

Prevalence of glucose-6-phosphate dehydrogenase deficiency among pregnant women



**ASSIGN
BUSTER**

RESEARCH PROPOSAL

THE PREVALENCE OF GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE AT THE PRAMSO GOVERNMENT HOSPITAL.

ABSTRACT

Glucose 6-phosphate dehydrogenase (G6PD) is a cytoplasmic enzyme involved in the prevention of cellular oxidative damage by stimulation of detoxification of free radicals. It catalyzes the production of nicotinamide adenine dinucleotide phosphate (NADPH), which is necessary for maintenance of reduced levels of glutathione (GSH) important to protect erythrocytes from oxidative damage and to reduce susceptibility to haemolysis. G6PD deficiency is the commonest inherited red cell enzymopathy worldwide. It affects around 400 million people globally with the highest prevalence in the tropics and subtropics. The gene coding for the enzyme is found on the X-chromosomes hence the condition is sex linked, thus manifesting in heterozygous males and homozygous females. Blood sample would be taken from three hundred and thirty (330) participants and methaemoglobin reduction test would be employed for this cross-sectional study. The principle of the test is that, haemoglobin is oxidized to methaemoglobin by sodium nitrite. The redox dye, methylene blue activates the pentose phosphate pathway, resulting in enzymatic conversion of methaemoglobin back to haemoglobin in those red cells with normal G6PD activities that is greater than 25%. In G6PD deficient cells that is less than 25% activity; there would be no enzymatic conversion of methaemoglobin to

normal haemoglobin. This study is expected to provide information for the prevalence of G6PD enzymatic defect among pregnant women at the Pramso government Hospital and to ascertain if the high levels of anaemia in pregnancy recorded by the facility is as a result of this enzymopathy.

1. RESEARCH BACKGROUND

Glucose-6-phosphate dehydrogenase (G6PD) is a cytoplasmic enzyme involved in prevention of cellular oxidative damage by stimulation of detoxification of free radicals. It catalyzes the production of nicotinamide adenine dinucleotide phosphate (NADPH), which is necessary for maintenance of reduced levels of glutathione (GSH) important to protect erythrocytes from oxidative damage and to reduce susceptibility to haemolysis. (Frank, 2005; Monteiro, val, Siqueira, Franca, Sampaio and Melo, 2014).

G6PD deficiency is the commonest inherited red cell enzymopathy worldwide (Segel, 2004). It affects around 400 million people globally with the highest prevalence in the tropics and subtropics (Ademowo and Falusi, 2002). The disorder is caused by mutations in the G6PD gene, resulting in protein variants with different levels of enzyme activity that are associated with a wide range of biochemical and clinical manifestations. There are different types of the enzyme G6PD but only two are of clinical importance. These are type-A found in blacks and type-B found in both blacks and whites. The gene coding for the enzyme is found on the X-chromosome hence the condition is sex linked, thus manifesting in heterozygous males and homozygous females. The presentation is variable depending on the residual enzyme

activity and ranges from completely asymptomatic individuals to those who have lifelong haemolysis. Most significant manifestations are drug-induced haemolysis, favism, neonatal hyper-bilirubinaemia and non-spherocytic haemolytic anaemia (Luzzatto and Gordon-Smith, 2001; Kaplan and Hammerman, 2004).

Glucose-6-phosphate dehydrogenase deficiency came about as a result of an investigation made on hemolytic anaemia of some patients treated with 6-metoxo-8-aminoquinoline drugs for malaria in 1926 by Cordes. Exposure to an oxidant drug increases the need for NADPH and glutathione (GSH). Deficiency of G6PD prevents this need from being met and results in the oxidation of haemoglobin to methaemoglobin. The methaemoglobin then precipitate to form Heinz Bodies which attach themselves to the red cell membrane causing damage or hemolysis to the red cells. The major adult risk group for malaria in endemic countries are pregnant women, especially primigravidae. To prevent malaria in pregnancy, the World Health Organization (WHO) recommends the use of Sulphadoxine-Pyrimethamine (SP) for Intermittent Preventive Treatment in pregnancy (IPTp) (WHO, 2012). SP has the potential to cause acute haemolysis in G6PD deficient people resulting in significant haemoglobin (Hb) drop (Chan TK, Todd D, Tso SC, 1976). Example of other drugs with oxidant stress is aspirin, chloroquine, quinine, primaquine, vitamin K and C etc.

1. 2 RATIONALE OF RESEARCH

In view of G6PD deficiency and its burden on pregnant women, this study is aimed at evaluating and identifying the prevalence of G6PD enzymatic defect among pregnant women visiting the Pramso District Hospital?

