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Nutrition Education for Pregnant Women to Improve the Nutritional Status of Mothers and Fetuses

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ABSTRACT

The nutritional status of pregnant women is a major determinant of maternal and fetal health. Not only malnutrition such as anemia and chronic energy deficiency (CED), but also excess nutrition such as obesity can cause pregnancy complications. However, most nutritional interventions have not considered variations in nutritional status based on maternal body mass index (BMI). Nutrition education is one of the important interventions bto improve knowledge and change nutritional consumption behavior. This study aims to evaluate the effectiveness of nutritional education on the nutritional status of pregnant women and their fetuses. The study used a pre-post test design with a quantitative approach on 60 pregnant women in the second trimester who received nutrition education for 4 weeks. The parameters measured were changes in hemoglobin levels, upper arm circumference (MUAC), and weight gain. The results showed a significant increase in the average hemoglobin level (p <0.05) and MUAC after the intervention. Nutrition education has been proven effective in improving the nutritional status of pregnant women, both in terms of anemia, energy, and weight. This intervention should be an integral part of antenatal care (ANC) services, taking into account the diversity of maternal nutritional status and socio-economic background.

Keywords: *Nutrition Education, Pregnant Women, Nutritional Status, Hemoglobin, Upper Arm Circumference*

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INTRODUCTION

Maternal health is important for the welfare of future generations. One of the main aspects that affects a healthy pregnancy is the nutritional status of the mother during pregnancy. Lack of nutrients in pregnant women can cause complications such as anemia, low birth weight (LBW), and even maternal and neonatal death. Based on data from *the World Health Organization* (WHO), more than 40% of pregnant women in the world experience anemia, mostly caused by iron deficiency which can be prevented through proper nutrition education and intervention (World Health Organization (WHO), 2021) . Anemia in pregnant women is called "potential danger to mother child", which is why anemia requires serious attention from all parties involved in health services because it is one of the causes of maternal death (Ni Made Risma Dewi et al., 2023) .

In addition to the problems of anemia and Chronic Energy Deficiency (CED), Indonesia also still faces serious challenges in reducing the Maternal Mortality Rate (MMR). Based on the 2022 Indonesian Health Profile report, the MMR is still at 189 per 100,000 live births, which shows that many pregnant women still experience preventable complications, including those related to malnutrition and lack of access to quality health services (Ministry of Health of the Republic of Indonesia, 2023) . Poor nutritional status, such as anemia and CED, is known to be a major risk factor that increases maternal vulnerability to complications during pregnancy and childbirth (UNICEF, 2023) .

In Indonesia, nutritional problems in pregnant women are still a serious challenge. Riskesdas 2018 reported that 48.9% of pregnant women experienced anemia and around 24.2% experienced chronic energy deficiency (CED) which is characterized by an upper arm circumference <23.5 cm. This condition has an impact on increasing the risk of fetal growth and development disorders, including stunting in children in the future (Ministry of Health of the Republic of Indonesia, 2023) . Therefore, intervention efforts based on nutritional education are very important in order to prevent nutritional problems early on.

In addition to malnutrition, excess nutrition in pregnant women is also a problem that cannot be ignored. Excess weight and obesity during pregnancy can increase the risk of obstetric complications such as preeclampsia, gestational diabetes, fetal macrosomia, and cesarean delivery (Poston et al., 2016) . This condition is also associated with long-term risks such as obesity and metabolic syndrome in children later in life. Therefore, nutritional education is not only aimed at preventing malnutrition due to nutritional deficiencies, but must also include efforts to control excessive intake that is not in accordance with the metabolic needs of pregnant women.

According to WHO (2021), the nutritional intervention approach during pregnancy should be balanced and individualized, because maternal nutritional needs differ depending on the initial body mass index (BMI) status of pregnancy. However, in many studies and interventions, including this study, inclusion criteria often do not require initial BMI as a basis for screening, so it is important to consider the possibility of variations in nutritional status (both undernutrition and overnutrition) in the samples involved. Thus, the nutritional interventions provided must remain adaptive to the

multiple nutritional risks that are increasingly found in the pregnant maternal population, especially in developing countries such as Indonesia (Popkin et al., 2020) .

Previous studies have also shown that low maternal education levels correlate with a lack of knowledge about pregnancy nutrition, which results in inappropriate food consumption patterns. A study by Ramadhani et al. (2021) revealed that pregnant women with basic education are more likely to experience anemia than mothers with secondary or higher education, due to a lack of understanding of the importance of consuming micronutrients such as iron and folic acid. In addition, the results of a study by Sari and Dewi (2022) also stated that the level of maternal education affects compliance in consuming Fe tablets and following nutritional recommendations given by health workers. Thus, efforts to educate pregnant women about nutrition not only need to pay attention to aspects of content and delivery methods, but also need to be adjusted to the level of education and socio-cultural background of the mother so that it can be accepted and applied effectively in everyday life.

