

## Training on Early Detection of Chronic Energy Deficiency in Pregnancy

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### Abstract

*Chronic Energy Deficiency in pregnancy is a condition where pregnant women suffer from a lack of food that lasts for a long time. Pregnant women with chronic energy deficiency have poor eating behavior, which is influenced by knowledge, perception, beliefs, and health education. Health education provided by health workers can increase knowledge and change eating behavior and can be done better if assisted by an expert system. This activity aims to train health workers (doctors, midwives, nutritionists) to carry out early detection of chronic energy deficiency in pregnancy using an expert system, increasing knowledge, attitudes, and eating behavior of pregnant women. The method that will be carried out is training using the web-based expert system modelangraini.com for health workers, health education for pregnant women, and increasing knowledge and changing the eating behavior of pregnant women. This activity was carried out for 1 day and took place in the Faculty of Medicine, University of Lampung on Saturday 30 September 2023 with 45 family doctors, midwives, and nutritionists in Bandar Lampung City participating. The results of the evaluation of the implementation of the service showed that there was an increase in participants' understanding by 91.1% to good understanding, 8.9% of participants had a fairly good understanding, and no participants had a poor understanding of the causes, risk factors, impacts, prevention methods, and early detection of chronic energy deficiency in pregnancy with techniques that are fast, easy and can help health workers in providing education and interventions on the eating behavior of pregnant women. This training activity can improve the skills of health workers to increase the knowledge, attitudes, and eating behavior of pregnant women so that they can prevent, overcome, and help reduce the prevalence of chronic energy deficiency in pregnant women and prevent stunting in toddlers.*

**Keywords:** *early detection, chronic energy deficiency, training, health workers*

### Abstrak

Kurang Energi Kronis pada kehamilan merupakan keadaan ibu hamil menderita kekurangan makanan yang berlangsung lama. Ibu hamil kurang energi kronis memiliki perilaku makan yang kurang baik, yang dipengaruhi oleh pengetahuan, persepsi, kepercayaan dan edukasi kesehatan. Edukasi kesehatan yang diberikan oleh tenaga kesehatan bisa meningkatkan pengetahuan dan

merubah perilaku makan dan bisa dilakukan dengan lebih baik apabila dibantu oleh sebuah sistem pakar. Tujuan dari kegiatan ini adalah melatih tenaga kesehatan (dokter, bidan, ahli gizi) untuk melakukan deteksi dini kurang energi kronis pada kehamilan menggunakan sistem pakar, meningkatkan pengetahuan, sikap dan perilaku makan ibu hamil. Metode yang akan dilakukan adalah dengan pelatihan deteksi dini kurang energi kronis pada kehamilan melalui penggunaan sistem pakar berbasis web modelangraini.com untuk tenaga kesehatan, pendidikan kesehatan untuk ibu hamil, dan peningkatan pengetahuan serta perubahan perilaku makan ibu hamil. Kegiatan ini dilaksanakan selama 1 hari dan bertempat di Aula Gedung A Lantai 1 Fakultas Kedokteran Universitas Lampung pada hari Sabtu tanggal 30 September 2023 dengan peserta 45 orang dokter keluarga, bidan dan ahli gizi di Kota Bandar Lampung. Hasil evaluasi pelaksanaan pengabdian didapatkan bahwa terjadi peningkatan pemahaman peserta sebanyak 91,1% menjadi pemahaman yang baik, 8,9% peserta memiliki pemahaman cukup baik, dan tidak ada peserta memiliki pemahaman yang kurang mengenai penyebab, faktor risiko, dampak, cara pencegahan, dan deteksi dini kurang energi kronis pada kehamilan dengan teknik yang cepat, mudah dan dapat membantu tenaga kesehatan dalam melakukan edukasi dan intervensi perilaku makan ibu hamil. Kegiatan pelatihan ini dapat meningkatkan keterampilan tenaga kesehatan dalam upaya meningkatkan pengetahuan, sikap dan perilaku makan ibu hamil sehingga bisa mencegah, menanggulangi, dan membantu mengurangi prevalensi kurang energi kronis pada ibu hamil serta mencegah stunting pada balita.

