

### How well are pregnant women in Croatia informed about the oral glucose tolerance test?

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#### Abstract

**Introduction:** Preanalytical errors still constitute the largest source of errors in laboratory work. Proper patient preparation and patient's knowledge about a particular procedure affects its accuracy and reliability. We hypothesized that most of pregnant women are not well enough informed about the proper procedure for the OGTT. The aims of this study were to investigate: (i) how well pregnant women are informed about the OGTT; (ii) the most common way to inform pregnant women about OGTT and (iii) whether pregnant women's level of knowledge about the OGTT differ regarding source of information.

**Materials and methods:** The anonymous questionnaire was conducted across the country in 23 Croatian primary and secondary healthcare centres. The questionnaire contained 9 questions on certain demographic data and familiarity with OGTT procedure. All 343 participants filled the questionnaire before the first blood draw.

**Results:** 42% of the participants demonstrated high and 38% adequate level of knowledge about the OGTT procedure. Majority of participants were informed about the procedure by gynaecologist (56%). The level of knowledge differed among participants with different sources of information ( $P = 0.030$ ). Further analysis showed that the level of knowledge was lower in pregnant women having received information from their gynaecologist compared to pregnant women who received information from the laboratory staff.

**Conclusions:** In general, pregnant women are familiar with OGTT procedure, main source of information about the OGTT procedure is their gynaecologist, but the level of knowledge was higher in women who received information about the OGTT procedure from the laboratory staff.

**Key words:** preanalytical phase; oral glucose tolerance test; survey; patient education; gestational diabetes

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#### Introduction

A preanalytical and pre-preanalytical phase represent important stage in laboratory medicine and both remain the most error-prone part of the laboratory work influencing the reliability of the laboratory results (1-3). Preanalytical variables like fasting requirements, biological variation, time and venipuncture techniques, physical activity or smoking as well as actions during sampling (some laboratory procedures require several blood draw or sampling at a particular time; it is very important to follow the proper instructions during the sampling in order to achieve better reliability of test results) can affect test results (3,4). To ensure the quality of a sample it is necessary to minimize

the preanalytical variability (5) which can definitely be accomplished by a proper patient preparation for blood collection. Failure to follow recommendations for fasting requirements before and/or during blood sampling may lead to wrong or even abnormal test results which may result in diagnostic error (6,7).

International Association for the Diabetes and Pregnancy Study Groups (IADPSG) developed recommendations for the diagnosis and classification of hyperglycaemia in pregnancy (8) and the World Health Organization (WHO) accepted these diagnostic criteria in August 2013 and defined two categories of hyperglycaemic disorders in pregnancy:

diabetes mellitus in pregnancy and gestational diabetes (9). Gestational diabetes (GD) is a disorder of glucose metabolism which first appears or is discovered during pregnancy. GD is associated with foetal and maternal complications. Some foetal complications include macrosomia, neonatal hypoglycaemia; perinatal mortality, hyperbilirubinemia, and respiratory distress syndrome while mothers have an increased risk of developing pre-diabetes or diabetes after pregnancy (10,11). Diagnostic criteria for GD were defined according to the plasma glucose concentrations determined after specific fasting and post-oral glucose tolerance test (OGTT). One or more glucose values equal or exceeding diagnostic threshold indicates GD (8,11).

OGTT is performed for diagnosis of GD so proper information about it would contribute to avoiding the majority of life-style related factors which might falsely alter the results. In 2014, the Working Group for the Diagnosis of Diabetes in Pregnancy of the Croatian Chamber of Medical Biochemists developed a standard laboratory procedure for laboratory diagnosis of diabetes in pregnancy. This standard procedure provides guidelines for the oral glucose tolerance test (OGTT) as a template notice for pregnant women (12). It includes all information and particular details about preg-

nant woman's behaviour few days prior to the test, how the test needs to be performed, what they should or should not do (Table 1).

According to the available recommendations, gynaecologists and laboratory staff should inform patients about proper preparation for the OGTT (12).

As there are no unique approach on how to inform patients about the specific laboratory procedure, we supposed that laboratories in Croatia have a different way of disseminating information. In communication with the heads of laboratories, we found that certain laboratories send written information (in the form of a leaflet) to the gynaecologists, some have only written information in the premises of a laboratory, whilst others make an appointment and explain the process to patients, and there are those which do not inform patients in any way. Considering that, our hypothesis was that most of the pregnant women are not well enough informed about the adequate OGTT procedure for blood sampling and that they are not aware of the importance of the proper OGTT procedure for diagnosis of gestational diabetes.