Nutrition education for pregnant women aims to increase knowledge, awareness, and practice of consuming balanced nutritious food during pregnancy. Research shows that nutrition education provided by health workers systematically can increase the intake of important micronutrients such as iron, calcium, and folic acid, and improve the nutritional status of pregnant women (Hamidah, 2025) . In addition, education can encourage compliance with the consumption of supplements such as Fe tablets, which have so far had low levels of compliance in various regions.

Effective education programs must be participatory, iterative, and linked to local practices and dietary patterns. Education that is one-way and not tailored to the cultural context tends to be less successful in changing pregnant women's consumption behavior (Uyun, 2024) . Educational interventions involving individual and group counseling resulted in significant improvements in hemoglobin levels and mid-upper arm circumference of pregnant women (UNICEF, 2023) .

In addition to educational factors, family support and the availability of nutritious food also influence the effectiveness of behavioral change. Good knowledge without adequate environmental support and economic access is often not enough to create real change (Sirnan, Helni Sadid Parassab, 2025). Therefore, a multisectoral approach involving families, health workers, and local governments is needed to strengthen the impact of nutritional education on pregnant women (Lailiyah, 2023) .

Based on this background, this study aims to evaluate the effect of nutrition education on improving the nutritional status of pregnant women, especially through the parameters of hemoglobin levels, upper arm circumference, and body weight. This study is expected to contribute to formulating more effective and contextual maternal health interventions in primary health services.

METHODS

This study used a pre-experimental pre-post test design with a quantitative approach. The population was pregnant women in the second trimester registered at Puskesmas Kampung Baru. A total of 60 respondents were selected by purposive sampling based on the inclusion criteria: gestational age 13–27 weeks, no comorbidities, and willing to undergo regular education. Interventions in the form of nutritional education were carried out once a week for 4 weeks by a nutritionist, covering the following materials: nutritional needs of pregnant women, examples of balanced menus, and the importance of consuming Fe tablets. Data were collected through measurements carried out before and after the intervention on the variables of hemoglobin levels (hb), upper arm circumference (MUAC) and weight gain using forms and measuring instruments such as HB meters, digital scales and MUAC tapes. In addition, researchers also conducted structured interviews with questionnaires for respondent characteristic data . Data analysis used a paired t-test with a significance level of $p < 0.05$.

RESULTS

Table 1. Comparison of Average Nutritional Status of Pregnant Women Before and After Nutrition Education

Variables	Before Intervention (Mean ± SD)	After Intervention (Mean ± SD)	p-value (Paired t-Test)
Hemoglobin Level (g/dL)	10.4 ± 0.7	11.6 ± 0.6	0.001*
MUAC (cm)	22.1 ± 1.3	23.4 ± 1.1	0.002*
Body Weight (kg)	53.2 ± 5.0	55.0 ± 5.1	0.015*

The average hemoglobin level before the intervention was 10.4 g/dL indicating mild anemia in pregnant women. After four weeks of nutritional education, the average increased to 11.6 g/dL. This increase was considered statistically significant with a *p value of 0.001* . These results indicate that education about consuming iron-rich foods and the importance of consuming Fe tablets successfully improved the hemoglobin status of pregnant women.

The average MUAC of pregnant women before the intervention was 22.1 cm, which is in the risk category of Chronic Energy Deficiency (CED). After education, the average increased to 23.4 cm with a *p value = 0.002* . This increase indicates an improvement in the energy status of pregnant women. Nutrition education plays a role in increasing mothers' understanding of the importance of adequate energy consumption from carbohydrates, healthy fats, and proteins.

The average weight of pregnant women before the intervention was 53.2 kg, and after the intervention increased to 55.0 kg. The results of the analysis showed a significant difference with *p = 0.015* . This indicates that nutrition education helps mothers understand the need for additional calories during pregnancy and encourages increased food intake in a healthy and controlled manner.

DISCUSSION

1. Average Hemoglobin Level

After being given nutrition education for four weeks, the average hemoglobin level increased from 10.4 g/dL to 11.6 g/dL ($p = 0.001$), indicating an improvement in mild anemia status in pregnant women. According to research conducted by (Syarifah, 2024) the results of the tabulation test between before and after giving iron tablets showed that there was an effect of giving iron tablets on the hemoglobin levels of female students. This study is also supported by research from (Diddana et al., 2018) in Ethiopia which found that nutrition education increased the compliance of pregnant women in consuming iron and had an impact on reducing the prevalence of anemia by up to 30%.

the Health Belief Model theory, changes in health behavior such as increasing nutrient intake can occur when individuals are aware of the risk of disease (anemia), understand the benefits of action (iron consumption), and feel confident in being able to change their behavior (self-efficacy). Education plays an important role in shaping these perceptions (Anin Wijayanti & Siti Solihat Holida, 2024) .

