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Development of Nutrition Education Module during Pregnancy and Evaluation Effectively Increase the Daily Energy Intake, Mid-Upper Arm Circumference, and Body Weight of Adolescent Pregnant Women

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Abstract

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BACKGROUND: The nutritional status and health of pregnant women are determinants of perinatal growth and the welfare of neonates. Therefore, efforts to prevent fetal growth disorders start from the time of pregnancy, one of which is through increasing knowledge of pregnant women.

AIM: This study aims to produce educational media products in the form of modules and measures their effectiveness on daily energy intake, mid-upper arm circumference (MUAC), and weight of pregnant women.

METHODS: The research method uses the stages of Research and Development. The module development stages consist of product analysis, initial product development, expert test validation (materials and media), small sample trials, and large sample trials. The large sample trial used a quasi-experimental.

RESULTS: After receiving education through the module, pregnant women's daily energy intake increased by 3629.8 kcal, MUAC increased by 2.55 cm, and body weight increased by 7.47 kg, with a significance $p < 0.05$.

CONCLUSION: The pregnancy nutrition module is effective in increasing pregnant women's daily energy intake, MUAC size, and weight. Further research was conducted using the nutrition module during pregnancy as a medium of education on the family approach to increasing pregnant women's nutritional intake through family and community support.

Introduction

Normal birth weight is an important starting point as a reflection of the baby's ability to adapt to a new living environment, so babies with low birth weight (LBW) <2500 g or excess (>4000 g) will be more at the risk of experiencing problems [1]. A fetus that lacks nutritional intake during pregnancy causes intrauterine growth restriction and LBW babies is predictors of growth failure and a risk factor for stunting [2].

The health profile of West Sulawesi Province in 2017, the prevalence of LBW, is high, namely, 1,176 babies from 25,613 births or about 6% of the total baby births. Likewise, short neonatal births (<48 cm) increased from 20.2% to 22.7%, and births of babies with head circumference <33 cm were 38% in 2017. According to the characteristics of LBW births, birth length of 48 cm and head circumference of 33 cm, the majority of these occur in baby girls, low-education parents, and those living in rural areas [3]. UNS/SCN (2013) explained that neonatal stunting reflects

malnutrition that is passed down between generations, especially in teenage pregnancies [4].

Multiple risk factors such as young age, low income, and low socioeconomic status make them vulnerable to intergenerational growth failure. Early marriage is a risk factor for complications of pregnancy and childbirth and increases maternal and infant mortality [5]. This causes variations in the development of bone size, and it is feared that it will repeat itself in the next life cycle called the "Intergeneration Cycle of Growth Failure" [6].

Efforts to prevent fetal growth and development disorders begin when the mother is pregnant [7]. In addition to nutritional interventions, increasing knowledge of pregnant women is effective for preventing stunting [8]. In an effort to increase knowledge, information media is needed and is able to make pregnant women study independently, one of which is a module [9]. Modules are media that can help recipients of information learn independently with minimal assistance from extension workers [10]. According to Musdalifah, the development of the module as an educational medium for stunting risk detection has proven to be effective in increasing maternal knowledge [7].

In this study, we analyzed the development of a nutrition module during pregnancy, and evaluated the results on daily energy intake, mid-upper arm circumference (MUAC), and body weight. This study aims to produce an educational media product in the form of a module so that pregnant women are expected to increase knowledge related to nutrition during pregnancy and independently and actively maintain the health of themselves and the fetus in their womb.

Methods

This study was module development research that adopts the simplified Borg and Gall development model by Tim Pultijakov team. The module development stages consist of product analysis that will be developed through focus group discussion (FGD), initial product development, and expert test validation (materials and media) to get input on material content and display of module feasibility from experts. After that, it was continued with a small sample trial (ten representatives of pregnant women with various levels of education, from elementary school to master), to get an idea of the understanding of potential users of the module to be developed. At the final stage, the module effectiveness test is carried out through a large-sample test. The study subject were collected using consecutive sampling method. The inclusion criteria were teenage pregnant women (19 years), MUAC 23.5 cm, from poor families, and low education level but can read and write. The study included 52 pregnant women

who met the inclusion criteria. A large sample trial using a quasi-experimental type of research (one group pre-test and post-test design). The research location is in the Working Area of the City Health Center in Mamuju Regency. This study has obtained an ethical approval recommendation issued by the ethics commission of Hasanuddin University on October 30, 2020. All of the 52 samples collected were then analyzed using the SPSS application using a paired t-test.

