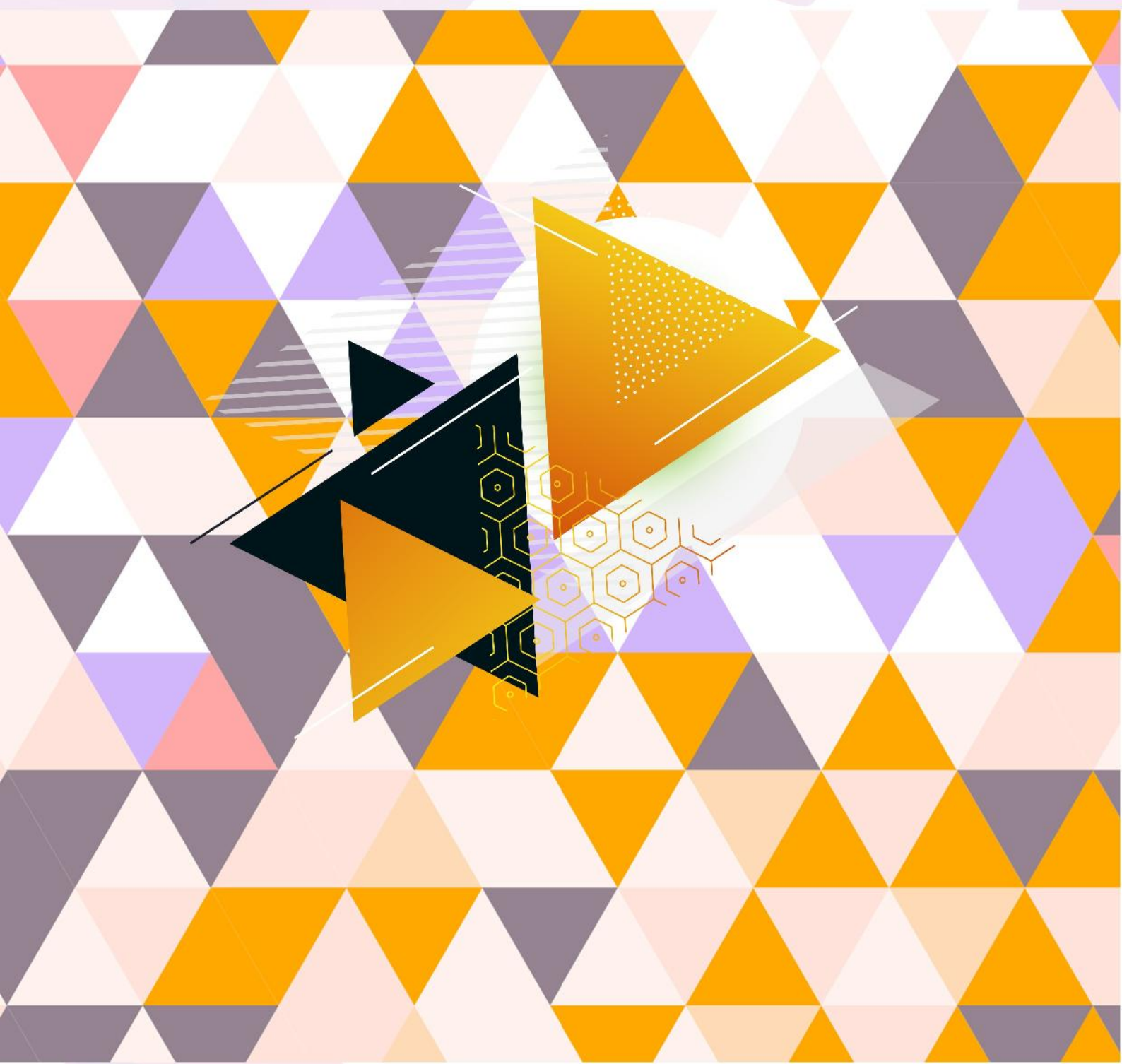


MUHAMMADIYAH

Journal of Epidemiology



**Faculty of Public Health
University of Muhammadiyah Jakarta**

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The Effect of Pre-Pregnancy Body Mass Index (BMI) with The Incidence of Hypertension in Pregnancy

¹⁾Fitriani, ²⁾Syahrani

^{1),2)}Akademi Kebidanan Yapma Makassar, Jalan Maccini Raya No 197 Makassar 90223

Email : fith_rhie@ymail.com

ABSTRACT

Hypertension is a health problem that often appears during pregnancy and can cause complications in 5-10 percent of pregnancies, and causes maternal morbidity. High body mass index before pregnancy is associated with an increased risk of pregnancy outcome, one of them is hypertension in pregnancy. The aim is to study the effect of pre-pregnancy Body Mass Index (BMI) with the incidence of hypertension in pregnancy. This research was conducted with cross-sectional study method in pregnant women and sample chosen randomly which numbered 78 people, at the Jongaya Health Center in Makassar during the period June to July 2019.

