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**Original Article**

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# Prevalence of Glucose-6-Phosphate Dehydrogenase (G6PD) Deficiency in a Tertiary Care Hospital in North India

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## ABSTRACT

**Background**: Glucose-6-phosphate dehydrogenase (G6PD) deficiency is one of the most common inherited hemolytic disorders occurring among humans.
**Aim**: In this study, the aim was to find out the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in a group of students studying MBBS in a tertiary care hospital in North India.
**Material & Methods**: Student's history information was collected in questionnaires and blood samples data were collected and reported.
**Results**: In this study, the results showed that the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency among a group of 600 students studying MBBS, evaluated at NCMCH in North India was nil (0%). The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.
**Conclusion**: It is concluded that the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in a group of 600 students studying MBBS in NCMCH in North India was nil in our study.

**Key Words**: *(G6PD) glucose-6-phosphate dehydrogenase; (NCMCH) N.C. Medical College and Hospital*

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## INTRODUCTION

Glucose-6-phosphate dehydrogenase (G6PD) is the first enzyme in the pentose phosphate pathway (PPP). G6PD converts glucose-6-phosphate (G6P) into 6-phosphogluconolactone (6PGL) & produces NADPH. This pathway maintains the level of coenzyme nicotinamide adenine dinucleotide phosphate (NADPH), which in turn maintains the supply of reduced glutathione, which prevents oxidative damage. Glucose-6-phosphate dehydrogenase (G6PD) deficiency leads to hemolysis of red blood cells when they are exposed to oxidative stress, since G6PD maintains levels of the important intracellular antioxidant glutathione. Oxidative stress leads to breaking of heme-globin bond. Some part of globin separates & sticks inside the RBC. This globin chain is known as Heinz body. Heinz bodies appear as rounded structure protruding from the margin of a RBC. When the RBC containing heinz body passes via spleen, splenic macrophages bites out heinz body & gives bitten appearance of RBC. A lack of this enzyme G6PD can cause hemolytic anemia.

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is one of the most common inherited hemolytic disorders occurring among humans. G6PD deficiency is inherited as an X-linked recessive disorder. Males are more likely to have G6PD deficiency than females.

An estimated 400 million people worldwide have glucose-6-phosphate dehydrogenase deficiency. This condition occurs most frequently in certain parts of Africa, Asia, the Mediterranean, and the Middle East. It affects about 1 in 10 African American males in the United States.

## AIMS AND OBJECTIVES

To find out the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in a group of students studying MBBS in NCMCH in North India

## MATERIALS AND METHODS

**Study Setting and Period of Study**:

The study was conducted at Department of Physiology, N.C. Medical College & Hospital in Haryana, North India during the period from 10 June 2021 to 09 June 2023.

**Study Design**:

The study was a Hospital Based Study, conducted at NCMCH, a tertiary care hospital in Haryana, North India.

**Sample Size**:

For the present study, blood samples of a total of 600 students studying MBBS in NCMCH were recorded & evaluated. The data of the medical examination of students done at the time of admission in N.C. Medical College & Hospital was also collected and evaluated.

**Study Variables**:

Glucose-6-phosphate dehydrogenase (G6PD) deficiency in students

**Inclusion Criteria/ Selection Criteria:**

Participants in the study eligible for inclusion were MBBS students of either sex of all age groups studying at N.C. Medical College & Hospital in Panipat, Haryana, North India.

Students were included after obtaining proper informed written consent from them.

**Study Characteristics**:

In this study, the blood samples of 600 students studying MBBS were evaluated. The demographic information, history, physical examination, and glucose-6-phosphate dehydrogenase (G6PD) deficiency in the student's questionnaire were recorded. In this study, glucose-6-phosphate dehydrogenase (G6PD) deficiency was recorded after collecting blood samples from students, under all aseptic procedures. Students that satisfied the inclusion criteria were selected and the students who did not meet the inclusion criteria were excluded.

**Data Collection Methods and Tools**:

Student's history information was collected in questionnaires and blood samples data were collected and reported, and then statistical analysis of data was performed using SPSS software. Calculations of P values were done using Quick Calcs-Graphpad Software.

**Statistical Methods and Statistical Interpretation**:

Chi- square test was used to calculate Two-tailed P values in our study. When presenting P values, it was helpful to use the asterisk rating system as well as quoting the P value:

**P < 0.05* , it is statistically significant,**
**P < 0.01 ** , it is very statistically significant,**
**P < 0.001***, it is extremely statistically significant.**

## RESULTS AND OBSERVATIONS

For the present study, blood samples of a total of 600 students studying MBBS in NCMCH were recorded & evaluated. The data of the medical examination of students done at the time of admission in N.C. Medical College & Hospital was also collected and evaluated. None of the student gave any history of frequent bleeding, dark colored urine, jaundice, etc. No student was found to have features of hemolytic anemia. No student had splenomegaly. In this study, the results showed that the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency among a group of 600 students studying MBBS, evaluated at NCMCH in North India was nil (0%). The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

## DISCUSSION

In this study, the results showed that the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency among a group of 600 students studying MBBS, evaluated at NCMCH in North India was nil (0%). The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

**Following studies support our observations:**

- Gampio Gueye NS, et al gave an update on glucose-6-phosphate dehydrogenase deficiency in children from Brazzaville, Republic of Congo. A total of 212 febrile children were genotyped for G6PD variants. Overall, 13% (27/212) of the children were G6PD deficient and 25% (25/100) females were heterozygous (11 BA− and 14 A+A−). The remaining 160 children had a normal G6PD genotype. The mean red blood and mean platelet counts

were significantly lower in hemizygous male (G6PD A−) participants than in normal male (G6PD A+ or B) participants ($p < 0.05$). This study gives an update on G6PD deficiency among Congolese children [1].

