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Effects of nutrition counselling on iron deficiency anemia in pregnancy

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ABSTRACT

Anemia is a significant public health concern in pregnant women and women of reproductive age globally. The prevalence of anemia in Thailand was approximately 36.7%. Common causes of anemia were iron deficiency anemia (IDA) and beta-thalassemia trait (BTT). World Health Organization (WHO) recommends that dietary adjustments focusing on iron-rich foods foster the improvement of IDA and IDA with BTT. This study aimed to evaluate the effect of nutrition counselling in pregnant women with IDA on anemia parameters and dietary intake records. Retrospective data were obtained from the Division of Nutrition and Antenatal Care (ANC) Clinic at Bamrasnaradura Infectious Diseases Institute (BIDI) in Nonthaburi, Thailand. Nutrition Care Process Model was used in nutrition service at BIDI. During the second trimester, nutrition counselling was provided at the ANC Clinic by a dietitian routinely based on WHO guidelines for nutritional anemia. The anemia parameters and dietary intake records were recorded during ANC visits at the second and third trimesters. A paired t-test was used to evaluate differences within each group. Collected data from 61 pregnant women with anemia were analyzed (IDA: 55; BTT: 6). In the third trimester, the changes in hematocrit levels were significantly high in both IDA ($p \leq 0.001$) and BTT groups ($p = 0.016$). In addition, the improvement in daily energy consumption and iron-rich foods was significantly observed in both groups ($p \leq 0.001$). In conclusion, the delivery of nutrition counselling focusing on iron-rich foods significantly enhanced IDA parameters and eating behaviours, including increased hematocrit levels, and improved daily energy intake and iron-rich foods intake among pregnant women with anemia.

Keywords: *Anemia, pregnancy, nutrition care process model, nutrition counselling and iron rich diet*

INTRODUCTION

Insufficient intake of nutrients that cover the synthesis of hemoglobin and erythrocytes is termed nutritional anemias. The most common nutrient that contributes to anemia is iron (WHO, 2017). Iron deficiency anemia (IDA) is a general issue found in pregnant women and women of reproductive age. The prevalence of anemia among pregnant women was 40% worldwide (WHO, 2022a). Current reports revealed that moderate to severe levels of anemia in reproductive-age women aged between 15-49 were found in South Africa, South America

and Asia. Particularly, the prevalence of anemia in Thailand was found to be 36.7% (WHO, 2022b). Specific parameters used to diagnose IDA include the lower cut-off of hemoglobin in pregnancy (10.5 g/dL) or hematocrit (HCT) (33%) (American College of Obstetricians and Gynecologists [ACOG], 2021). High risk groups to develop IDA are pregnant and postpartum women with poor nutritional status. Besides IDA, other causes can also develop anemia such as the coexistence of IDA and beta-thalassemia trait (BTT), infectious diseases, and sickle cell anemia (ACOG, 2021; Breymann, 2015). IDA can contribute to maternal and fetal consequences such as maternal mortality with high blood loss, cardiovascular symptoms, poor physical and mental performance, prematurity, death in utero, and infection (Breymann, 2015).

IDA can be prevented or treated in different ways, including improving dietary diversity, supplementation with iron and folic acid, and adequately consuming other vitamins and minerals. Intervention addressing nutrition-related behavior is suggested according to WHO (2017)'s guidelines and Dietary Reference Intake for Thais 2020 (DRIs) (Bureau of Nutrition, 2020). Nutrition-specific interventions focus on the most proximal causes of anemia. These approaches, especially nutrition counselling which suggests women with IDA increase their consumption of various sources of dietary containing iron, vitamin A, vitamin B12, and folate and avoid combining iron inhibitors, could improve the bioavailability and absorption of IDA-related micronutrients. Therefore, the changes in knowledge, skills, and intakes of micronutrients among women with IDA support them to obtain the optimal level of biochemistry markers for anemia, including hemoglobin and hematocrit concentrations (WHO, 2017). Nutrition counselling is a two-way communication through which client and dietitian interpret the results and discuss appropriate dietary plans to meet goals in order to obtain healthy eating behavior (Maclellan & Berenbaum, 2003). In addition, a dietitian also assesses nutritional status along with dietary intake data, this information is considered prior to design dietary plans (Dao et al., 2019).