**Kata kunci:** Deteksi dini, Kurang Energi Kronis, Pelatihan, Tenaga kesehatan

## INTRODUCTION

Stunting is a condition of failure to grow in children under five years of age (toddlers) due to chronic malnutrition and recurrent infections, especially during the First 1,000 Days of Life, that was from the fetus to the child aged 23 months (Titaley *et al.*, 2019; Yuliarti, Ermi and Arinda, 2022). Stunting can be caused by very diverse factors, from the condition of the mother or preconception women, fetal period, and infancy/toddler period or in line with the period of the first 1000 days of life. The first 1000 days of life are a golden period as well as a critical period for a person (windows of opportunity). The health and nutritional conditions of the mother before and during pregnancy, the mother's body posture, the distance between pregnancies which tend to be close together, the mother being a teenager, and inadequate nutritional intake during pregnancy affect fetal growth and the risk of stunting (Saleh *et al.*, 2021). Intervention efforts during the first 1000 days of life period include during pregnancy, when the baby is born, babies aged 6 months to 2 years, and monitoring the growth of toddlers in posyandu as well as clean and healthy living behavior (Setianingsih and Hussain, 2023). Inadequate nutrition intake in pregnant women can make she will be at risk of suffering from chronic energy deficiency (CED). Chronic energy deficiency in pregnant women is a condition where pregnant women suffer from a chronic lack of food which results in health problems for the mother (Yuliarti, Ermi and Arinda, 2022). The indicator to describe a pregnant woman with CED is measuring the Mid-Upper Arm Circumference (MUAC) on the left upper arm of less than 23.5 cm as measured using a measuring tape (Yosefinata, Zuhairini and Luftimas, 2022).

The results of Indonesian Basic Health Research (Riskesdas) in 2018 show that in Indonesia, the prevalence of CED in pregnant women reached 17.3%, in Lampung province it was 13.6%, and in Bandar Lampung City it was 17.1%. The prevalence of CED in pregnant women aged 15-19 years is 33.5% and in pregnant women aged 20-24 years is 23.3%; This figure is still high so further

intervention is needed. One indicator of efforts to improve nutrition in Indonesia is reducing the prevalence of chronic energy deficiency in women of childbearing age, both pregnant and non-pregnant (Ministry of Health Republic of Indonesia, 2018a).

Pregnant women are one of the nutritionally vulnerable groups. Based on the national survey of nutritional status, 53.9% of pregnant women experienced an energy deficit (<70% level of nutritional adequacy), for protein adequacy, 51.9% of pregnant women experienced a protein deficit (<80% level of nutritional adequacy). Insufficient energy and protein intake in pregnant women can cause CED. Pregnant women with CED are at risk of giving birth to low birth weight (LBW) babies which can also be an indirect cause of maternal death and have an impact on increasing the prevalence of stunting in Indonesia (Ministry of Health Republic of Indonesia, 2018b). The World Health Assembly (WHA) targets reducing stunting rates by 40 percent from the 2013 prevalence of 22 percent by 2025. Meanwhile, one of the health development targets that will be achieved in 2025 is to reduce the prevalence of malnutrition among children under five (Branca *et al.*, 2012).

Lack of food intake is the main risk factor for chronic energy deficiency in pregnant women. Based on the results of the Nutrition Consumption Monitoring which was carried out at the same time as the assessment of nutritional status data collection in 2016, it showed that 26.3 percent of pregnant women met energy adequacy and 29.3 percent of pregnant women met protein adequacy in their daily consumption. Based on the conditions of energy and protein adequacy above, this contributes quite significantly to the occurrence of CED in pregnant women in Indonesia (Ministry of Health Republic of Indonesia, 2018b).

Pregnancy causes increased energy metabolism, therefore, the need for energy and other nutrients increases during pregnancy. This increase in energy and nutrients is needed for the growth and development of the fetus, increasing the size of the uterine organs, as well as changes in the composition and metabolism of the mother's body. So a lack of certain nutrients needed during pregnancy can cause the fetus to not grow properly (Marshall *et al.*, 2022). Pregnant women's needs will increase more than usual and the exchange of almost all materials occurs very actively, especially in the third trimester. Due to the increase in consumption, food needs to be increased, especially consumption of food sources of energy to meet the needs of the mother and fetus (Jouanne *et al.*, 2021).

