Amerta Nutrition
e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Suryani et al. | Amerta Nutrition Vol. 8 Issue 3SP (December 2024). 17-23

RESEARCH STUDY
English Version
OPEN ACCESS

The Influence of Maternal Knowledge Increase about Pregnant Women's Nutrition on Pregnancy Outcomes in Bengkulu City

Pengaruh Peningkatan Pengetahuan tentang Gizi Ibu Hamil terhadap Outcome *Kehamilan di Kota Bengkulu, Indonesia*

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ARTICLE INFO

Received: *12-09-2024*
Accepted: *30-08-2024*
Published online: *31-12-2024*

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DOI:
10.20473/amnt.v8i3SP.2024.17-23

Available online at:
https://e-journal.unair.ac.id/AMNT

Keywords:
Knowledge, Pregnant women, Pregnancy outcomes, Infant birth weight

ABSTRACT

Background: Poor maternal health knowledge indirectly affects pregnancy outcomes. According to previous research, as many as 65% of mothers with poor or below average understanding give birth to children with low birth weight (LBW). Maternal and infant health information is needed.
Objectives: To determine the effect of increased maternal knowledge on pregnancy outcomes.
Methods: This study used a non-randomized quasi-experimental methodology. The study was conducted in Bengkulu City from August 2023 to January 2024. This study involved pregnant women who lived in the working area of Bengkulu City health centers (five health centers). This study examined education, knowledge, and pregnancy outcomes. Validity and reliability were verified using a questionnaire (0.969 Cronbach's Alpha). Pre- and post-tests were conducted before and one month after school. The dependent t-test assessed the impact of the intervention and the correlation test assessed pregnancy outcomes.
Results: The average maternal knowledge before and after the intervention was 16.58 and 18.08. Pregnant women's understanding changed after the intervention (p-value=0.000). Increased maternal knowledge did not affect pregnancy outcomes (p-value=0.301).
Conclusions: There was an increase knowledge of pregnant women after education provision, but this did not have an impact on pregnancy outcomes. Education about pregnancy nutrition is very necessary so that mothers have good knowledge and maintain their intake.

INTRODUCTION

The most important element that directly affects the health of the mother and fetus is nutrition[1]. During pregnancy, it is essential for women to increase their food intake, ensuring that the food provides adequate macro and micronutrients. These critical nutrients, which include carbohydrates, proteins, fats, vitamins, water, iron, and folic acid, must be sourced from a variety of foods to meet the body's need[2]. Additionally, there is a recommendation from the World Health Organization (WHO) that pregnant women take a greater quantity of macro and micro nutrients throughout their pregnancy. In addition, it is recommended that pregnant women boost the amount of foods they consume, including fresh fruits and vegetables, whole grains, meat, fish, nuts, oranges, and salmon[3].

According to the findings of a literature review that included fifty-three studies, the amount of calories and macronutrients that were consumed by pregnant and nursing women in Malaysia and Indonesia was lower than the Recommended Dietary Allowance (RDA) or the Recommended Nutrient Intake (RNI). To add to this, the majority of studies have determined that these women did not meet the Estimated Average Requirement (EAR) for water-soluble vitamins (less than 80% of the EAR), vitamin D (less than 70% of the EAR), or vitamin E (less than 50% of the EAR). Furthermore, the consumption of calcium, potassium, and iron among pregnant women in Indonesia was less than sixty percent of the adult equivalent daily intake (EAR). When compared to the recommended daily allowance (RDA) and recommended daily intake (RNI) for pregnant women, the standardized mean differences (SMD) across the 21 studies that reported total amounts of protein consumption were -2.26 (95% confidence interval; -2.98, -1.54)[4]. The mother's health condition can be improved and

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complications during pregnancy, and can be prevented by ensuring that the mother consumes sufficient nutrition during her pregnancy[5].