There are 33.3% of pregnant women who had obesity and hypertension, 50% of pregnant women who had overweight and hypertension, and 16.7% of pregnant women who had normal Body Mass Index and Hypertension. There was significant correlation between Body Mass Index (BMI) with systolic blood pressure ($p = 0,000$), Body Mass Index (BMI) with diastolic blood pressure ($p = 0.002$). Body Mass Index (BMI), significantly influence the incidence of hypertension in pregnancy.

Prevalence of pregnancy women who are overweight / obese during pregnancy caused by diet or improper pregnancy weight management. Suggested an early clinical detection of prehypertension and intervention including life style modification, particularly weight management

Keywords: *Pregnancy, Hypertention, Body Mass Index (BMI), Blood Pressure*

INTRODUCTION

Data from the World Health Organization (WHO) in 2015, there were around 585,000 women who died per year during pregnancy or childbirth and 51.1 percent was recorded as one of the problems for pregnant women worldwide due to an increase in blood pressure in pregnant women which is an early symptom of pregnancy poisoning (preeclampsia and eclampsia)¹.

In Indonesia, maternal mortality is still quite high, even the highest in Southeast Asia. The results of the Inter-Census Population Survey (SUPAS) in 2015 found that MMR in Indonesia was 305/100,000 live births.⁴

In South Sulawesi, especially in the city of Makassar, in 2016 there was 23.42/100,000 live births and there was a decrease in 2017 of 19.22 / 100,000 live births (Dinas Kesehatan Kota Makasar, 2018).

There is a change in the proportion of causes of maternal death, namely bleeding and infection, which tends to decrease, while the proportion of Hypertension in Pregnancy (HDK) is increasing. More than 30% of maternal deaths in Indonesia in 2010 were caused by HDK.⁴

During pregnancy there are physiological and anatomical changes that occur in the mother and not all pregnancies can run smoothly. Hypertension is one of the problems in pregnancy that can cause complications in 5-10% of pregnancies worldwide⁵.

Hypertension in pregnancy can progress to preeclampsia, eclampsia and HELLP syndrome. Classification of hypertension in pregnancy if the blood pressure is $\geq 140 / 90$ mmHg. Divided into light-medium (140 - 159/90 - 109 mmHg) and heavy ($\geq 160 / 110$ mmHg)⁶.

Hypertension in pregnancy is a multifactorial disorder from both maternal and pregnancy factors. One of the maternal

factors is the Body Mass Index (BMI). High Body Mass Index (BMI) is a nutritional problem related to the presence of excess fat deposits in the body which can be a risk factor for various types of degenerative diseases, such as hypertension in pregnancy, diabetes mellitus, coronary heart disease and other health problems⁷.

The nutritional status of pregnant women that is most sensitive to predict pregnancy outcome is pre-pregnant body weight and maternal weight gain during pregnancy (Overweight) and obesity in pregnancy are high-risk obstetric conditions. From various studies, overweight and obesity have been shown to increase the risk of maternal and fetal morbidity and mortality, including increasing the risk of hypertension and gestational diabetes during pregnancy⁸.

Pre-pregnant body mass index (BMI) is used to monitor weight gain and as an indicator of good or bad nutritional status of pre-pregnant women which is also associated with pregnancy complications such as hypertension.

Data on pre-pregnant body weight or pre-pregnant BMI need to be known to obtain adequate data on weight gain during pregnancy. During pregnancy, the mother's weight is expected to increase ± 12.5 kg, depending on body size and body weight before pregnancy. It is known that weight during pregnancy according to trimester will be used to determine when intervention in pregnant women needs to be carried out, especially for conditions in Indonesia, but usually this data is not available or difficult to be available in the community. Adequate maternal weight gain will result in optimal maternal outcomes to prevent complications during pregnancy, childbirth and the puerperium. Weight gain during pregnancy is important for monitoring the nutritional status of pregnant women⁹.