Nutrition counselling is a part of the Nutrition Care Process and is provided routinely at the Antenatal Care (ANC) Clinic in Nonthaburi, Thailand; however, the evaluation of nutrition counselling's effectiveness on IDA in pregnancy has not been established. The aim of this study was to evaluate the retrospective data of nutrition counselling in pregnant women with IDA focusing on anemia parameter and dietary intake records.

METHODOLOGY

Study design

The retrospective data from the Division of Nutrition and ANC Clinic were obtained. The inclusion criteria of data were pregnant women aged 19-49 years who were diagnosed with IDA and IDA with BTT and were willing to participate in nutrition counselling. The exclusion criteria of data were pregnant women who were diagnosed with IDA caused by other conditions such as HIV infection and antiretroviral therapy. A total of 61 pregnant women with IDA and IDA with BTT who visited the ANC Clinic at Bamrasnaradura Infectious Diseases Institute (BIDI) in Nonthaburi, Thailand from January 2018 to December 2019 (24 months) were analyzed. The sample size was calculated based on Hulley et al. (2013)'s sample size calculation for a retrospective, descriptive study for a continuous variable as follows:

$$N = 4Z\alpha 2S2/W2$$

where, $Z\alpha = 1.96$; Standard normal deviate for α with confidence level of 95%
$S = 10$; Standard deviation of the variable
$W = 5$; Desired total width of confidence interval
therefore, $N = 4(1.96)2(10)2/ (5)2$
$N = 61$

Data were separately assessed by records of IDA (n=55) and BTT (n=6) according to obstetricians' diagnoses at the ANC Clinic. The 2-Time visiting record was collected during the second trimester (T1) and third trimester (T2) along with the IDA parameters and dietary intake record. All data were managed and analyzed by researchers.

Nutrition care process

A nutrition counselling service with the dietitian is a routine practice delivering pregnant women who visit ANC Clinic at BIDI since 2017. Obstetricians diagnosed whether individuals have IDA and IDA with BTT, and nurses reminded individuals that nutrition counselling for IDA would be available. Nutrition Care Process Model (NCPM) is a systematic problem-solving method that is used in nutrition and dietetics professions to identify nutrition-related issues and make decisions on patients' nutrition care regarding them (Swan et al., 2017). NCPM was used to provide nutrition care by dietitians at BIDI. NCPM included nutrition assessment, nutrition diagnosis, nutrition intervention, and nutrition monitoring and evaluation. The modified NCPM used in this setting is shown in Figure 1. First, nutrition assessment involved obtaining relevant information such as dietary intake data, anthropometric measurements, laboratory data, and client medical history. Second, nutrition diagnosis confirmed the identification of IDA and determined the symptoms of anemia. Third, nutrition intervention was conducted by