One of the potential causes of malnutrition during pregnancy is lack of information and inadequate food consumption. Other potential causes are disease, lack of appropriate food sources and health services, unpleasant family environment, poverty, as well as social and political problems[6]. Research conducted previous researchers found that only 46.5% of respondents were able to answer questions about the importance of essential nutrients during pregnancy, and only 48.8% of respondents understood the concept of multivitamins and supplements during pregnancy[7]. In order to help mothers achieve good weight gain during pregnancy, it is important to have an adequate understanding of the nutritional intake they consume[8,9].

Nutrition education is a commonly used strategy proven to be effective in enhancing dietary knowledge and behaviors during pregnancy, as well as improving perinatal outcomes[10]. The nutritional intake of mothers directly influences newborn birth weight[11], and low birth weight (LBW) has a significant health implications[12].

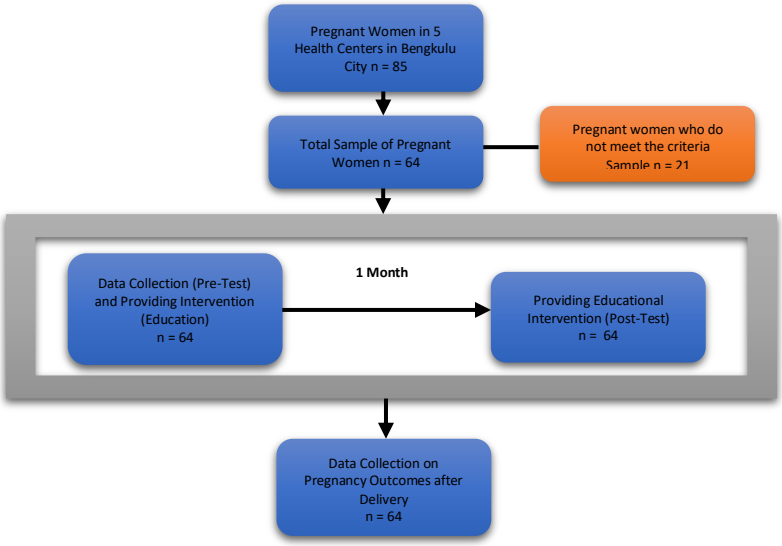
A review of intervention studies revealed that nutrition education aimed at increasing protein and energy intake reduced the risk of preterm birth and low birth weight. Specifically, women who received nutritional education saw an increase in their infants' birth weight by nearly half a kilogram, while no impact was observed among well-nourished women[13]. A quasi-experimental study evaluated the effectiveness of educational methods in improving pregnant women's knowledge[14]. Another study using Android-based media demonstrated that the educational medium not only enhanced understanding, but also motivate mothers to meet their nutritional needs[15].

Several factors can cause suboptimal nutrition among pregnant women in Indonesia, including limited nutritional knowledge and traditional food restrictions (food taboos). As a result, this lack of adequate nutrition can affect both maternal and fetal health. Therefore, proper nutrition education is crucial to help pregnant women recognize the importance of proper nutritional intake to optimize both maternal and infant health and minimize pregnancy problems[16].

Research related to maternal knowledge and birth outcomes has never been conducted in Bengkulu City, but previous research conducted in districts in Bengkulu Province proved that normal/poor maternal knowledge is related to the incidence of low birth weight. An initial survey found that mothers were unaware of the nutritional needs during pregnancy and the function of consuming iron tablets, associating them only with preventing anemia. Based on these findings, this study aimed to determine the influence of maternal knowledge increase on pregnancy outcomes in Bengkulu city.

METHODS

This study used a quasi-experimental design with a pre-post non-randomized design. The initial stage was to collect data on all pregnant women in the second and third trimesters. Furthermore, mothers who met the criteria were continued to participate in educational activities. Before being given education, mothers were given a pre-test instrument, knowledge, then after one month a post-test measurement of knowledge was carried out. After the mother gave birth, pregnancy outcome data were collected. The study was conducted in Bengkulu City, from August to January 2024. The population in this study were all pregnant women in the working areas of five health centers in Bengkulu City. The selection of the health center location was based on the results of initial observations conducted by the research team, where most mothers still did not understand about the nutrition of pregnant women. The flow of this research can be seen in figure 1.



