Development of Instruments Test to Detect Diabetes Mellitus in Pregnancy

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Abstract

Background: Diabetes mellitus in pregnancy is a disorder of carbohydrate tolerance that results in hyperglycemia which is characterized by polyuria, polydipsy, and polyphagia. Pregnant women with DM in pregnancy are associated with high morbidity and mortality. Early detection of DM in pregnancy is important so that further treatment can be done. There is no test instrument that can be used to detect DM in pregnancy. Obtain a test instrument to detect the symptoms of Diabetes Mellitus in pregnancy. Method: The type of research used is R&D (Research and Development). Development research conducted to produce a product in the form of an early detection instrument for diabetes mellitus in pregnancy. The study was conducted by providing early detection instruments for Diabetes Mellitus in pregnancy in first trimester pregnant women and then examining fasting blood sugar in first trimester pregnant women. The number of samples in the study 119 taken by Purposive Sampling technique. Analysis of data using the value of sensitivity, specificity, and accuracy. Result: The test instrument consisted of 13 questions, with a sensitivity value of 72.41%, a specificity value of 91.11%, and an accuracy value of 86.55%.. Conclusion: Early detection instruments for diabetes mellitus in pregnancy can be used as standard guidelines for antenatal care in pregnant women and can be used as an alternative to detect DM in pregnancy before supporting examinations by midwife professionals can be further developed research development using standard methods for measuring blood sugar more accurately and The research was carried out by measuring the precision value so that the instrument produced accurate and consistent results.

Keywords: early detection, diabetes mellitus in pregnancy, sensitivity, specificity, accuracy

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Introduction

Diabetes mellitus in pregnancy is a disorder of carbohydrate tolerance that results in hyperglycemia characterized by polyuria, polydipsy, and polyphagies. Pregnancy in women with DM is associated with high morbidity and mortality. Around 21.3 million or 16.2% of births in 2015 in the world showed signs of hyperglycemia or high blood sugar levels during pregnancy and 85.1% were caused by Diabetes Mellitus in pregnancy, whereas in Indonesia as many as 1.9-5% of all pregnant women experience diabetes mellitus in pregnancy (PERKENI, 2015)(Negrato et al., 2012)(Federation, 2017)(Sunjaya & Sunjaya, 2018).

The frequency of diabetes mellitus in undiagnosed pregnancies is 10-25%, this increases the morbidity and mortality rates for both mother and baby. Complications or problems arising from diabetes mellitus in pregnancy are babies born with macrosomia, birth trauma, labor induction or caesarean section, premature birth, pre-eclampsia, hypoglycemia in neonates, hyperbilirunemia in neonates and perinatal death. Complications that can occur in the future are the risk of type 2 diabetes and the risk of diabetes mellitus in pregnancy in future pregnancies (Indonesia, 2013)(Hunt et al., 2014)(Bachaspati, 2018).

The complications that will arise from Diabetes Mellitus in an undetected pregnancy will be very dangerous for both the mother and the baby to be born. Good control during pregnancy of diabetes mellitus in pregnancy will control blood glucose so that complications can be prevented. Early detection of increased glucose levels in pregnancy by pregnant women is still low because of the lack of ability of pregnant women to make early detection. Detection of blood glucose levels can only be done using medical devices or by laboratory examinations based on indications, as it is known that blood glucose level testing is an important procedure in antenatal care checks in Indonesia, so the incidence of Diabetes Mellitus in pregnancy is often hard to find and lack attention (Rahmawati et al., 2016)(Kudarti dkk, 2014)(Sulistiyah, 2017).

Early detection of a disease with a diagnostic test results in an accurate instrument. Instruments with diagnostic tests are reflected by the values of sensitivity, specificity, and accuracy so that

it is needed to detect diabetes mellitus in pregnancy in pregnant women. Instruments that have high sensitivity, specificity, and accuracy values will be able to detect DM in pregnancy so that it can be used by midwives for screening as an effort to prevent diabetes mellitus in pregnancy in trimester I pregnant women. In a study conducted by Perovic, 2012 which resulted in a high sensitivity value of 90.9% indicating that the Ultrasound Gestational Diabetes Score (UGDS) is a good predictor for detecting diabetes mellitus in pregnancy, this tool has a sensitivity value above 90% due to the method used using ultrasound which is known to have high accuracy. Then in research conducted by Imamah, 2017 showed that 38 pregnant women out of 80 pregnant women who were examined turned out to have high risk factors for hyperglycemia in pregnancy but this research was carried out using a screening questionnaire only (Perović et al., 2012) (Imamah, 2017)

So that there are no test instruments to determine the symptoms of Diabetes Mellitus in pregnant women in Indonesia, so it is necessary to develop an innovation of the instrument used as a means of early detection of Diabetes Mellitus in pregnancy. The renewal of this paper is the development of an instrument for early detection of diabetes in pregnancy by using blood sugar checks and tools that have good sensitivity, specificity and accuracy.