Lack of energy intake from macronutrients (carbohydrates, protein, and fat) and micronutrients, especially vitamin A, vitamin D, folic acid, iron, zinc, calcium and iodine, and other micronutrients, results in CED during pregnancy, which begins with the risk of CED and is characterized by low energy reserves over a long period as measured by mid-upper arm circumference (MUAC). Poor maternal eating behavior during pregnancy will risk suffering from chronic energy deficiency, so this behavior must be changed. Based on the health belief model (HBM) theory, individual behavior can be changed by changing individual beliefs (perceptions) by increasing knowledge. Knowledge can be increased with health education (Mousa, Naqash and Lim, 2019). The poor eating behavior of pregnant women can be changed by providing additional knowledge in the form of health education by health workers. Health education by health workers can increase pregnant women's knowledge about pregnant women's nutrition and change the eating behavior of pregnant women (Kebbe *et al.*, 2021).

The results of a preliminary study conducted by the service team through interviews with several health workers, that are doctors, midwives, and nutritionists at first-level health facilities in Bandar Lampung City, found that 80% of pregnant women had poor eating behavior. This eating behavior is influenced by knowledge, perception, beliefs, and health education. Health education provided

by health workers has been proven to be able to increase knowledge and change eating behavior as seen by an increase in maternal weight during pregnancy.

Early detection of CED in pregnancy carried out by health workers for pregnant women can be done better if assisted by an expert system. An expert system is a computer program or information system that contains some knowledge from one or more human experts related to a field that tends to be specific, such as doctors and other health workers. A web-based expert system that can be used for early detection of CED in pregnancy and health education for pregnant women in increasing knowledge and behavior related to nutrition can be accessed via the address [modelangraini.com](http://modelangraini.com).

The web-based expert system [modelangraini.com](http://modelangraini.com) is an expert system used to assess the risk of CED in pregnant women. This web-based expert system [model angraini](http://modelangraini.com). the site consists of several components, namely data on pregnant women, nutritional knowledge, dietary restrictions, food intake, conclusions about the risk of CED, and suggestions. The final part of the [modelangraini.com](http://modelangraini.com) web-based expert system is in the form of suggestions that can be the basis for education from health workers (doctors, midwives, and nutritionists) in increasing the knowledge and eating behavior of pregnant women so that they can prevent CED. Therefore, community service training on early detection of CED in pregnancy for health workers using a web-based expert system to change the eating behavior of pregnant women as an effort to prevent CED is very important for health workers, that are doctors, midwives, and nutritionists who is in the city of Bandar Lampung.

## **GENERAL DESCRIPTION OF THE COMMUNITY, PROBLEMS AND TARGET SOLUTIONS**

### **General description**

Chronic energy deficiency in pregnant women is a nutritional problem that must be addressed and prevented because chronic lack of energy in pregnant women will increase the prevalence of stunting in toddlers. The prevalence of CED in pregnant women based on the 2018 RISKESDAS results in the city of Bandar Lampung is still quite high, which is 17.1%. Pregnant women with CED have poor eating behavior. Prevention and health promotion efforts are needed to prevent and reduce the incidence of CED pregnant women. Health prevention and promotion is focused on overcoming the direct causes and indirect causes of CED in pregnancy, one of which is using health education media. Health education is carried out by health workers at the scope of individuals, groups, and the wider community using appropriate media facilities. Well-targeted health education will have an impact on comprehensive prevention (5 levels of prevention) and increase health knowledge and improve the health status of the community, including pregnant women with CED. Improving the skills of health workers using a web-based expert system to change the eating behavior of pregnant women as an effort to prevent CED is an effort to empower the community in preventing CED pregnant women. The scope of this activity is health workers (family doctors, midwives, and nutritionists) who are gatekeepers in health facilities that serve the health of CED pregnant women (who are part of the 1000 First Day of life program. Health workers (family doctors, midwives, nutritionists ) will be trained in skills to use the [modelangraini.com](http://modelangraini.com) web-based expert system so that health workers will be able to assess nutritional knowledge, eating behavior of pregnant women, the risk of CED during pregnancy and then provide health education to pregnant women based on suggestions and findings in the web-based expert system [modelangraini.com](http://modelangraini.com).

