.9		
31 - 40	18	31.6		18	31.6		
>40	2	3.5		2	3.5		
Ethnic Group							
Malay	42	73.7		42	73.7		1.000
Chinese	11	19.3		11	19.3		
Indian	4	7.0		3	7.0		
Education Level							
Primary	4	7.0		0	0.0		0.206
Secondary	21	36.8		26	45.6		
Diploma	19	33.3		19	33.3		
Degree	13	22.8		12	21.1		
Parity							
Primigravida	25	43.9		22	38.6		0.568
Multipara	32	56.1		35	61.4		
Occupation							
Housewife	13	22.8		27	47.4		0.022*
Employed	42	73.7		29	50.9		
Self-Employed	2	3.5		1	1.8		
Pregnancy Status							
Plan	25	43.9		10	17.5		0.002*
Unplanned	32	56.1		47	82.5		
BMI[t] (kg/m^2)							
Underweight	4	7.0		1	1.8		0.426
Ideal	22	38.6		25	43.9		
Overweight	25	43.9		22	38.6		
Obesity	6	10.5		9	15.8		
Household Income (RM)							
< 2,500	20	35.1		29	50.9		0.123
2,500 - 4,999	26	45.6		22	38.6		
5,000 – 9,999	11	19.3		4	7.0		
10,000 - 14,999	0	0.0		1	1.8		
≥ 15,0000	0	0.0		1	1.8		

[a] *Mean (SD)*
[b] *Continuous variables analysed using t test, categorical variables using Chi-Square test*
**P<0.05*

To Evaluate the Effect of Health Education Intervention Program on The Knowledge, Attitude, and Practice Between the Intervention and Control Group

Table 3 shows that the intervention significantly improved knowledge scores in the intervention group (mean diff = 1.98, p = 0.002*). The effect size (partial eta-squared) for knowledge was moderate (0.16), indicating a meaningful impact. The statistical power for knowledge was high (0.89), suggesting a strong ability to detect the intervention's effect, leading to rejection of the null hypothesis. Meanwhile, the intervention significantly improved attitude scores in the intervention group (mean diff = 1.74, p<0.001*). The effect size for attitude was relatively large (0.26), signifying a substantial impact. The statistical power for attitude was very high (0.993), indicating a near-certainty of detecting the intervention's effect, which led to the rejection of the null hypothesis. Nevertheless, the intervention significantly improved practice scores in the intervention group (mean diff = 5.47, p<0.001*). The effect size for practice was substantial (0.74), showing a highly significant impact. The statistical power for practice was at its maximum (1.0), guaranteeing the detection of the intervention's effect. Consequently, the null hypothesis was firmly rejected.

In a nutshell, the health education intervention had a significant and positive impact on participants' knowledge, attitude, and practice regarding folic acid in the intervention group when compared to the control group. These findings demonstrate the effectiveness of the intervention, with substantial effect sizes and high statistical power, suggesting robust and reliable results.

Table 3: Comparison of the Effect of Health Education on KAP of Folic Acid (n=114)

Comparison		Mean (SD)	Mean diff (95%CI)	F stat (df)	p-value*	Partial ETA Square	Power
Intervention Group							
Knowledge	Pre-test	13.40 (4.50)	1.98	10.53	0.002*	0.16	0.89
	Post-test	15.39 (2.53)	(0.76, 3.21)	(1.00)			
Control Group							
Knowledge	Pre-test	12.58 (4.96)	-2.54	8.75	0.005*	0.14	0.82
	Post-test	10.04 (5.33)	(-4.27, -0.82)	(1.00)			
Intervention Group							
Attitude	Pre-test	25.72 (2.66)	1.74	20.02	<0.001*	0.26	0.993
	Post-test	27.46 (2.46)	(0.96, 2.52	(1.00)			
Control Group							
Attitude	Pre-test	24.82 (2.73)	0.49	1.38	0.245	0.02	0.211
	Post-test	25.32 (2.45)	(-0.35, 1.33)	(1.00)			
Intervention Group							
Practice	Pre-test	27.68 (4.36)	5.47	158.28	<0.001*	0.74	1.0
	Post-test	33.22 (3.51)	(4.60 – 6.35)	(1.00)			
Control Group							
Practice	Pre-test	28.72 (4.42)	0.32	0.19	0.668	0.003	0.71
	Post-test	29.04 (4.88)	(-1.15, 1.78)	(1.00)			