Table. Total Recommendations and Rate of Weight Gain During Pregnancy Based on Pre-Pregnancy BMI

Pre-Pregnancy BMI	Total Gain Weight (kg)	Second and 3rd Trimester Weight Gain Rate (kg / week) (range) *
Skinny (Underweight) (<18.5 kg / m²)	12.5 - 18	0.51 (0.44 - 0.58)
Normal (18.5–24.9 kg / m²)	11.5 - 16	0.42 (0.35 - 0.50)
Grease (overweight) (25.0–29.9 kg / m²)	7 - 11.5	0.28 (0.23 - 0.33)
Obesity (≥ 30 kg / m²)	5 - 9	0.22 (0.17 - 0.27)

* The calculation assumes an increase of 0.5 - 2 kg in the 1st trimester

Source: Committee to Reexamine IOM Pregnancy Weight Guidelines Food and Nutrition Board on Children Youth and Families, 2009

Body Mass Index (BMI) with overweight and obesity categories reflects a change in body composition. The body consists of fat mass and fat free mass. The increase in BMI illustrates that an increase in the proportion of fat mass to body fat-free mass causes an increased risk of suffering from degenerative diseases, namely hypertension and diabetes mellitus.¹¹

An increase in BMI $\geq 25\%$ during pregnancy will increase the risk of having a baby with a birth weight of more than 4000 grams. In addition, overweight and obesity have been shown to be associated with increased complications in pregnancy, such as impaired glucose tolerance and gestational diabetes, increased risk of infection,

thromboembolism, hypertension problems in pregnancy, and even maternal and fetal death. (Agnihotri S, 2016).

Overweight and obesity is defined as abnormal or excessive accumulation of adipose tissue in the body. This condition is caused by a combination of genetics, metabolism, life style/behavior, socio-economic, environmental and cultural factors.¹³

Overweight (overweight) and obesity are associated with hypertension in pregnancy. In a logistic regression analysis study showed obesity increased the likelihood of occurrence seven fold with OR = 7.0; 3.1-15.9 as a risk factor for the occurrence of hypertension in pregnancy¹⁴.

Currently, the availability of preconception services and the involvement of women of childbearing age with these services is still lacking. Many women are not aware of the impact of being overweight or obesity on their health, especially during pregnancy. Educating them about lifestyle changes that can optimize their chances of a healthy pregnancy can help them make informed decisions about when to get pregnant. The main goal is to encourage women to achieve a BMI within the normal range of 18.5 - 24.9 kg/m². A decrease in BMI before pregnancy has been shown to reduce the risk of hypertension in pregnancy, namely preeclampsia by 10%¹⁵.

This study aims to determine the effect of pre-pregnancy Body Mass Index (BMI) on the incidence of hypertension in pregnancy.

METHODS

This study uses a design *Crosssectional Study* which is one type of research design that is analytic in nature and is included in the type of observational research design. This design is intended to study the dynamics and variations of the variables contained in the research title "The Effect of Pre-Pregnant Body Mass

Index (BMI) with the Incidence of Hypertension in Pregnancy".

Body Mass Index (BMI) is a simple tool to monitor the nutritional status of adults, especially those related to underweight and overweight.

The pre-pregnant mother's body mass index (BMI) (BMI, kg / m²) is obtained from the pre-pregnancy weight of the mother (kg) divided by the height (meters) squared. BMI cut off points as recommended by WHO (BMI <18.5 kg / m² - *underweight*; 18.5 ≤ BMI <25.0 kg / m² - normal, overweight; 25.0 ≤ BMI <30.0 kg / m² - *overweight*; and BMI ≥30.0 kg / m² -obesity)¹⁶.

The data used are primary data from interviews and measurements of blood pressure, body weight and height conducted by researchers or health workers. The instruments used were observation sheets, scales, height gauges, mercury sphygmomanometer and stethoscope.

The steps taken in this study were: (1) identification of the research problem (incidence of hypertension in pregnancy), (2) identification of the influence factor (body mass index), (3) determination of the unit of observation, unit of analysis, sample size, and method of sampling, (4) determining the time and location of the study, and (5) measuring variables.

Research Population

The population in this study were all pregnant women who came to the Jongaya puskesmas, Tamalate sub-district, Makassar city in the period from June to July 2019.

Research Samples

Samples drawn from the study population are structured as follows: Observation unit; Pregnant women who had their pregnancy checked at the Jongaya puskesmas, Makassar city, during the period June to July 2019. Unit of

analysis; Incidence of hypertension in pregnancy, and the factors that influence it, namely; Body Mass Index for pre-pregnant women (BMI). The sample size was determined using a saturated sampling technique, where all pregnant women who checked their pregnancies during the June to July period were made as sample members with the consideration that the sample did not meet the minimum sample size if the sample size was calculated.