The aims of this study were to explore: (i) how well pregnant women are informed about the OGTT procedure for laboratory blood testing; (ii) the

**TABLE 1.** Croatian standard template information for pregnant women.

#### **Oral glucose tolerance test (OGTT) in pregnancy**

Your gynaecologist has ordered a glucose tolerance test for you. The test takes two hours, and blood will be drawn 3 times during the testing process. Your cooperation is very important for the accuracy of the findings. Please follow the instructions below:

- Three days prior the test you need to consume your usual meal, without changes in input quantity and types of food and drinks.
- 24 hours prior the test strengthen physical activity is prohibited (swimming, gym, cycling).
- The evening prior the test, from 23 hours onwards, it is prohibited the entry of food and beverages. In the specified period you can drink just plain water.
- Bring some reading material or other activity to pass the time because you are required to remain in the collection centre until the procedure is completed.
- In the morning, on the day of the test, the consumption of food and drink (except plain water) and smoking is prohibited.
- Report to the laboratory on an empty stomach in the morning. You will have blood drawn in the fasting state.
- Slowly, in small sips, you will drink a glass of glucose dissolved in water.
- Exactly 60 and 120 minutes after the glucose drink, please contact the laboratory to another and third blood sample.
- During the test performance it is prohibited physical activity, consumption of food, beverages and smoking. Sit quietly in the waiting room and make sure to report to the laboratory at the correct time.
- After the third blood collection (120 minutes) it is allowed and recommended consuming food and drinks.

Note: This table is a translation of the Recommendation published in Croatian language with the consent of the authors (12).

most commonly used way to inform pregnant women about OGTT procedure and (iii) whether pregnant women differ in the level of knowledge about the OGTT procedure regarding the source of information.

## Materials and methods

### Study design

We conducted this survey across the country in 23 Croatian healthcare centres (16 primary health care and 7 secondary healthcare centres) as a cross-sectional study in May 2014 throughout the first 15 days. The questionnaire was anonymous and it consisted of 9 questions on certain demographic data and familiarity with OGTT procedure (Table 2).

343 pregnant women, who were admitted to the laboratory in the morning between 7 and 9 a.m. for the OGTT procedure, participated in the study. Laboratory staff gave them the questionnaire which the participants filled before the first blood draw.

The initial number of participants was then reduced by number due to the following exclusion criteria: refusing to fill in the questionnaire, giving more than one answer to the questions 6-9 and/or returning incomplete questionnaire. After this initial selection we got the final number of 329 acceptable questionnaires, which were also suitable for statistical analysis.

The level of knowledge about OGTT procedure was expressed as the score (minimum score = 0; maximum score = 4). Score was calculated by counting the number of correct answers to 4 relevant questions (6 to 9). The relevancy of these questions lies in their association to the understanding of the whole OGTT procedure (high level = score 4, adequate level = score 3, moderate level = score 2 and low level = score 1 or 0). The average level scores were calculated as the average of scores in particular subgroups.

We analysed the difference in giving correct answers by comparing the proportions of the correct answers among three groups of sources of infor-

**TABLE 2.** The questionnaire about level of information for OGTT procedure (N = 329).

Question	N (%)
<b>1. Pregnancy week:</b>	
a) ≤ 12	37 (11)
b) 13-23	78 (24)
c) 24-28	145 (44)
d) ≥ 29	69 (21)
<b>2. Number of pregnancy:</b>	
a) first	149 (45)
b) second	128 (39)
c) third and more	52 (16)
<b>3. Have you ever done OGTT?</b>	
a) no, this is the first time	201 (61)
b) yes	128 (39)
<b>4. Do you consider yourself well informed about the procedure?</b>	
a) yes	181 (55)
b) no	28 (9)
c) partially, I am not sure	120 (36)
<b>5. Where did you get the information about the procedure?</b>	
a) gynaecologist	184 (56)
b) laboratory staff	53 (16)
c) internet	34 (10)
d) nowhere	24 (7)
e) gynaecologist + laboratory staff	15 (5)
f) gynaecologist + internet	14 (4)
g) gynaecologist + laboratory staff + internet	2 (1)
h) laboratory staff + internet	3 (1)
<b>6. Several days before the examination it is important to:</b>	
a) eat and move as little as possible	63 (19)
b) eat as usual, strictly rest	5 (2)
c) eat as usual, avoid excessive physical activity*	261 (79)
<b>7. On the examination day fasting is important:</b>	
a) yes*	328 (99)
b) no	1 (0.3)
<b>8. After taking glucose and until the second blood retrieval it is important:</b>	
a) to move as much as possible	16 (5)
b) not to eat, drink, smoke and move*	243 (74)
c) there are no special demands	79 (21)
<b>9. The next blood retrieval is:</b>	
a) exactly 60 and 120 minutes after taking glucose*	220 (67)
b) in between 60 and 120 minutes after taking glucose	87 (26)
c) it is not strictly specified	22 (7)