Method

The research design used in this research and development (R&D) research with a descriptive approach where the research method is used to produce products in the form of instruments and test the effectiveness of the instrument's products.

The study was conducted from December 2019 to January 2020. The population in the study were all pregnant women in the city of Bengkulu.

Population reference in this study is pregnant women in Bengkulu city. The sample in this study was first trimester pregnant women who met the inclusion criteria which amounted to 119 samples with a sampling technique using Nonprobability Sampling where to use Purposive Sampling.

Result and Discussion

1. Characteristics of Respondents

The results of the analysis of the research conducted were the distribution of characteristics of first trimester pregnant women registered in the register of each puskesmas working area in Bengkulu City. The description of the distribution of each of the instruments is presented in tabular form as follows:

Table 1. Distribution of Characteristics of TM I Pregnant Women with Gestational Diabetes Mellitus Risk (n = 119)

No	Karakteristik	F	%
1	Usia		
	< 20	6	5,1
	20-35	105	88,2
	>35	8	6,7
2	Pendidikan		
	SMP	21	17,6
	SMA	50	42,1
	Perguruan Tinggi	48	40,3
3	Usia Kehamilan		
	1-4 minggu	3	2,5
	5-8 minggu	40	33,6
	9-12 minggu	79	63,9

Table 1 shows the characteristics of the majority of respondents in this study occupying a healthy reproductive age, then the characteristics of the level of education of middle and higher education respondents, then the characteristics of respondents at the age of the majority of pregnancy in the last trimester I.

2. Sensitivity Test

The results of the study obtained the value of the sensitivity of Diabetes Mellitus in pregnancy early detection instruments as follows:

Table 2. Table Sensitivity Test

Gold Standard Test	Risk Factor Instrumens		Total
	Risk	No Risk	
Positive (≥126 mg/dl)	21(a)	8 (b)	29 (a+b)
Negative (<126 mg/dl)	8 (c)	82 (d)	90 (c+d)
Total	29 (a+c)	90 (b+d)	119 (a+b+c+d)

Note : a. True Positive (TP) = 21 b. False Positive (FP) = 8 c. False Negative (FN) = 8 d. True Negative (TN) = 82

The results of table 2 sensitivity value is 72.41%, which is obtained from the calculation of the number of pregnant women who have a risk of DM in pregnancy and the results of fasting blood sugar examination ≥126 mg / dl compared to all pregnant women who are at risk of Diabetes Mellitus in pregnancy.

3. Specificity Test

The results obtained for the specificity of the early detection instrument for Diabetes Mellitus in pregnancy are as follows:

Table 3. Specificity Test

Gold Standard Test	Risk Factor Instrumens		Total
	Risk	No Risk	
Positive (≥126 mg/dl)	21 (a)	8 (b)	29 (a+b)
Negative (<126 mg/dl)	8 (c)	82 (d)	90 (c+d)
Total	29 (a+c)	90 (b+d)	119 (a+b+c+d)

Note : a. True Positive (TP) = 21 b. False Positive (FP) = 8 c. False Negative (FN) = 8 d. True Negative (TN) = 82

The results of table 3 specificity value is 91.11%, which is obtained from the calculation of the number of pregnant women having no risk of diabetes mellitus in pregnancy and the results of fasting blood sugar <126 mg / dl compared with the total number of pregnant women who do not have diabetes risk Melitus in pregnancy.

4. Accuracy Test

The results obtained for the accuracy of early detection instruments for Diabetes Mellitus in pregnancy risk are as follows:

Table 4. Accuracy Test

Gold Standard Test	Risk Factor Instrumens		Total
	Risk	No Risk	
Positive (≥126 mg/dl)	21 (a)	8 (b)	29 (a+b)
Negative (<126 mg/dl)	8 (c)	82 (d)	90 (c+d)
Total	29 (a+c)	90 (b+d)	119(a+b+c+d)

Note : a. True Positive (TP) = 21 b. False Positive (FP) = 8 c. False Negative (FN) = 8 d. True Negative (TN) = 82

The results of table 4 the accuracy value is 86.55%, which is obtained from the calculation of the number of positive people who have the risk of Diabetes Mellitus in pregnancy plus the number of people who do not have the risk divided by the total number of respondents who examined the instrument.