- Kumar, Pradeep, et al evaluated the prevalence of glucose-6-phosphate dehydrogenase deficiency in India. PubMed, Science Direct, Google Scholar and Springer Link databases were searched for studies that investigated G6PD deficiency in Indian population. A total of 72 studies with a total sample size of 38,565 and 2,623 G6PD deficient subjects were included in the meta-analysis. In conclusion the meta-analysis confirms the overall magnitude of the frequency of G6PD deficiency (8.5%) in the Indian population [2].
- Lauden SM, et al evaluated the G6PD status and infectious disease screening tests of 1001 adult male Cameroonian blood donors (mean age 31.7 ± 9.8 years). The prevalence of G6PD deficiency was 7.9%. There was no difference in levels of hemoglobin or ABO subtype between those who were G6PD-normal compared to those that were deficient. These data suggest that G6PD deficiency is common among West African male blood donors and may be associated with specific infectious disease exposure [3].
- Mukherjee MB, et al evaluated the Glucose-6-phosphate dehydrogenase (G6PD) deficiency among tribal populations of India. The prevalence varies from 2.3 to 27.0 per cent with an overall prevalence of 7.7 per cent in different tribal groups. Since the tribal populations live in remote areas where malaria is/has been endemic, irrational use of antimalarial drugs could result in an increased number of cases with drug induced haemolysis. Therefore, before giving antimalarial therapy, routine screening for G6PD deficiency should be undertaken in those tribal communities where its prevalence is high [4].
- Shenkutie TT, et al evaluated the prevalence of G6PD deficiency and distribution of its genetic variants among malaria-suspected patients visiting Metehara health centre, Eastern Ethiopia. A total of 498 study participants were included in the study, of which 62% (309) were males. The overall prevalence of G6PD deficiency based on the biosensor screening was 3.6% (18/498), of which 2.9% and 4.8% were males and females, respectively. Eleven of the G6PD deficient samples had mutations confirmed by G6PD gene sequencing analysis. A significant association was found in sex and history of previous malaria infection with G6PD deficiency. The study showed that the G6PD deficient phenotype exists in Metehara even if the prevalence is not very high [5].
- Tripathi P, et al evaluated the prevalence of glucose-6-phosphate dehydrogenase deficiency in anemic subjects from Uttar Pradesh, India. A qualitative fluorescent spot test and dichlorophenol-indolphenol (DCIP) test were performed. G6PD-deficient, positive samples were further processed for mutation analysis by Sanger sequencing. Out of 1,069 cases, 95 (8.8%) were detected as G6PD deficient (by DCIP test) and were sent for molecular analysis. The G6PD Mediterranean mutation (563C > T) is the most common variant among G6PD-deficient individuals followed by the Coimbra (592C→T) and Orissa (131C→G) variants. They concluded that all symptomatic patients (anemic or jaundiced) should be investigated for G6PD deficiency [6].

## SUMMARY

In this study, the aim was to find out the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in a group of students studying MBBS in NCMCH in North India. The study was a Hospital Based Study, conducted at Department of Physiology, N.C. Medical College & Hospital, a tertiary care hospital in Haryana, North India, during the period from 10 June 2021 to 09 June 2023.

For the present study, blood samples of a total of 600 students studying MBBS in NCMCH were recorded & evaluated. The data of the medical examination of students done at the time of admission in N.C. Medical College & Hospital was also collected and evaluated. The demographic information, history, physical examination, and glucose-6-phosphate dehydrogenase (G6PD) deficiency in the student's questionnaire were recorded. In this study, glucose-6-phosphate dehydrogenase (G6PD) deficiency was recorded after collecting blood samples from students, under all aseptic procedures. Students that satisfied the inclusion criteria were selected and the students who did not meet the inclusion criteria were excluded. Student's history information was collected in questionnaires and blood samples data were collected and reported, and then statistical analysis of data was performed using SPSS software. Calculations of P values were done using Quick Calcs-Graphpad Software. The Chi- square test was used to calculate Two-tailed P values in our study.

In this study, the results showed that the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency among a group of 600 students studying MBBS, evaluated at NCMCH in North India was nil (0%). The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

## CONCLUSION

In our study, it is concluded that the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in a group of 600 students studying MBBS in NCMCH in North India was nil.


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This research received no specific grant from any funding agency.

## CONFLICTS OF INTEREST

There is no conflict of interest.


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