\* indicates correct answer to the question

mation: gynaecologists vs. laboratory staff, gynaecologists vs. internet and laboratory staff vs. internet.

In order to find out more about those differences we divided our data into two groups: 1) the answers to the questions six and seven which reveal the knowledge about the preparation for the procedure and 2) the answers to the question eight and nine which reveal the knowledge about the OGTT procedure itself.

### Statistical analysis

The data was presented in numbers and percentages. The Kolmogorov-Smirnov test was used to assess the normality of distribution of all variables. The differences on knowledge about OGTT procedure between groups were tested by Mann-Whitney and Kruskal-Wallis tests. The Conover *post hoc* tests were applied for multiple comparisons where appropriate. Chi square test was applied for the comparison of categorical data. Subsequent testing of certain categories was done by a test of comparisons of proportions. The level of significance was defined as a P value less than 0.05. The statistical analyses were performed by using MedCalc 12.7.0.0 statistical software (MedCalc Software, Mariakerke, Belgium).

### Results

The data regarding the participants' level of knowledge about the OGTT procedure were following: 42% of the participants demonstrated high level, 38% had adequate, 17% had moderate level, and only 3% had low level of knowledge. All data about general information are shown in Table 2.

The results showed no difference in the level of knowledge among participants who had or had not done OGTT some times in the past ( $P = 0.066$ ) nor was there any difference found in the level of knowledge between the participants coming from the primary health or secondary healthcare centres ( $P = 0.856$ ).

However, the level of knowledge differed among participants with different number of pregnancies ( $P = 0.036$ ). The *post hoc* analysis showed that women pregnant for the first time had a lower level of knowledge than women which had been pregnant more than once (average level score 3.1 and 3.4, respectively). The level of knowledge differed also among participants with the different sources of information ( $P = 0.030$ ). The *post hoc* analysis showed that the level of knowledge was lower with pregnant women having received information from their gynaecologist or having received no information at all compared to the pregnant women who received information from the laboratory staff (average level score 3.1, 3.0 and 3.6, respectively). The overall average score for the level of knowledge for the entire group of participants was 3.5.

Interestingly, the proportion of patients who received the information from a gynaecologist, laboratory staff or from the Internet, did not differ in giving the correct answer to question six, seven and nine ( $P = 0.836, 0.127$  and  $0.075$ , respectively), but they differed in giving the correct answer to question eight ( $P < 0.001$ ) (Table 3). The *post hoc* analysis showed that higher proportion of the correct answer to the question eight arose from the pregnant women who received information from the laboratory staff compared to those who re-

**TABLE 3.** Comparison of proportions of the correct answers to the question eight in three pairs of sources of information.

Source of information	Correct answers to the questions 8 (%)	Compared pair	Difference (%)	P value
Gyn	70	Gyn vs. Lab	25	< 0.001
Lab	95	Gyn vs. Int	13	0.189
Int	83	Lab vs. Int	12	0.156

Gyn – gynaecologist, Lab – laboratory staff, Int – internet.

**TABLE 4.** The comparison of the proportions of the correct answer to the question six and seven vs. correct answer to the question eight and nine regarding the source of information

Source of information	Correct answers to the question 6 and 7 (%)*	Correct answers to the questions 8 and 9 (%)**	Difference (%)	P value
Gynaecologist	90	70	20	< 0.001
Laboratory staff	91	82	9	0.110
Internet	90	66	24	0.002

\* The answers to the question 6 and 7 reflect awareness about the preparation for the OGTT procedure

\*\* The answers to the question 8 and 9 reflect awareness about the OGTT procedure itself

ceived information from their gynaecologist (94.3 and 69.6%, respectively).

The resulting proportions of the correct answers to the question six to nine regarding the source of information and the comparison of those proportions are presented in Table 4. The answers to the question 6 and 7 are related to the preparation for the OGTT procedure and answers to the question 8 and 9 are related to the OGTT procedure itself.