The results of research of the early detection instrument for Diabetes Mellitus in pregnancy were obtained with a sensitivity value of 72.41%. This early detection instrument can detect pregnant women with the risk of Diabetes Mellitus in pregnancy and indeed indeed has Diabetes Mellitus in pregnancy. The sensitivity value in this study shows the early detection instrument of Diabetes Mellitus in sensitive pregnancy so that it can effectively be used in detecting a pregnancy disorder that is Diabetes Mellitus in pregnancy. In line with research conducted by Perovic, 2012 which produced a high sensitivity value of 90.9% showing Ultrasound Gestational Diabetes

Screening Score (UGDS) is a good predictor for detecting diabetes mellitus in pregnancy, it has a sensitivity value above 90% due to the method which is used using ultrasound which is known to have high solubility. But not in line with research conducted by Harahap, 2010 is to discuss the development of tools, namely the development of screening tools for hypertension carried out in previous studies, which obtained a sensitivity value of 61.6% so that hypertension screening tools are quite effective to be used to detect hypertension, this is because the instruments used does not have a high validity value and high reliability so that the tool has a sensitivity value that is effective enough to detect hypertension (Perović et al., 2012)(Heryudarini Harahap, Yekti Widodo, Sri Muljati, Agus Triwinarto, 2010).

The results of the early detection instrument for Diabetes Mellitus in pregnancy were obtained with a specificity value of 91.11%, where this value indicates that the instrument has a high specificity value so that it is specific in detecting Diabetes Mellitus in pregnancy in Indonesia. Specificity values in this study indicate that early detection instruments for Diabetes

Mellitus in pregnancy can be used in detecting a pregnancy disorder, Diabetes Mellitus in pregnancy. This is supported by research conducted by Hansarikit, 2011 where a high specificity value of 81.8% in the modification of criteria using fasting blood sugar and 2 hours of plasma glucose measurement can be used as a standard alternative to detect diabetes mellitus in pregnancy (Heryudarini Harahap, Yekti Widodo, Sri Muljati, Agus Triwinarto, 2010).

The diagnostic test results on this instrument obtained an accuracy value of 86.55%, this shows that the early detection instrument of Diabetes Mellitus in pregnancy can be said to be accurate in detecting Diabetes Mellitus in pregnancy. The accuracy of an instrument is seen from the higher value of accuracy produced, the test has a high accuracy, so this instrument is accurate and effective for correctly detecting all subjects tested with an accuracy value of 86.55% . This research is in line with Noerjanto, 2014 with an accuracy value of 75%, it can be said that the instrument developed is effective in detecting osteoporosis so that it can be used as an early indicator to detect osteoporosis (Noerjanto et al., 2014).

Until now there is no instrument for early detection of Diabetes Mellitus in pregnancy in Indonesia that is accurate in detecting early Diabetes Mellitus in pregnancy as reflected by the value of sensitivity, specificity, and accuracy of a diagnostic test. In the development of early diabetes mellitus detection instruments in pregnancy with high sensitivity, specificity, and accuracy values, they can be made as a preliminary diagnosis before other supporting examinations with the aim that immediate prevention and treatment can be given immediately. The composition of these instruments is in the form of history items and symptoms that indicate a possibility of a disease, so that the assessment of the health history of pregnant women is important which is developed through this early detection instrument for diabetes mellitus in pregnancy so that it can be used by midwives and pregnant women to detect early mothers pregnant so that it can be applied in basic health services for early detection of Diabetes Mellitus in pregnancy.

It is hoped that with the early detection instruments for gestational diabetes mellitus that have high sensitivity, specificity, and accuracy values can be used as guidelines for future health service standards to improve government programs in early detection of diabetes mellitus in pregnancy. Early detection of pregnancy can reduce the risk of complications that will occur during pregnancy and childbirth which aims to reduce morbidity and mortality rates for mothers and children in Indonesia.

Conclusion

1. The sensitivity value of early detection instruments for diabetes mellitus in pregnancy is 72.41% which means the ability of DM early detection instruments in pregnancy in first trimester pregnant women to give positive results for pregnant women who suffer from DM in pregnancy by 72.41%.

2. The specificity value of the early detection instrument for diabetes mellitus in pregnancy is 91.11%, which means the ability of the early detection instrument of DM in pregnancy in first trimester pregnant women to give negative results to pregnant women who do not suffer from DM in pregnancy by 91.11%.

3. The accuracy value of early diabetes mellitus detection instruments in pregnancy is 86.55%, which means the ability of DM early detection instruments in pregnancy in first trimester pregnant women to correctly detect all pregnant women tested is 86.55%.

The results of diagnostic tests that have been carried out show that early detection instruments for DM in pregnancy have the ability to detect pregnant women who are at risk of DM in pregnancy or not at risk of DM in pregnancy. The output of this study is that early detection instruments for DM in pregnancy can be used directly by pregnant women to detect DM in pregnancy in order to foster motivation for early detection of DM in pregnancy and check for blood sugar with the presence or absence of indications during pregnancy. So that the expected outcome of this study is that early detection instruments for DM in pregnancy can be used as standards for pregnancy care services for pregnant women to improve existing programs and can be used as an alternative for early detection of DM

in pregnancy for all pregnant women before supporting examinations so that the incidence rate DM in pregnancy can be found.

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