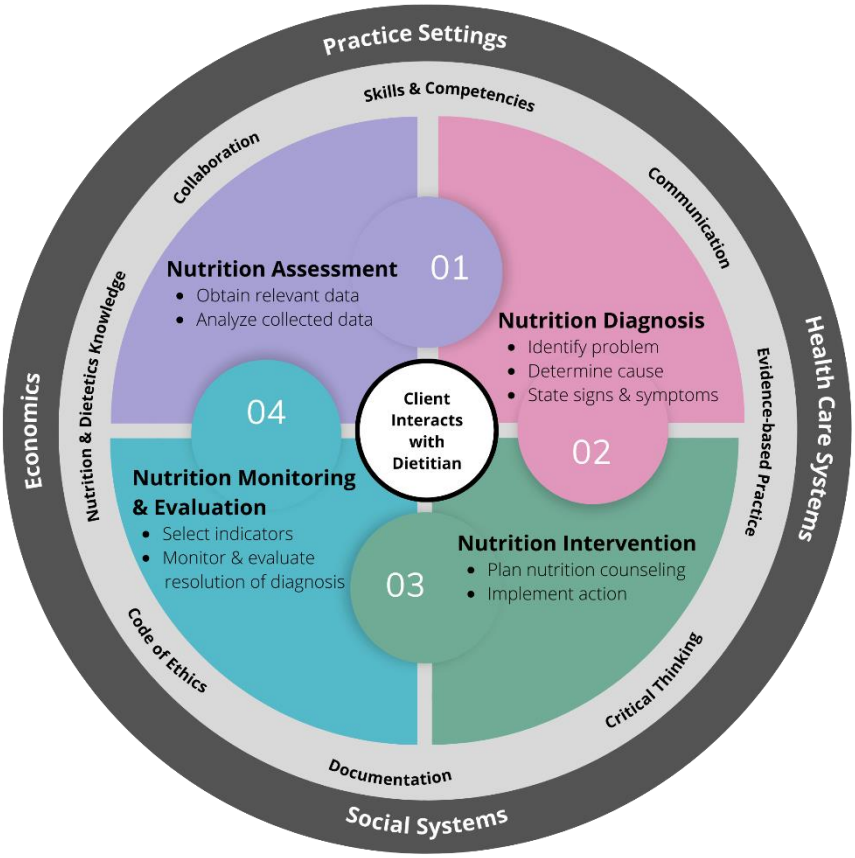

Figure 1: Nutrition care process model for pregnant women with IDA and BTT (Swan et al., 2017)

providing nutrition counselling for approximately 25 minutes. Nutrition counselling services were provided by dietitians according to WHO's Nutritional Guidelines for Anemia and DRIs for Thais, specifically on the diversity of dietary enhancing the consumption of main nutrients of concern for IDA such as iron, vitamin A, vitamin B12, and folate (Bureau of Nutrition, 2020; WHO, 2017). These beneficial foods can be found in meat, poultry, fish, eggs, fruits, and green vegetables. Avoidance of foods that can interfere with important nutrients against IDA absorption (e.g., tea, coffee, calcium supplementation) was consistently suggested (WHO, 2017). Thai food models were used as counselling media during the nutrition counselling process to ensure the accurate amount of dietary intake and IDA-concerned foods (Figure 2.). Lastly, nutrition monitoring and evaluation were performed. Data were recorded, including dietary data, gestational ages, and IDA parameters.

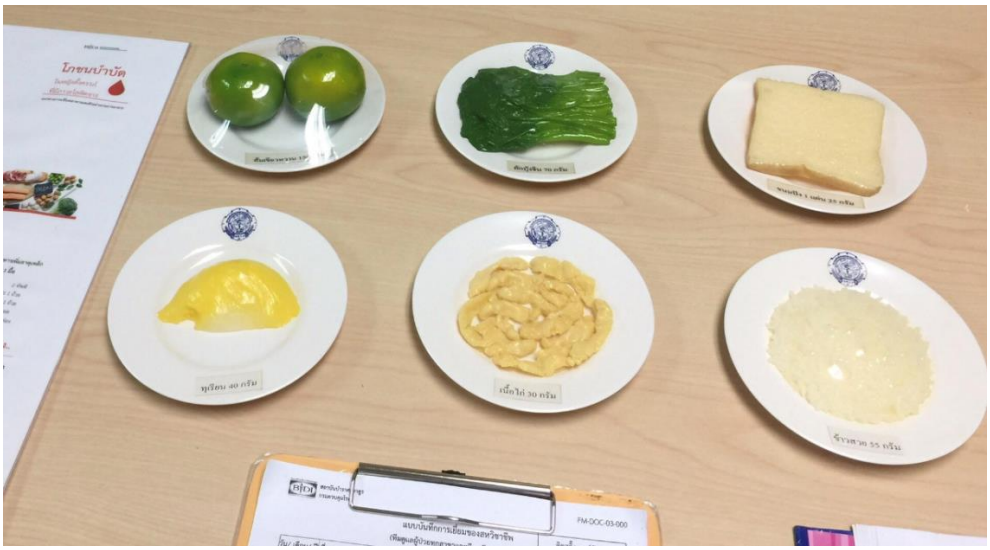

Figure 2: Food models used in nutrition counselling

Outcome measure

Measurement of IDA parameter (i.e., %HCT) was performed by BIDI Laboratory Division following the orders of obstetricians. 24-Hour dietary recall records were evaluated by dietitians, covering daily total energy, total carbohydrate, total protein, total fat, and iron content in foods. Dietary intake data were recorded using the 24-Hour dietary recall technique at T1 and T2 (2 days) and calculated based on Food Composition Database for Thai Foods (Food Research for Nutrition Section, 2016).