Diddana et al.'s (2018) research in Ethiopia also supports this finding, where nutritional education based on a health belief model can significantly increase hemoglobin levels in pregnant women by up to 30%.

Health education is an effort to form healthy conscious behavior through the delivery of information and motivation (Anin Wijayanti & Siti Solihat Holida, 2024) . In the context of pregnancy, education plays a role in increasing maternal awareness of the importance of iron intake to prevent anemia that can endanger the mother and fetus (Mujandari & Khairani, 2025) .

2. Average MUAC

The mean MUAC increased from 22.1 cm to 23.4 cm after nutrition education ($p = 0.002$), indicating an increase in energy and protein intake in pregnant women. According to previous research conducted by (Garg & Kashyap, 2022) found that nutrition education in pregnant women showed an average increase in MUAC of 1.2 cm after 6 weeks, compared to the control group without education. The use of visual food guides and interactive sessions played an important role. (Sunuwar et al., 2019) that a 6-week nutrition counseling program significantly improved the energy status of pregnant women through increased MUAC and body weight.

According to *Maslow's Hierarchy of Needs Theory* , fulfilling physiological needs such as adequate and nutritious food intake is a basic human need (Sunarya, 2022) . The increase in MUAC reflects the fulfillment of these needs obtained from the consumption of balanced carbohydrates, proteins, and fats introduced in education.

Research by Garg and Kashyap (2022) also showed that 6 weeks of nutrition education increased the average MUAC of pregnant women by 1.2 cm, supporting the effectiveness of education-based interventions on energy status.

According to Maslow's basic needs theory, fulfilling physiological needs (including nutrition) is the main priority for body balance. MUAC is used as an indicator to detect the risk of

KEK, and its increase reflects the improvement of pregnant women's energy reserves. With the increasing understanding of mothers about energy needs during pregnancy and examples of balanced nutritional menus provided during education, there is a change in consumption behavior that has an impact on improving energy status.

3. Average Weight of Pregnant Women

The average weight of pregnant women increased from 53.2 kg to 55.0 kg after nutrition education ($p = 0.015$), reflecting an increase in calorie consumption that is more in line with pregnancy needs. This study is in line with research conducted by (Ayushree, 2020) studied nutritional education interventions for pregnant women in food-insecure areas. The results showed an average weight gain of 2.1 kg after 4 weeks of intensive education on local diets based on plant and animal sources . This study is supported by research (Sulistiawati et al., 2021) with statistical analysis results showing that education based on pre-pregnancy BMI nutritional status is effective in adjusting the weight gain of pregnant women. Providing information on healthy living during pregnancy to pregnant women who are overweight (obese) can also control weight gain, dietary habits and physical activity.

According to Bandura's social learning behavior theory, behavior is influenced by interactions between individuals, the environment, and cognition. Nutrition education functions as an external stimulus that encourages mothers to adopt better and more balanced eating behaviors. Weight gain occurs because mothers better understand the types of food and portions recommended to support fetal growth and maintain their health, especially after being given knowledge in the form of visuals, modules, and group discussions (Anin Wijayanti & Siti Solihat Holida, 2024) .

CONCLUSIONS

This study aims to evaluate the effect of nutrition education on improving the nutritional status of pregnant women as measured by three main parameters: hemoglobin levels, upper arm circumference (MUAC), and body weight. Based on the results obtained, it can be concluded that:

1. Nutrition education significantly increased the hemoglobin levels of pregnant women from an average of 10.4 g/dL to 11.6 g/dL (p = 0.001), indicating an improvement in mild anemia status.
2. Upper arm circumference (UMC) also increased significantly, from an average of 22.1 cm to 23.4 cm (p = 0.002), indicating an increase in energy status and a decreased risk of Chronic Energy Deficiency (CED).
3. Maternal weight gain increased significantly, from an average of 53.2 kg to 55.0 kg (p = 0.015), reflecting improvements in calorie and macronutrient intake during pregnancy.

These results indicate that structured and sustainable nutrition education interventions can have a positive impact on the nutritional status of pregnant women. Thus, nutrition education needs to be an integral part of antenatal care (ANC) services in primary health care facilities, especially with an approach that is appropriate to the social context and education level of the mother.

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