Time and Research Location

This research was conducted from June to July 2019 in the working area of the Jongaya Health Center, Tamalate District, Makassar City, South Sulawesi Province.

Data Collection and Analysis

Data collection was carried out through direct interviews with pregnant women using a questionnaire to obtain data on the demographic characteristics of pregnant women, then measurement of TB, body weight was carried out to obtain data on the body mass index (BMI) of pregnant women, as well as measurement of pregnant women's blood pressure to determine whether the mother was pregnant. have pregnancy hypertension or not.

In this study, several stages of analysis were carried out, namely 1) descriptive analysis of research variables; This analysis was conducted to see the normal distribution of body mass index (BMI) and pregnancy hypertension data. 2) Pearson correlation analysis to see the correlation between body mass index (BMI) and the incidence of hypertension in pregnancy. 3. Regression analysis is used to see the effect of Body Mass Index (BMI) on the incidence of hypertension in pregnancy. cross tabulation is also done to see the relationship between variables.

Presentation of Data

TaFrequency distribution bells, cross tabulations, as well as tables of pearson correlation and linear regression analysis results, are presented to provide information on body mass index (BMI) variables and incidence variables of hypertension in pregnancy.

RESULTS AND DISCUSSION

This research was conducted at the Jongaya Health Center in Makassar City from June to March 2019. The sample unit (observation unit) was pregnant women who checked themselves at the Jongaya Health Center in Makassar City, from June to July 2019, while the unit of analysis was the incidence of hypertension. in pregnancy, as well as Body Mass Index (BMI). A total of 78 pregnant women participated in this study, and after examining the completed questionnaires, it turned out that all of them met the requirements to be included in data processing and analysis.

The results of the univariate analysis of the Body Mass Index (BMI) of pregnant women, provided information that: out of 78 (100%) pregnant women, there were 6 (7.7%) who were obese, 20 (25.6%) were overweight, 44 (56.4%) were normal, and 8 (10.3%) were thin. Meanwhile, the results of the univariate analysis conducted on the incidence of hypertension in pregnancy, provided information that: out of 78 (100%) pregnant women, 18 (23.1%) had hypertension, and 60 (76.9%) did not have hypertension.

Table 1. Distribution of Pregnant Women Based on Body Mass Index (BMI) Criteria

BMI Body Mass Index	n	%
Obesity	6	7,7
Overweight	20	25.6
Normal	44	56.4
Thin	8	10.3

Total	78	100.0
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Table 2. Distribution of Pregnant Women Based on Incidence of Hypertension in Pregnancy

Incidence of Hypertension	n	%
Hypertension	18	23.1
Not hypertension	60	76.9
Total	78	100.0

From the results of the bivariate analysis conducted, it shows that there are 33.3% of pregnant women who have obesity and hypertension, 50% of pregnant women who have overweight and hypertension, and 16.7% of pregnant women who have normal Body Mass Index and hypertension.

Women in the higher BMI category had a significant increase in the incidence of pregnancy with hypertension and preeclampsia. A systematic review concluded that there was a direct relationship between obesity and preeclampsia with a 3 to 10 times increased risk in obese women. Several studies have also found a 2 to 8-fold increased risk of developing cardiovascular disease after pregnancies complicated by preeclampsia¹⁵.

Table 3. Distribution of Body Mass Index (BMI) Based on Incidence of Hypertension

Body Mass Index (BMI)	Pregnancy Hypertension			
	Yes		No	
	n	%	n	%
Obesity	6	33,3	0	0,0
Overweight	9	50,0	1	18,3
Normal	3	16,7	4	68,3

Thin	0	0,0	8	13,3
Total	18	100,0	6	100,0

The results of this study are in line with research conducted by Isnaniar et al. In 2019, namely 7 (54.55%) obese pregnant women who did not experience hypertension (45.45%) did not. Based on the statistics, obesity has a significant effect on the incidence of hypertension during pregnancy with a p-value of 0.013 (<0.05).

Pearson correlation is a correlation measure used to measure the strength and direction of the linear relationship of two variables. The results of the analysis show that, There is a significant correlation between Body Mass Index (BMI) and systolic blood pressure (p = 0.000), and Body Mass Index (BMI) with diastolic blood pressure (p = 0.002).