Statistical analysis

Means ± SD were used to present continuous data. All of the data from both T1 and T2 in IDA (n=55) and BTT (n=6) were normally distributed. Although the sample size of BTT was small, the normal distribution of data was observed. Thus, differences within groups were tested by a paired t-test. A p-value ≤ 0.05 was considered statistically significant. General information was explained using descriptive statistics. The data analysis was done by using IBM SPSS Statistics for Mac, Version 27.0 (New York, United States).

RESULTS

General information

All pregnant women (n=61) are local residents in Nonthaburi, Thailand. Priority population data on age and gestational age were included. General information on IDA and BTT groups is shown in Table 1.

Table 1: General information of pregnant women with IDA and BTT

	IDA (n=55)	BTT (n=6)
Age (years)	27.2 ± 5.9	26.0 ± 5.3
Gestational age at T1 (weeks)	25.9 *± 8.8*	20.7 *± 4.1*
Gestational age at T2 (weeks)	32.1 *± 2.7*	33.0 ± 3.0

Data are expressed as mean ± SD.

Comparison of anemia parameter

HCT level (%) was used as a parameter to identify IDA in both pregnant women with IDA and BTT. At T2, the average HCT level was significantly higher in the IDA group (p ≤ 0.001) and BTT group (p = 0.016) when compared to their records in T1. While the difference between groups was not examined. Table 2 presents the data on HCT levels among IDA and BTT groups.

Table 2: Comparison of HCT level at before and after receiving nutrition counselling among pregnant women with IDA and BTT

	IDA (n=55)		BTT (n=6)	
	T1	T2	T1	T2
HCT (%)	31.4 ± 3.6	34.4 ± 2.4	31.1 ± 2.8	32.5 ± 2.7
Mean difference within group	2.96 ± 4.0		1.40 ± 1.5	
p-value	0.001*		0.016*	

Data are expressed as mean ± SD. The paired t-test was used to test the mean difference within-group at T1 and T2. *Indicates p-value ≤ 0.05.

Dietary intake information

Evaluation of dietary intake data was done through the 24-Hour dietary recall records obtained during the nutrition counselling process. Results found that the amount of daily consumption of energy, carbohydrate, fat, protein, and iron in foods was increased at T2 in both IDA and BTT groups when compared to their T1 records. In the IDA group, there was a significantly higher intake of all dietary groups between T1 and T2 (p ≤ 0.001). In the BTT group, no significant difference was found in protein intake however, there were statistically significant differences between T1 and T2 among energy, carbohydrate, fat, and iron groups (p ≤ 0.05). The difference between groups was not examined. Dietary intake information is shown in Table 3.

Table 3: Dietary intake information at before and after receiving nutrition counselling among pregnant women with IDA and BTT

Dietary group	IDA (n=55)			BTT (n=6)		
	T1	T2	*p*-value	T1	T2	*p*-value
Energy (kcal)	1720.5 ± 58.4	2268.8 ± 80.6	0.001*	1824.5 ± *96.5*	2181.43 ± 95.2	0.001*
Carbohydrate (%)	53.1 ± 2.8	60.1 ± 2.5	0.001*	55.2 ± 3.2	59.4 ± 3.3	0.001*
Protein (%)	12.2 ± 1.1	14.9 ± 2.1	0.001*	14.1 ± 2.2	15.1 ± 1.8	0.409
Fat (%)	34.6 ± 2.9	25.0 ± 1.1	0.001*	30.7 ± 2.7	25.5 ± 2.3	0.005*
Iron in foods (mg)	6.4 ± 1.5	28.1 ± 0.8	0.001*	5.2 ± 1.7	20.2 ± 1.4	0.001*

Data are expressed as mean ± SD. The paired t-test was used to test the mean difference within-group at T1 and T2. *Indicates p-value ≤ 0.05

DISCUSSION

In this study, medical records on IDA parameters and nutrition counselling data were successfully investigated. The researchers were aware that consideration of multiple causes of anemia was crucial as they could alter the accuracy of data analysis (LaMorfe, 2016). Reviewing anemia cases in pregnancy concerning IDA, BTT, infectious diseases, and sickle cell anemia was made prior to the analysis process. Merely anemia cases with IDA and IDA coexistence with BTT were included, whereas anemia caused by infectious diseases and sickle cell anemia was not reported at ANC Clinic. The optimum number of subjects in the IDA group was gained to reflect the result from a single-center study. Gestational ages were in the ranges of the second trimester (25.9 ± 8.8 and 20.7 ± 4.1,) and third trimester (32.1 ± 2.7 and 33.0 ± 3.0) in the IDA group and BTT group, respectively.