**p-value<0.05*

[a] Repeated measure Analysis of Variance (ANOVA)

DISCUSSION

To Compare the Effect of The Health Education Intervention Program on The Knowledge, Attitude, and Practice Between the Intervention and Control Group

This study aimed to evaluate the effect of a health education program on improving the knowledge, attitude, and practice of folic acid supplementation among periconceptional women in the community clinic. Sociodemographics for both groups consisted mainly of women aged 21 to 30 years of Malay descent and with different educational backgrounds. The health education intervention had a significant impact on several fronts. First, it significantly improved knowledge scores, with the intervention group seeing a significant increase while the control group's scores decreased. Furthermore, the intervention had a positive effect on attitude, as the intervention group showed a more significant increase in attitude scores compared to the control group. Statistical analysis confirmed a significant effect on attitude, although with somewhat lower statistical power. Nevertheless, the intervention had a profound effect on practice, as the intervention group showed a significant increase in practice results, while the improvement in the control group was less pronounced. The implications for practice were highly significant and were characterized by an extreme effect size and robust statistical power.

This study found that the intervention group's knowledge scores improved significantly, in line with that of Al-Marwani and Al-Zahrani's (2022) study, in which participants' knowledge of FA increased significantly after the intervention. The current study supports the notion that education and training play a critical role in improving knowledge about folic acid. This highlights the importance of educational interventions to increase knowledge on FA, as evidenced by the findings of this study and supported by existing research.

On the other hand, this study showed a positive effect of the intervention on attitudes, with the intervention group showing a more significant increase in attitude scores compared to the control group. This finding is consistent with Kamau *et al.* (2019), who reported an increase in positive attitudes toward FA supplementation among pregnant women, although they found no statistically significant difference between the intervention and control groups. The current finding is consistent with previous research that has consistently shown that interventions can lead to positive attitude changes.

The findings of this study highlight the significant impact of educational interventions on improving periconceptional women's practices related to folic acid supplementation. This study highlights the critical role of educational interventions in promoting and improving positive folic acid supplementation practices in pregnant women. The results clearly demonstrate the effectiveness of educational interventions in improving and influencing actual practices related to folic acid supplementation before and during pregnancy. This was in line with the study reported by Lin *et al.* (2017), whereby the majority of women in the intervention group consumed FA significantly higher compared to the control group at the post-interventional phase.

In conclusion, the consistent results of numerous studies underline the central role of educational interventions in promoting and improving practices related to folic acid supplementation among periconceptional women. These results are consistent with previous research and highlight the critical contribution of educational interventions in promoting positive and beneficial folic acid supplementation practices before and during pregnancy.

Implications of the Study

This study highlights the importance of implementing effective health education strategies to improve periconceptional women's knowledge, attitudes, and practices regarding folic acid (FA) supplementation. By doing so, we can contribute to the reduction of birth defects. It is imperative that healthcare providers and policymakers prioritize educational initiatives aimed at equipping women with the necessary knowledge and promoting positive attitudes and practices related to FA supplementation during the periconceptional period. Such efforts can have a significant impact on the overall health and well-being of mothers and infants.

Study Limitation

Due to the COVID-19 pandemic and the adaptation of the new norm, it was a challenge to obtain the required sample size. However, the researcher managed to capture 57 participants in each group, which was

considered sufficient. Besides, there is limited literature on interventional studies involving FA supplementation.

CONCLUSION

In conclusion, this study has shed light on the inadequate average knowledge about folic acid supplementation among periconceptional women attending public clinics. Implementation of a health education intervention has shown statistically significant improvements in knowledge, attitude, and practice. These results highlight the critical role of regular health education initiatives in bringing about significant changes in women's periconceptional knowledge, attitudes, and practices related to folic acid supplementation, with the ultimate goal of reducing the risk of birth defects. Health care providers and policymakers should prioritize integrating ongoing health education programs to equip periconceptional women with the necessary information and promote positive practices for maternal and child health.

Conflict of Interest

The authors declare no potential conflict of interest.

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