

## Original Article

# The Association between the Level of Glycosylated Hemoglobin and the Immunogenicity of the Rubella Vaccination

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Received: 26 August, 2021; Accepted: 25 October, 2021

## Abstract

**Background:** Diabetes mellitus (DM) can influence various aspects of the immune system that may alter the immune response to vaccines. Data about altering the immune response to the rubella vaccine in the presence of diabetes are not enough. We aimed to evaluate the association between the level of glycosylated hemoglobin (HbA1C) and the immunogenicity of the rubella vaccination.

**Materials and Methods:** This cross-sectional retrospective study was conducted on the medical records of women who were tested to pre-pregnancy to check their antibody levels against rubella and had plasma levels of HbA1C.

**Results:** During 3 years, 112 women with anti-Rubella IgG data were finally analyzed. The mean age $\pm$ SD of participants was 32.10 $\pm$ 4.87. According to the data, we detected no correlation between the plasma levels of HbA1C and IgG levels against rubella (Correlation Coefficient 0.219,  $p = 0.020$ ).

**Conclusion:** We revealed no correlation between the plasma levels of HbA1C and impaired immunogenicity of the rubella vaccination. We recommended a large-scale controlled clinical trial to evaluate the IgG levels against rubella in patients with high plasma levels of HbA1C compared to the control group.

**Keywords:** Diabetes Mellitus, Rubella, Antibodies, Glycosylated hemoglobin

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Please cite this article as: Haghighi M, Goudarzi m, Sistanizad M, Pourheidari E. The Association between the Level of Glycosylated Hemoglobin and the Immunogenicity of the Rubella Vaccination. Novel Biomed. 2022;10(1):9-11.

## Introduction

Rubella is an acute, contagious viral infection usually associated with mild symptoms in children and adults, including mild fever and rash. However, during pregnancy, especially during the first trimester, this infection can cause miscarriage, fetal death, stillbirth, and congenital rubella syndrome that consequence infants with congenital malformations<sup>1,2</sup>.

There is no specific treatment for rubella, but the disease is preventable by vaccination<sup>1</sup>. In Iran, all children get two doses of MMR (measles-mumps-rubella) vaccine, starting with the first dose at 12 through 15 months of age and the second dose at 4 through 6 years of age. MMR vaccine is an attenuated live virus vaccine<sup>1,2</sup> and causes protection through activation of humoral and cellular immune responses<sup>3</sup>. Diabetes mellitus (DM) can influence various aspects of the immune system that may alter the immune

response to vaccines<sup>3-5</sup>. Data about altering the immune response to the rubella vaccine in the presence of diabetes are not enough.

We aimed to evaluate the association between the level of glycosylated hemoglobin (HbA1C) and the immunogenicity of the rubella vaccination.

## Methods

**Setting and subjects:** This cross-sectional retrospective study was conducted on the medical records of women who tested in Negaresh pathobiology laboratory in Tehran, Iran, between January 2018 and July 2021, to pre-pregnancy check of their antibody levels against rubella.

**Eligibility criteria:** Included criteria were patients who had antibody levels against rubella and plasma levels of HbA1C. Immunocompromised state or using any immunomodulatory drugs, substance abuse, using any glucose-lowering agents, and using any glucose-elevating drugs were considered as not inclusion criteria.

**Data gathering:** We recorded age, the blood level of anti-rubella IgG and IgM antibodies, and the plasma level of HbA1C. Rubella IgG and IgM titer were evaluated quantitatively via ELISA microplate reader (DA-32000).

**Analysis:** The records were analyzed using SPSS version 24 (IBM, New York, USA). Kolmogorov–Smirnov test was used to evaluate the normal distribution of data. The correlation was assessed using the Spearman test. P-value < 0.05 was considered as significance correlation.

## Results

During 3 years, according to the inclusion and not inclusion criteria and excluding records with missing data, data from 112 women with anti-Rubella IgG was finally analyzed. The mean age $\pm$ SD of participants was 32.10 $\pm$ 4.87.

According to the data, we detected no correlation between the plasma levels of HbA1C and IgG levels against rubella (Correlation Coefficient 0.219, p = 0.020).

## Discussion

It has been suggested that DM can influence the immune response to vaccines, affecting various aspects of the immune system<sup>3-5</sup>. The negative impact of DM on the immune response against influenza and Hepatitis B was reported rated by some articles<sup>6-9</sup>, but this association is not clear about rubella. We detected no correlation between the plasma levels of HbA1C and IgG levels against CMV. Whereas Petra Z. et al. reported lower antibody responses to the rubella vaccination in children with DM, reviewing the factors that influence the immune response to vaccination<sup>8</sup>. On the opposite, Dashti AS. et al. showed a significantly higher level of IgG antibody against rubella vaccine in children with diabetes compared with controls<sup>3</sup>.

Several other factors have also been suggested that may play a role in the difference in response to MMR vaccine, including sex, self-esteem, and personality, polymorphisms in the receptors of vitamin A and D<sup>8</sup>. Lack of evaluation of these factors, the single-center experience, and the small sample size were the main limitations of our study. Considering the limitations of this study, a large-scale clinical trial is needed to evaluate this correlation.

## Conclusion

We revealed no correlation between the plasma levels of HbA1C and impaired immunogenicity of the rubella vaccination. We recommended a large-scale controlled clinical trial to evaluate the IgG levels against rubella in patients with high plasma levels of HbA1C compared to the control group.

## Acknowledgment

None.

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