Results

The implementation of this development research is carried out from November 2020 to February 2021. The stages of development research are described as follows:

1. Conduct a product analysis to identify new developments

Products will be developed as a result of needs analysis, literature review, and field surveys, as well as FGD activities involving general practitioners, coordinating midwives, village midwives, health promotion officers, nutrition officers, nurses, and cadres in the Puskesmas working area where the study is being conducted. From the results of the FGD, it is proposed to make special educational media discussing the nutrition needed during pregnancy in the form of a module

2. Development of the first product

This development stage is the development of the initial draft which includes formulating the objectives of the nutrition module during pregnancy and compiling the module materials.

- a. Formulation of the purpose of the nutrition module during pregnancy

The purpose of this module is to increase the knowledge of pregnant women about understanding the first 1,000 days of life, the nutritional needs of pregnant women, the need for iron and additional food, and the impact of malnutrition on pregnant women and fetuses

- b. Preparing and compiling materials for the nutrition module during pregnancy

The materials/materials compiled were obtained through a literature review with reference to the objectives of the nutrition module during pregnancy. Prepare evaluation questions and screening sheets/checklists for the risk of LBW births in pregnant women

- c. Develop an evaluation tool (validation instrument) to measure the feasibility and effectiveness of the module

3. Expert Test Validation

Materials experts and media experts were selected based on criteria including: a minimum of 5 years of clinical and teaching experience in related fields, and at least has a master degree. Expert test validation was conducted to determine the quality and feasibility of the developed pregnancy nutrition module. The expert test is carried out by submitting an initial draft of the module to be assessed by each expert based on the module validation instrument issued by the National Education Standards Agency. The following is the implementation and presentation of expert test validation data for the nutrition module during pregnancy.

a. Validation by a material expert

- Expert quantitative data on material

Based on the validation results of ten material experts on the nutrition module during pregnancy, the score was 3.58, the presentation feasibility aspect was 3.76, the language feasibility aspect was 3.60, and the contextual feasibility aspect was 3.72. The average score was 3.72. This indicates that the module developed in terms of material, which includes aspects of content feasibility, presentation feasibility, language feasibility, and contextual feasibility, is very good

- Material expert qualitative data

On a questionnaire sheet, qualitative data from material experts are input and advice from material experts is provided. enlarged images, use terminology that is easy for lay people to understand, use more general language in the introduction, use images with sources or specially made by experts, if using original photos, make sure to get permission, nutritional needs during each trimester of pregnancy, nutritional benefits for pregnant women and fetuses, and "We had already revised all relevant expert input" (Figure 1)

b. Media expert authorization in this study

Two media experts have been used for product validation, such as the chairman of Hasanuddin University Makassar's center for the study and development of learning

- Media quantitative data

Based on the validation, results of two media experts on the nutrition module during pregnancy based on the aspect of the suitability of the module size 3.50, cover design 3.62, module content design 3.64, and average value 3.58. This indicates that the module was developed in terms of material which includes aspects of the size of the module, the cover design of the module content design is very good

- The qualitative data of media experts was obtained from the input and advice of media experts on the questionnaire sheet. The media expert inputs include; the size of the module should be reduced so that it is easy to carry, use the motto of local cultural wisdom, and make a video link (youtube) that is easily accessible to all pregnant women. All media expert inputs have been revised (Figure 2)

4. Trial with a small sample size

Input and suggestions were obtained based on the results of the test/review from media and material experts. The module is then revised/improved. Furthermore, the module was tested in a small sample trial to ten pregnant women of varying levels of education. The component of pregnant women's interest in the module got a score of 3.73, the material aspect got a rating of 3.70, and the language aspect got a score of 3.70, for a total score of 3.71, which indicates the module from the viewpoint of interest, the material and language are excellent