Tabel 1. Target description

No	Name of target	Characteristics of target	Amount	General problem or targets
1	Family Doctors	Family doctor in primary care	15	Health Sector
2	Nutritionist	Nutritionist in primary care	15	Health Sector
3	Midwives	Midwives in primary care	15	Health Sector

### Problem

Pregnant women with nutritional and health problems have an impact on the health and safety of the mother and baby as well as the quality of the baby born. The condition of pregnant women with CED risks reducing the muscle strength that helps the birth process, which can result in prolonged labor and postpartum bleeding, even maternal death. The risk to the baby can result in fetal death (miscarriage), prematurity, birth defects, etc. Pregnant women with CED can disrupt the growth and development of the fetus, that are physical growth (stunting), brain and metabolism which can cause non-communicable diseases in adulthood. Pregnant women with CED will cause health problems, children's education in the future, and of course the economy. CED pregnant women have insufficient knowledge, attitudes, and skills regarding maintaining health during pregnancy and preventing CED. Poor eating behavior during pregnancy has a high risk of suffering from CED. Efforts to increase knowledge, attitudes, and eating behavior of pregnant women to prevent and overcome CED can be made by training health workers using an expert system. Not many health workers (doctors, midwives, and nutritionists) know and can use expert systems for early detection of CED in pregnancy so that intervention can be carried out as early as possible.

### Target Solutions

The activity of early detection of CED in pregnancy is to improve the skills of health workers using a web-based expert system to change the eating behavior of pregnant women to prevent CED. This is a community empowerment activity in the form of training the skills of health workers (family doctors, midwives, and nutritionists) using a web-based expert system modelangraini.com. The use of the web-based expert system modelangraini.com can be used as a basis for health education to increase knowledge and change the eating behavior of pregnant women. Training using the web-based expert system modelangraini.com for health workers (family doctors, midwives, and nutritionists) by providing guidebooks, delivering material through lectures and discussions, as well as direct practice using the expert system. After the training, monitoring, and evaluation were carried out to increase knowledge and changes in the eating behavior of pregnant women.

Table 2 Problems and solutions

No	Problem	Solutions	Indicators of goals
1	Knowledge, Attitudes and Eating Behavior of Pregnant Women in Preventing CED	Early Detection of CED and Eating Education by Health Workers	Increase of knowledge /skill/ behavior in eating patterns
2	Skills in using the Health Care Expert System in Early Detection of Pregnancy CED	Web-Based Expert System Training for Early Detection of CED in Pregnancy	Increase skill in early detection of CED in pregnancy using a web-based expert system

## METHOD

The community service method for early detection of CED in pregnancy by increasing the skills of health workers using a web-based expert system to change the eating behavior of pregnant women as an effort to prevent chronic energy deficiency through Training, Health Education, Evaluation

Training of health workers (family doctors, midwives, and nutritionists) through outreach activities, lectures, discussions, and direct practice in using the web-based expert system modelangraini.com will be attended by 45 health workers (family doctors, midwives, and nutritionists) who is in the city of Bandar Lampung.

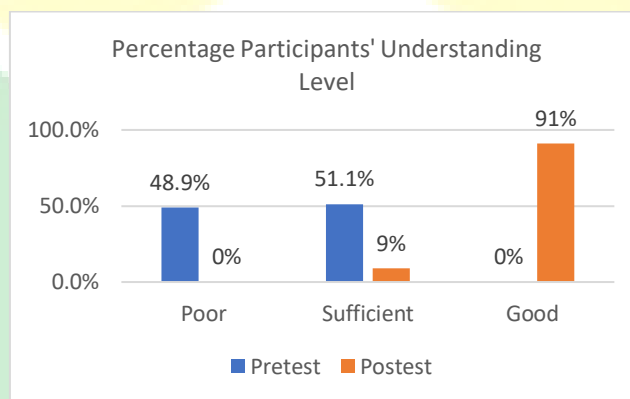
## RESULTS AND DISCUSSION

The community service activity "Training on Early Detection of Chronic Energy Deficiency in Pregnancy" consists of 2 activity stages, which are the delivery of material and practice of early detection of chronic energy deficiency in pregnancy using an expert system. This community service activity was carried out in the Hall of Building A, Floor 1, Faculty of Medicine, University of Lampung (FK UNILA) on Saturday 30 September 2023 with 45 family doctors, midwives and nutritionists in Bandar Lampung City participating. This community service activity began with a speech by the implementing team and an explanation of nutritional problems for pregnant women from 09.00 WIB to 09.30 WIB. Then continued with training activities which began with a pretest and then continued with the delivery of material by the implementation team from 09.30 WIB to 12.00 WIB, and then continued with discussion. After break time (rest, prayer, and lunch) at 12.00-13.00 WIB, it continues with the direct practice of early detection of chronic energy deficiency in pregnancy using a web-based expert system, that is "modelangraini.com" at 13.00-15.00 WIB.