The current study demonstrated that nutrition counselling focusing on the increase of dietary diversity of IDA-related foods and avoiding absorption inhibitors improved the skills and eating behaviors of pregnant women regarding the main nutrients affecting IDA. Behavior changes led to improved HCT levels, optimum daily energy consumption, and increased intake of iron-rich foods. The result was consistent with WHO's guideline for effective prevention and control of nutritional anemia which demonstrates the bioavailability of IDA-related micronutrients can be increased when proper intake was made (WHO, 2017). In the third trimester, there was a significant increase in the HCT levels of IDA and BTT groups compared to the report in the second trimester of each group based on the ACOG's criteria (ACOG, 2021). Similar results were reported by research on a balanced diet-iron supplementation program in pregnancy done in Bangkok, Thailand showing that the program improved laboratory HCT results (Seaharattanapatum et al., 2021). Another study on reproductive-age women found that PRECEDE model-oriented nutrition education has a positive effect on IDA preventive behaviors (Khani et al., 2021). In addition, Nahrisah et al. (2020) reported that culturally tailored nutrition education and counselling significantly increased the HCT levels in pregnant women with IDA. On the contrary, another RCT conducted counselling on hemoglobin, HCT, and weight gain in pregnant women showed the HCT levels in participants did not improve, yet the counselling was provided by nurses and not mainly focused on nutrition contents (Shafagat et al., 2018). Regarding daily food consumption, food models were used as counselling media during the nutrition counselling process to estimate amounts of food consumption. Therefore, this study has proven that nutrition counselling along with the use of food models significantly enhanced the proper amounts of daily energy consumption in both IDA and BTT groups. The results confirmed the consistency of daily energy consumption with the Thai DRIs for pregnant women (1,800-2,300 kcal/day in the second or third trimester) and WHO guidelines 2017 (%Energy/day = Protein: 10-15%, Fat: 20-25%, and Carbohydrate: 55-60%) (Bureau of Nutrition, 2020; WHO, 2017). Although there was no significant difference was found in protein intake in the BTT group, the protein intake was found higher in T2 than in T1. Furthermore, the intake of iron-rich foods was significantly increased in the two groups of study. These foods were in accordance with counselling content. At T2, most clients consumed greater amounts of iron-rich and IDA-concerned foods when compared to T1 such as meat, fish, poultry, liver, green leafy vegetables, fruits, and fruit juices. Also, they consumed lesser amounts of inhibitors such as tea and coffee and avoided having dairy products in the same meals as IDA-concerned foods. This study indicates comparable results to previous nutrition education and counselling programs among pregnant women with IDA in Thailand and several countries (da Silva Lopes et al., 2018; Khani et al., 2021; Nahrisah et al., 2020; Seaharattanapatum et al., 2021).

This study had various limitations. It was a single-center analysis; therefore, the sample size of the BTT group was somewhat small. The result in this group may be unable to generalize the effectiveness of the nutrition counselling approach in a larger population. There was a chance of bias due to the lack of a comparison group, however, this study was an uncontrolled interventional study, which could not select clients at the ANC clinic to be in the controlled group. Apart from obstetricians' diagnoses, only HCT level was used as a laboratory indicator. Further research is suggested to investigate in wider populations and settings. A comparison group should be considered. Other laboratory indicators involved with IDA should be considered such as hemoglobin levels, red blood cell count, and ferritin (ACOG, 2021).

CONCLUSION

To sum up, this study has demonstrated the effectiveness of nutrition counselling on pregnant women with IDA by improving the IDA parameter, optimizing average daily energy consumption, and enhancing iron-rich foods intake.

AUTHOR CONTRIBUTIONS

Preeyapat Mangkalard wrote the manuscript; Preeyapat Mangkalard and Supawadee Ponta performed nutrition counselling; Lawan Ruekngarm submitted the request to access medical records and obtained ethical approval. All authors read and approved the final manuscript.

ETHICS APPROVAL

This study was registered in the Institutional Review Board of Bamrasnaradura Infectious Diseases Institute and underwent committee review and approval (N037h/63_Exempt).

FUNDING

Not applicable.

CONFLICTS OF INTEREST

The authors declare no competing interests in this work.

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