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Table 1: Distribution of respondent characteristics

Variable	(n = 52)			
	n (%)	Min	Max	Mean ± SD
Age		13	19	17.46 ± 1.54
Parity		1	3	1.43 ± 0.66
Job				
Does not work	52 (100)			
Education				
No school	8 (15.40)			
Elementary school	42 (80.76)			
Junior high school	2 (3.84)			
Income/month				
<1 million	31 (59.61)			
1-<2 million	21 (40.39)			
Pre test results				
MUAC size		19.0	23.5	22.15 ± 1.30 (cm)
Energy intake		522	1755	1074.4 ± 347.6 (Kcal)
Body weight		43	52	49.26 ± 9.95 (Kg)

MUAC: Mid-upper arm circumference.

5. A large sample size was used in the trial

This study refers to sociodemographic variables such as age, parity, occupation, education, and family income. The mothers who became respondents in this study had a minimum age of 13 years and a maximum age of 19 years, as shown in the table. Pregnant women who become respondents are parity 1 and have a maximum parity of 3. All of the respondents are unemployed. In terms of education level, it is divided into three categories: No school, elementary school, and junior high school. The majority of the three groups, as many as 42 people (80.76 %), have an elementary school education, while the rest are not in school and have a junior high school education. According to family income, all respondents earn less than the regional minimum wage of West Sulawesi Province, which is 2.5 million/month, with 31 people (59.61%) earning 1 million and 21 people earning 2 million (40.39%).

Table 2: Test results of a large sample of nutrition modules during pregnancy on energy intake of pregnant women

Variable	n	Mean ± SD (kcal)	Mean Difference	95% CI	p
Pre-test	52	11023.1 ± 3256.1	-3629.6	-2971.7--4287.5	0.000
Post-test	52	14652.7 ± 2708.7			
Paired t-test					

Based on the results of the initial examination of the size of the MUAC, respondents had a minimum size of 19 cm and a maximum size of 23.5 cm, a daily energy intake of 522 Kcal and a maximum of 1755 Kcal, a minimum body weight of 43 kg, and a maximum of 52 kg (Table 1).

A total of 52 pregnant women after being given education, the results of the different paired sample test, it was proven that there was an increase in the average daily energy intake of pregnant women before after education with a value of -3629.6 Kcal. It was statistically significant, with $p < 0.001$ (Table 2). The results of the t-test paired sample difference test, it was proven that there was an increase in the size of the MUAC, with a value of -2.55 cm. The results of the significance of $p < 0.001$ indicates that the nutrition module during pregnancy is effective in increasing the size of the MUAC of pregnant women (Table 3)

Table 3: Results of a large sample trial for the nutrition module during pregnancy on the size of the mid-upper arm circumference (MUAC)

Variable	n	Mean ± SD (cm)	Mean Difference	95% CI	p
Pre-test	52	23.25 ± 2.12	-2.55	-2.30--2.80	0.000
Post-test	52	25.80 ± 1.92			
Paired t-test					

There was a difference in the weight of pregnant women before and after the intervention, with an increase of -7.47 kg, a significant $p < 0.001$ (Table 4).

Table 4: Results of large sample trials for nutrition module during pregnancy on pregnant women's body weight

Variable	n	Mean ± SD (Kg)	Mean Difference	95% CI	P
Pre test	52	49.26 ± 9.95	-7.47	-5.35--9.58	0.000
Post test	52	56.73 ± 7.92			
Paired t-test					

Discussion

The development of the module using the Research and development method produces a product in the form of an educational module that is in accordance with the needs and demands of stakeholders at the research site as well as measuring the effectiveness of the resulting module for pregnant women as users. All components are arranged according to the input from the discussion at the beginning of the module development to the small sample test stage.