The training was carried out by delivering material about chronic energy deficiency (CED) in women of childbearing age and pregnancy, causes of CED, risk factors for CED in pregnant women, the impact of CED on pregnancy, how to prevent CED in pregnant women, early detection of CED in pregnancy with fast techniques, it is easy and can help health workers in providing education and intervention on the eating behavior of pregnant women; by using a web-based expert system "modelangraini.com". The material was provided using an interactive lecture method to family doctors, midwives, and nutritionists using the material delivery in the form of power points. The evaluation methods used in training are pretest, interactive discussion, and posttest. The pretest was carried out to measure the participants' prior knowledge by administering a questionnaire. The interactive discussion begins by allowing participants to ask questions and asking other participants to answer first, then complete answers are given by the implementing team. Apart from that, interactive discussions were also carried out by asking participants several questions as a form of feedback on the material that had been presented. The post-test was carried out to measure the participants' final knowledge after being given the knowledge by administering a questionnaire. Before delivering material about chronic energy deficiency (CED) in women of childbearing age and pregnancy, causes of CED, risk factors for CED in pregnant women, the impact of CED on pregnancy, how to prevent CED in pregnant women, early detection of CED in pregnancy with fast techniques, easy and can help health workers in providing education and intervention on the eating behavior of pregnant women; By using a web-based expert system "modelangraini.com", participants are given a written pretest regarding the material and a written posttest regarding the material that has been presented. The results of the pretest questions were approximately 22 people (48.9%) participants poorly understood, 23

people (51.1%) had sufficient understanding, and none (0%) participants had a good understanding of chronic energy deficiency (CED), in women of childbearing age and pregnancy, causes of CED, risk factors for CED in pregnant women, the impact of CED in pregnancy, how to prevent CED in pregnant women, early detection of CED in pregnancy with techniques that are fast, easy and can help health workers in providing education and intervention eating behavior of pregnant women; by using a web-based expert system "modelangraini.com".

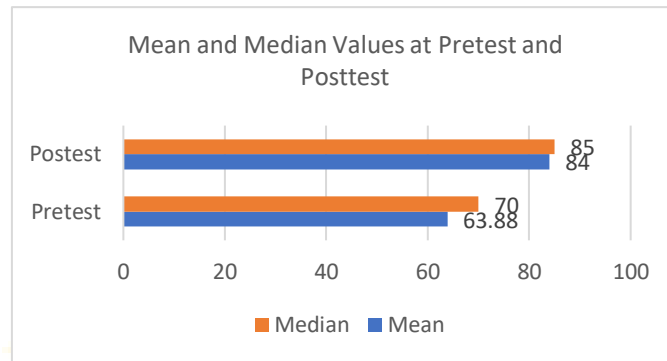
In the results of the post-test questions, it was found that there was an increase in participants' understanding, that were 41 people (91.1%) participants had a good understanding, 4 people (8.9%) had sufficient understanding, and none (0%) participants had a poor understanding of CED in women of childbearing age and pregnancy, causes of CED, risk factors for CED in pregnant women, the impact of CED on pregnancy, how to prevent CED in pregnant women, early detection of CED in pregnancy with techniques that are fast, easy and can help energy health in providing education and interventions on the eating behavior of pregnant women; by using a web-based expert system "modelangraini.com". An illustration of the percentage level of understanding during the pretest and posttest of participants is presented in Figure 1 .



Picture 1. The Percentage of Participants' Understanding Level

The participants' knowledge/understanding was based on having a mean pre-test score of 63.88 and a median score of 70, and experienced an increase during the post-test, with a mean post-test score of 84 and a median score of 85. The analysis was carried out using a 2-group mean test, that was the Wilcoxon test ( because the data is not normally distributed), and obtained a p-value of  $p = 0.000$ . This shows that the training provided regarding chronic energy deficiency (CED) in women of childbearing age and pregnancy, causes of CED, risk factors for CED in pregnant women, the impact of CED in pregnancy, how to prevent CED in pregnant women, early detection of CED in pregnancy using techniques which is fast, easy and can help health workers in providing education and intervention on the eating behavior of pregnant women; by using a web-based expert system "modelangraini.com". An overview of the mean and median scores during the participants' pretest and posttest is presented in Figure 2.