Images 1. Research flow

The sample was selected using a purposive sampling technique, after obtaining data on pregnant women in 5 health centers in Bengkulu City. Then select samples that meet the inclusion and exclusion criteria of

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this study. The results of the minimum sample calculation included 64 pregnant women, the minimum sample calculation formula is as follows[17]:

$$n = \frac{\sigma^2 \left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2}{(\mu 1 - \mu 2)^2}$$

$$n = \frac{2^2 \left(1{,}96 + 0{,}84\right)^2}{(5{,}5 - 6{,}2)^2}$$

$$n = \frac{31{,}36}{0{,}49}$$

$$n = 64$$

The inclusion criteria in this study were being willing to be a sample, having a cellphone for further communication, undergoing examinations, and living in the working area of the health center where the study was conducted. The exclusion criteria included pregnancy with complications, not being able to read and write, and not being able to follow the intervention provided.

The variables in this study consist of independent variables in the form of educational interventions provided and dependent variables in the form of knowledge and pregnancy outcomes. Data were collected using a questionnaire that had been tested for validity and reliability. The instrument contained 25 question items, and the validity test obtained in Cronbach's Alpha value of 0.969 Table 1).

Table 1. Validity and reliability test results

Question	R Table	R Count	Conclusion
Question 1	0.413	0.845	Valid
Question 2	0.413	0.728	Valid
Question 3	0.413	0.484	Valid
Question 4	0.413	0.653	Valid
Question 5	0.413	0.780	Valid
Question 6	0.413	0.732	Valid
Question 7	0.413	0.780	Valid
Question 8	0.413	0.814	Valid
Question 9	0.413	0.732	Valid
Question 10	0.413	0.462	Valid
Question 11	0.413	0.642	Valid
Question 12	0.413	0.760	Valid
Question 13	0.413	0.691	Valid
Question 14	0.413	0.845	Valid
Question 15	0.413	0.811	Valid
Question 16	0.413	0.752	Valid
Question 17	0.413	0.733	Valid
Question 18	0.413	0.699	Valid
Question 19	0.413	0.732	Valid
Question 20	0.413	0.845	Valid
Question 21	0.413	0.739	Valid
Question 22	0.413	0.845	Valid
Question 23	0.413	0.811	Valid
Question 24	0.413	0.731	Valid
Question 25	0.413	0.739	Valid
Cronbach's Alpha Value	0.6	0.969	Reliable

Before the intervention, pregnant women filled out an instrument to measure knowledge before the intervention and after one month using the same instrument, post-intervention knowledge data was collected. The intervention provided was given in the form of direct face-to-face education once, to pregnant women in the second and third trimesters. Furthermore, knowledge after education was re-measured after one month. The education provided included information on portions, types, and functions of nutritious foods, such as protein, carbohydrates, vitamins, minerals, and iron, as well as the frequency of consumption during pregnancy.

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The material also emphasized the introduction of Chronic Energy Deficiency (CED), its impacts such as low birth weight, and how to overcome it by increasing nutritional consumption. Pregnancy outcome data was collected after the mother gave birth by contacting the mother again and confirming with the mother after giving birth. A normality test was conducted on the knowledge and birth weight data, obtaining significant p-values <0.001, indicating that the data were not normally distributed. Consequently, the Wilcoxon test was used to evaluate the effect of intervention and the correlation test was applied to examine the pregnancy outcomes. This study was ethically approved by the Health Polytechnic Ethics Commission of the Ministry of Health, Bengkulu, under approval number No.KEPK.BKL /060/03/2024, March 07, 2024.