The material presented in this module can help pregnant women learn independently, because it is equipped with practice questions that can stimulate pregnant women to find answers to these questions, besides that the module is made with colors and looks that are as attractive as possible. This module is also equipped with a screening/checklist to detect the risk of giving birth to a baby with LBW so that it can make it easier for mothers to independently identify the initial conditions of their potential to give birth for LBW. Based on the results of the large sample test, the results of changes in nutritional consumption behavior of pregnant women were obtained as evidenced by an increase in daily energy intake, size of MUAC, and weight gain.

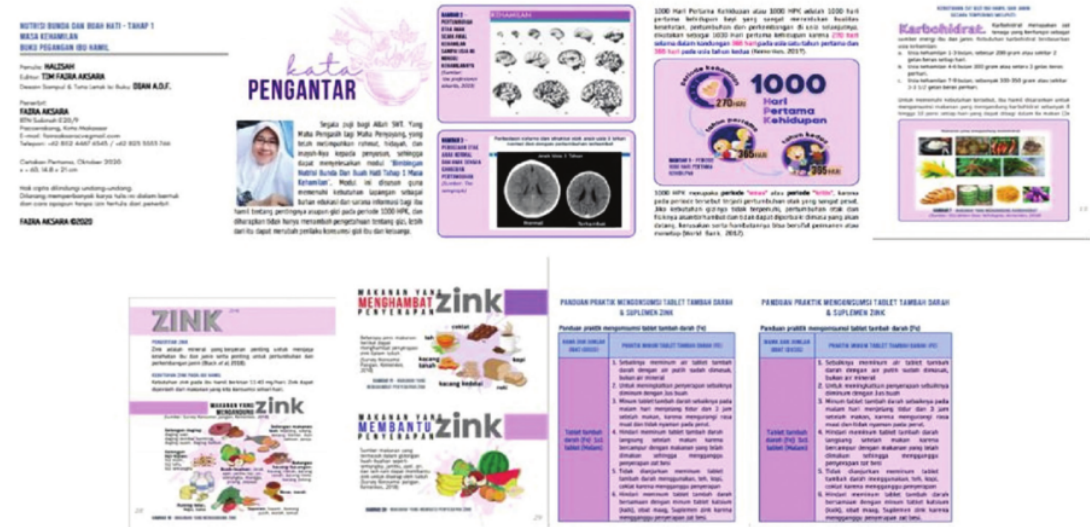


Figure 1: Qualitative data from material experts



Figure 2: The qualitative data of media experts

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The results of this study are in line with the results of Hasanah's research, which found a relationship between nutritional knowledge of pregnant women and diet, increased size of MUAC, and weight of pregnant women. Several research results related to module development have proven to be effective in increasing knowledge of the early detection of stunting risk [7]. The selection and use of media are one of the components that affect the results of the health promotion carried out. This means that the increase in knowledge is strongly influenced by the media used, including modules. The module really respects individual differences, so users can learn according to their ability level so that learning is more effective and efficient [11]. This is also supported by the result of Medri's *et al.* research that the module can be used and studied at any time, so it is not bound by time. When compared to leaflets, modul⁶ can provide clearer and more complete information. A module is a set of teaching materials that are packaged in a complete and systematic way, which contains a set of learning experiences that are planned and designed to achieve certain learning objectives.

Giving modules to respondents can provide access for users to learn health knowledge about anemia, its prevention including consuming iron tablets. Health literature such as modules can accommodate a person's achievements to understand health promotion, prevention, and treatment of a disease, such as anemia in pregnant women. The module can help users in increasing knowledge [12]. Research related to knowledge of module utilization can increase¹⁰ knowledge in exclusive breastfeeding efforts [13]. Knowledge is a very important domain for the formation of one's actions. Based on experience and research, it turns out that someone's actions that are realized by knowledge will be more regular than⁷ actions that are not realized by knowledge. With good knowledge, pregnant women can know food ingredients that can harm their pregnancy and can choose things that can support the quality of their pregnancy, including the importance of consuming iron tablets [14].

Conclusion

It can be concluded that the development of nutrition education modules during pregnancy can improve the nutritional status of pregnant women, particularly teenage pregnant women from the low-income families who are chronically deficient in energy, as evidenced by an increase in daily energy intake and an increase in the size of the MUAC and body weight.

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