Based on the pre-test and post-test questionnaires given, it is known that there has been an increase in the knowledge and understanding of participants (family doctors, midwives and nutritionists) regarding chronic energy deficiency (CED) in women of childbearing age and pregnancy, causes of CED, risk factors for CED in pregnant women, the impact of CED on pregnancy, how to prevent CED in pregnant women, early detection of CED in pregnancy using techniques that are fast, easy and can help health workers in providing education and interventions on the eating behavior of pregnant women; by using a web-based expert system "modelangraini.com".



Picture 2. Mean and Median Values at Pretest and Posttest

After the training activity with the delivery of material and discussion, the next activity is a direct practice in carrying out early detection of chronic energy deficiency in pregnancy using a web-based expert system "modelangraini.com". In this activity, participants were very enthusiastic about practicing and discussing direct methods for early detection of chronic energy deficiency in pregnancy and feedback regarding what would be taught to pregnant women to change their eating behavior to prevent and overcome the risk of chronic energy deficiency in pregnancy. Evaluation was carried out at the end of the activity through discussion and almost 95% of participants understood how to carry out early detection of chronic energy deficiency in pregnancy using a web-based expert system "modelangraini.com".

Health education is a way to support health programs that can produce changes and increase knowledge in a short time. The concept of health education is a learning process for individuals, groups or communities from not knowing about health values to knowing, from being unable to overcome health problems to being able (Hasanica *et al.*, 2020). Health education can play a role in changing the behavior of individuals, groups, and communities by health values. The expected change in behavior is to maintain and improve health, prevent the risk of illness, protect oneself from the threat of disease, and actively participate in the public health movement so that behavior change is the result of health education (Wang and Fang, 2020).

Providing health education/counseling to increase knowledge can be done using health promotion tools (Nara Lintan Mega Puspita *et al.*, 2023). Tools can be in the form of an expert system provided by health workers to the community, for example, pregnant women, so that they can increase knowledge and change behavior. An expert system is a knowledge-based program that provides expert-quality solutions to problems in a specific domain. The implementation of expert systems is widely used in the health sector because expert systems are seen as a way of storing expert knowledge in certain fields in computer programs so that decisions can be made by reasoning intelligently (Sirait, 2023).

The application of computer-based technology in the health sector includes the application of expert systems, which are knowledge-based programs that use human knowledge, where this knowledge is entered into a computer, and then used to solve problems that usually require expertise. The implementation of expert systems is widely used in the health sector because expert systems are seen as a way of storing expert knowledge in certain fields in computer programs so that decisions can be made using intelligent reasoning (Ilham Insani and Trisnawan Putra, 2018). One implementation of an expert system in the health sector is an expert system for early detection of health problems, for example, the risk of chronic energy deficiency in pregnant women. A web-based expert system that can be used for health education for pregnant women in increasing knowledge and behavior related to nutrition can be accessed via the address



modelangraini.com. This web-based expert system model angraini. site is an expert system used to assess the risk of chronic energy deficiency in pregnant women. The web-based expert system modelangraini.com consists of several components, which include data on pregnant women, nutritional knowledge, dietary restrictions, food intake, conclusions about the risk of chronic energy deficiency, and suggestions. The final part of the modelangraini.com web-based expert system is in the form of suggestions that can be the basis for education from health workers (family doctors, midwives, and nutritionists) in improving the knowledge and eating behavior of pregnant women so that can prevent chronic energy deficiency in pregnancy.

## CONCLUSIONS AND SUGGESTIONS

Training activities on early detection of chronic energy deficiency in pregnancy using this expert system can help health workers (family doctors, midwives, and nutritionists) assess the risk of chronic energy deficiency in pregnant women. Early detection of chronic energy deficiency in pregnancy using an expert system can be accessed for free via the website "modelangraini.com", can be used easily, and does not need to be downloaded on the communication device used. Using the expert system "modelangraini.com" can help health workers (family doctors, midwives, and nutritionists) to improve the eating behavior of pregnant women as an effort to prevent and overcome chronic energy deficiency during pregnancy. We recommend that health facility providers provide internet access because using the expert system "modelangraini.com" requires internet access. Apart from that, the use of *the* expert system "modelangraini.com" must be used periodically and continuously to assess the risk of chronic energy deficiency in pregnant women during their pregnancy.

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