RESULTS AND DISCUSSIONS

Based on results of characteristic data analysis by mother and baby, almost all mothers were aged 20 - 35 years (82.8%). Most mothers have a low level of education (67.2%), and the majority of them are housewives (81.3%), and nearly half of mothers experience a second pregnancy (46.9%). Regarding the method of delivering babies, more mothers gave birth normally (60.9%) compared to those who gave birth by Cesarean section or C-section. The majority labour assisted by midwives, amounting to 57.8%, while the rest handled by a doctor. Most of them (75%) has circumference arm above normal, indicating good nutritional status. Almost all babies born had normal weight, with percentage of 98.4% (Table 2).

Table 2. The characteristics of pregnant women

Variable	Frequency (n=64)	Percentage
Mother's Age		
<20 and >35 years	11	17.2
20 – 35 years	53	82.8
Education level		
Low	43	67.2
High	21	32.8
Occupation		
Housewife	52	81.3
Private employee	2	3.1
Self-employed	3	4.7
Honorary	4	6.3
Civil servant	3	4.7
Pregnancy to		
First	17	26.6
Second	30	46.9
Third	6	9.4
Fourth	8	12.5
Fifth	3	4.7
Delivery Method		
C-section	25	39.1
Normal	39	60.9
Birth Assistant		
Midwife	37	57.8
Doctor	27	42.2
Upper Arm Circumference		
CED (<23,5 cm)	16	25
Normal	48	75
Infant Birth Weight		
LBW	1	1.6
Normal	63	98.4

CED = Chronic Energy Deficiency
LBW = Low Birth Weight

The table 3 presents the mean score of maternal knowledge before the intervention, which was 16.58 and after the intervention, the average score of maternal knowledge increased to 18.08. The results of the statistical test obtained a p-value <0.001. This means that there is a difference in the knowledge of pregnant women before and after the intervention. Furthermore, after childbirth, the infant's birth weight was measured to examine the effect of increasing maternal knowledge on the infant birth weight. The findings of this study align with previous research, which stated that education positively impacts maternal knowledge increase[14,18]. While an increase in knowledge regarding maternal health and nutrients was observed among pregnant women, it is crucial that mothers develop a strong awareness of nutrition and the necessity of a more varied foods during pregnancy. The main sources of nutrition information include health care facilities, the media, NGOs (Non-Governmental Organizations), and family members. However, several challenges in implementing this knowledge are due to poverty and limited access to diverse food choices[19]. A similar study in Ethiopia found

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that maternal nutrition knowledge during pregnancy increased from 53.9% to 97%[17]. Although this study did not directly measure or monitor the food consumed by mothers, other studies have shown that increased knowledge influences maternal behavior in meeting nutritional needs during pregnancy. Likewise, a quasi-experimental study in Iran also revealed a significant improvement in pregnant women's nutritional awareness, increasing from 3% before the intervention to 31% after the nutrition education intervention[20].

Table 3. Differences in knowledge of pregnant women before and after intervention

Knowledge	Average	Median	SD	Min Max	p-value	n
Before	16.58	17	3.40	5-23	0.001	64
After	18.08	19	3.60	4-23		64

SD = Standard Deviation

There was no significant difference in the total diet knowledge scores of the intervention group (mean=14.60, SD=2.53) compared to the control group (mean=14.38, SD=2.08) in Jordan prior to the provision of health education (t (193) = 0.66, p-value=0.50). The difference in mean scores between the groups was minimal and not statistically significant, as indicated by the small t-value of 0.66. The intervention group achieved a significantly higher total diet knowledge score (mean=19.30, SD=0.88) than the control group (mean=14.36, SD=2.11) after the health education (t (193) = 21.12, p-value<0.001). The considerable and statistically significant improvement in the diet knowledge scores of the intervention group compared to the control group after the intervention is indicated by the large t-value of 21.12. Additionally, the intervention group exhibited a substantial increase in the total diet knowledge score from the pre-test (mean=14.60, SD=2.53) to the post-test (mean=19.30, SD=0.88), as indicated by the statistic t (94) = −19.21, p-value<0.001. Conversely, the control group did not exhibit a significant difference from the pre-test (mean=14.38, SD=2.08) to the post-test (mean=14.36, SD=2.11), as indicated by the statistic t (99) = 0.70, p-value=0.482[21]. After the nutrition education session, pregnant women showed statistically significant changes in total knowledge scores, from (66.5±28.9) to (117.6±25.3), and total attitude scores, from (3.3±2.1) to (9.5±2.8). The knowledge increase ranged from 45.5% to 80.5%, and attitude of 27.3% to 79.2% (p-value <0.001)[22]. There was a difference in the knowledge of pregnant women who were given education and those who were not given education. This shows that an effort to provide information to mothers will have an impact on increasing knowledge[23].