Table 4. Correlation Between Systolic and Diastolic Blood Pressure with Body Mass Index (BMI)

Blood pressure	Body mass index (BMI)
Systolic blood pressure	* 0,000
Diastolic blood pressure	* 0.002

* Significant at $p < 0.005$

People who are obese work harder to burn excess calories in their bodies, this calorie burning requires an adequate supply of oxygen in the blood, the more calories burned, the more oxygen supply in the blood, the large amount of blood supply certainly makes the heart work more hard, and the impact of blood pressure on obese people tends to be higher¹⁷.

In addition, a previous study by Quedarusman et al in 2013 found that obese pregnant women (BMI 25- \geq 30 kg / m²) were five times more likely to suffer from preeclampsia. Research conducted by

Puspitasari et al. In 2015 found that mothers with a BMI > 26 kg / m² tended to experience hypertension during pregnancy (Quedarusman et al, 2013; Puspitasari et al, 2015).

High body mass index is a nutritional problem because excess calories, excess sugar and salt can be a risk factor for various types of degenerative diseases, such as diabetes mellitus, hypertension in pregnancy, coronary heart disease, rheumatism and various types of malignancy (cancer) and other health problems. . This is related to the presence of excess fat deposits in the body⁷.

Linear regression analysis was conducted to see the effect of body mass index of pre-pregnant women on the incidence of hypertension in pregnancy. The analysis showed that the body mass index (BMI) of pre-pregnant women significantly affected the incidence of hypertension in pregnancy, with a significant value of systolic blood pressure $p = 0.000$ and diastolic blood pressure $p = 0.002$. The effect of systolic and diastolic blood pressure on body mass index (BMI) was 21.2% and 12.1%, respectively.

Table 5. Effect of Body Mass Index (BMI) on Incidence of Hypertension in Pregnancy

Blood pressure	R	R Square	t	p
Systolic	0.460	0.212	4,517	* 0,000
Diastolic	0.347	0.121	3,231	* 0.002

Independent variable: Body mass index (BMI)

* significant at $p < 0.005$.

This is in line with research conducted by Ibrahim M et al in 2010 on primigravidas, which showed significant results between obesity and the incidence of hypertension in pregnancy. The relationship between the weight of pregnant women and the risk of

preeclampsia is progressive. This is evidenced by an increase in the incidence of preeclampsia from 4.3% in mothers with BMI <19.8 kg / m² to 13.3% in pregnant women with BMI > 35 kg / m².⁹

The results of this study are also in accordance with the theory that high BMI values are associated with dyslipidemia, decreased VLDL (Very Low Density Lipoprotein) and increased serum / plasma triglycerides, LDL (Low Density Lipoprotein). This situation will induce oxidative stress and cause endothel system dysfunction. which is the basic concept of the cause of hypertension in pregnancy. High BMI values can also increase insulin resistance, free fatty acids, hyperandrogenemia and hyper-estrogenics. These conditions will affect the function of the endothel which will activate C-reactive protein and IL-6²⁰.

Weight loss before pregnancy can improve pregnancy outcome. The weight loss program recommended by ACOG is a motivational interviewing technique that is individually tailored and patient-centered by controlling diet, exercise, and lifestyle modification. It is not recommended to use drugs because their safety is not guaranteed and side effects can arise²¹.

Existencepreconception services, such as counseling about diet and physical activity and access to contraception for all women who are overweight or obese can help them achieve a healthy weight before becoming pregnant. This can reduce the risk of complications during pregnancy for both the mother and the baby²².

In principle, hypertension in pregnancy can be prevented, if pregnant women take more care of their pregnancy health by paying attention to daily consumption such as increasing calcium consumption and reducing consumption of fatty foods and can control and monitor weight gain during pregnancy in the KIA book to prevent hypertension in pregnancy.

CONCLUSION

The high prevalence of pregnant women who are overweight / obese during pregnancy is due to improper diet or weight management of pre-pregnant women. So it is necessary to do early clinical detection of pre hypertension, and lifestyle management, especially body weight.

Emphasize education about the importance of losing weight in all overweight and obese women planning a pregnancy.

The risk of hypertension in pregnancy can be controlled by dietary modifications that have been shown to reduce blood pressure in hypertensive patients. The recommended dietary principle is balanced nutrition, namely limiting sugar, salt, enough fruits and vegetables and foods low in saturated fat.

In addition, it is necessary to increase hypertension screening as an early detection for pregnant women who are at risk of hypertensive disorders in pregnancy. Also monitoring weight gain during pregnancy by doing Antenatal Care (ANC) regularly.

We recommend that you continue this research by involving a larger sample size and covering a wider area. It is also necessary to measure other variables, arm circumference (LILA) and body fat.

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