The self-declared level of knowledge by participants and their real level of knowledge did not differ ( $P = 0.073$ ). Out of 181 participants (55%) who stated that they are familiar with the procedure, even 151 (83%) have been properly informed about the correct OGTT procedure (mean score 3.5) ( $P = 0.128$ ).

## Discussion

In this study we investigated how well pregnant women are informed about OGTT procedure before laboratory testing. The main findings are: (i) a great majority of pregnant women had enough information about adequate preparation prior to OGTT, but only a minority of patients were completely familiar with the entire OGTT procedure (ii) their major source of instructions was their gynaecologist, and (iii) the ways of informing patients made a difference in the patients' knowledge about the procedure.

Proper patient's preparation for laboratory testing plays a key role in obtaining quality of the sample that subsequently affects test results. Unfortunately although it is well known that various factors such as diet, physical activity, stress, smoking

or drinking certain beverages can affect laboratory results, patients still remained poorly informed and aware of the preparation for laboratory testing (3,7).

For certain processes, it is not enough that patients are in the fasting state for blood sampling, they must follow specific instructions about the process prior taking a sample as well as on the day of the blood draw. By following those instructions patients contribute greatly to the usefulness of the results which could then be interpreted correctly by the physicians.

Although our first findings suggested that patients included in the study were well prepared for the OGTT procedure and that the patients' presumed knowledge coincided with our preliminary results, further analysis revealed that knowledge about the procedure differed regarding the source of the information about the whole procedure. Our results showed that patients who received instructions from their gynaecologist or from the internet were mainly informed about the need to be in the fasting state. These sources also gave certain explanation about the OGTT procedure which seems to be much less satisfactory in comparison to information provided by the lab personnel. We strongly believe that this lack of specific information could affect the patient's compliance to the further technical aspects of the procedure which could also affect the final test results. Simundic *et al.* (3) gave important framework for the harmonization of the fasting requirements definitions. The main points of this work are: 1) fasting time should be at least 12 hours (water consumption allowed); 2) blood sampling should be done in the

morning between 7-9 a.m.; 3) in the morning before blood sampling, patients should refrain from cigarette smoking and caffeine containing drinks and 4) "no sample is better than a bad sample". According to the National Institute of Child Health and Human Development (13), a few days prior to the test should pregnant patients should eat normal balanced diet containing at least 150 grams of carbohydrate *per* day for 3 consecutive days. Certain studies (14,15) have shown that different types of diet can decrease glucose concentration in postprandial response following the OGTT. Fruit, bread, cereals, grains, rice, crackers, and starchy vegetables such as potatoes, beans, and corn are good sources of carbohydrate (16). Some studies (17,18) have shown that exercise affect glucose results decreasing blood glucose levels at 120 min following the OGTT. Therefore, these factors affect the reliability of laboratory test results.

Another interesting finding in our survey was that no statistically significant difference was found in the level of knowledge between the patients who had already done the OGTT in the past and those who had not. And finally, the analysis showed no difference in the level of knowledge regarding the type of healthcare centre which we assign to the fact that most of the patients received information from the same type of source (a gynaecologist).

Therefore, in order to reduce the level of ignorance and poor education, it is necessary that the educational process includes all health workers. The first step is that all health professionals improve communication between themselves and patients. More time should be dedicated to patients and to directing them completely in the process of the blood drawing. In order to improve the pre-analytical phase of the laboratory work it is the responsibility of a laboratory to provide physicians with clear and understandable written instructions for the preparation of the patients if possible in an on-line form as well as in a form of a leaflet. It is also important that all updates and possible changes are available to all users of the laboratory services in an adequate time frame. According to Guidi *et al.* (4) quality improvement will be realized with the utter adherence to the inter-

national accepted standards and recommendations. We noted in our study that only 44% of participants were in adequate gestational age for the OGTT, even though the Croatian Society of Perinatology accepted the IADPSG's Consensus Panel and it would be presumed better concordance to these recommendations. More efforts should be made and better compliance of everyone included into the healthcare processes to achieve the overall better quality.

The main limitations of this study were short period of time for conducting the survey which resulted with unequal number of participants in all centres and the lack of certain demographic data about the patients.

## Conclusions

In general, pregnant women are familiar with OGTT procedure, main source of information is their gynaecologist, but women who received information about the OGTT procedure from the laboratory staff had shown better level of knowledge.

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## Potential conflict of interest

None declared.

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