Good knowledge in pregnant women plays a very important role in forming positive behaviors to maintain health during pregnancy. When a mother has adequate understanding of nutritional needs, signs of pregnancy dangers, and the importance of antenatal check-ups, she will be more motivated to implement a balanced diet, consume recommended supplements, and live a healthy lifestyle. This not only affects her own health, but also contributes to the optimal growth and development of the fetus she is carrying. Thus, increasing the knowledge of pregnant women can directly increase awareness and compliance with health practices during pregnancy, which ultimately helps prevent complications such as anemia, preeclampsia, or premature birth[24].

Based on the findings of the statistical analysis that was conducted using Spearman's correlation test, the p-value was found to be 0.222. This indicates that there is no association between higher knowledge and the weight of the child at delivery. There was a modest link between higher mother knowledge and birth weight, as indicated by the r-correlation value of 0.131, which indicates that the correlation was weak.

Table 4. Correlation between increased maternal knowledge with infant birth weight

Variables	r-value	p-value
Knowledge Infant Birth Weight	0.131	0.301

Most of the babies were born with normal weight and only one person had low birth weight (LBW) status. This is likely due to the increasing knowledge of the mother so that its weight was as expected. In line with previous studies, which stated that education in pregnant women does not affect low birth weight[4]. Different from the findings of other studies that maternal knowledge affects the weight of the baby born[25]. In addition, most mothers have low education level, while most of the babies born had normal birth weight.

Another factor that affects birth weight is the mother's perception, where those who perceive that their child will not be born with LBW conditions will increase the baby's weight. However, this mother's perceptions are not able to detect the occurrence of LBW in newborns[24] . Another study also revealed that birth weight is influenced by the mother's education, infectious diseases (malaria) experienced by the mother, antenatal visits, and drinking water sources[25]. The strength of this study lies in the quasi-experimental method that provides education that focuses on maternal nutrition during pregnancy and continuous monitoring of mothers until delivery to see pregnancy outcomes, especially birth weight. Meanwhile, the weakness of this study is the lack of exploration of other contributing factors, such as health problems experienced by mothers during pregnancy and diet. In addition, this study did not explore other factors that influence pregnancy outcomes and only measured outcomes through infant birth weight, with simple statistical analysis. This indicates the need for a more comprehensive approach to examine the relationship between maternal nutrition education and pregnancy outcomes.

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CONCLUSIONS

There was an increase of pregnant women's knowledge after intervention, but the increase in knowledge did not directly affect the birth weight of the infant. Although education has been proven effective in increasing the knowledge of pregnant women, more comprehensive efforts are required to positively influence the birth outcomes, such as birth weight.

ACKNOWLEDGEMENT

The author extends gratitude to all parties who contributed to the successful completion of this research. Special thanks are given to Poltekkes Kemenkes Bengkulu, for their material support.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors of this study make no declaration of conflict of interest. DIPA Poltekkes Kemenkes Bengkulu provided funding for this investigation in 2024 under the number DP.04.03/F.XXXI/280/2024. The study design, data collection, analysis, interpretation of results, and manuscript composition were not affected by this.

AUTHOR CONTRIBUTIONS

DS: conceptualization, investigation, methodology, supervision, writing–review and editing; AK: methodology, writing–original draft; YND: methodology; formal analysis, writing–original draft; BAP: writing–original draft, writing–review and editing.

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