1. 3PROBLEM STATEMENT

In the G6PD deficient patients, the red cells capacity to protect itself from oxidative stress is reduced. This is because the affected individuals produce lower than normal amount of NADPH, which results in an impaired capacity to generate reduced glutathione (GSH) which protects the cells from lysis. Due to the burden of malaria in the sub-Saharan region especially Ghana, the world health organization(WHO) has recommended the use of sulfadoxine-pyrimethamine (SP) as a prophylaxis for pregnant women. Like any other malaria drug, SP has been known to cause oxidative stress which can result in hemolytic anaemia dangerous to pregnant women who are deficient in G6PD. Unfortunately, most pregnant women are not tested for the G6PD deficiency before the drugs are administered as the prevalence of G6PD deficiency is unknown in the District.

1. 4RESEARCH QUESTION

1. 4. 1What is the prevalence of G6PD deficiency among pregnant women visiting the Pramso District Hospital?

1. 4. 2Is G6PD deficiency a factor of anaemia in pregnancy among women visiting the Pramso District Hospital?

1. 5RESEARCH HYPOTHESIS

1. 5. 1The prevalence of G6PD among pregnant women visiting the Pramso District Hospital is high.

1. 5. 2Anaemia among pregnant women visiting the Pramso District Hospital is high.

1. 6RESEARCH OBJECTIVE

The aim of the study is to determine the prevalence of G6PD deficiency among pregnant women visiting the Pramso District Hospital.

The specific objectives of the study are:

1. 6. 1To determine the prevalence of G6PD deficiency among pregnant women visiting the Pramso District Hospital

1. 6. 2To determine the G6PD enzyme activity among pregnant women visiting the Pramso District Hospital

1. 6. 3To check for anaemia in pregnancy among patients visiting the Pramso District Hospital

2. 1 MATERIALS AND METHODS

A cross-sectional design will be used in this study. The study period will be from, december 201 to January, 2019.

2. 1. 2 Study Area

The study would be undertaken at the Pramso District Hospital in the Ashanti Region.

2. 1. 3 Study Population and sample size

All pregnant women aged 15 to 45 years who attend antenatal clinic at the Pramso District Hospital would be considered and be recruited into the study. A total number of three hundred and thirty (330) participants would be recruited for this study from the study population.

$$\text{Sample size} = Z^2 \times P(1-P) / X^2$$

Z= 1. 96 at 95% confidence level

P= population proportion (assumed to be 0. 5) that is 50%

X= margin of error at 5% (0. 05)

$$\text{Sample size} = (1. 96)^2 \times 0. 5(1-0. 5) / (0. 05)^2 = 384. 16 = 384$$

2. 1. 4 Participants' selection technique

The convenient sampling method would be used in the recruitment of the participants to respond to the questionnaires.

2. 1. 5 Inclusion and exclusion criteria

Inclusion criteria

2. 1. 5. 1Pregnant women 15-45 years who visit the antenatal clinic of the Pramso District Hospital would be considered and be recruited into the study.

Exclusion criteria

2. 1. 5. 2Non-pregnant women will be excluded.

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2. 1. 5. 3 Related pregnant women will also be excluded.

2. 1. 5. 4 Recently transfused pregnant women will also be excluded.

2. 1. 5. 5 Pregnant women with severe anemia will also be excluded.

2. 1. 6 Data collection procedure

Four milliliters of EDTA venous blood sample will be collected by clean venepuncture from a total of three hundred and thirty (330) pregnant women for the study.

Laboratory analysis

2. 1. 6. 1 Test method: Methaemoglobin reducing test : this method is one of the simplest and less expensive methods to screen for G6Pd deficiency

2. 1. 6. 2 Test principle

Haemoglobin is oxidized to methaemoglobin by sodium nitrite (oxidant). The redox dye, methylene blue activates the pentose phosphate pathway (PPP), resulting in enzymatic conversion of methaemoglobin back to haemoglobin in those red cells with normal G6pD activities that is greater than 25%. In G6PD deficient cells that is less than 25% activity; there would be no enzymatic conversion of methaemoglobin to normal haemoglobin.

2. 1. 7 Data analysis

The data obtained would be analysed with the aid of the Statistical Package for Social Scientist Statistical Software (version 16. 0, SPSS Inc., Chicago, IL, USA).

2. 2 ETHICAL CONSIDERATIONS

The approval of this study would be sought from the committee on Human Research, Publications and Ethics (CHRPE) of Kwame Nkrumah University of Science and Technology and the management of the study site. Each volunteer would sign or thumb-print an informed written consent after the study had been explained to them in the language they understand. All protocol followed would be in line with the ethical standards of the Ghana health service.

2. 3 EXPECTED OUTCOME

This study is expected to provide information as to the Body of Knowledge in Ghana with respect to the prevalence of the G6PD enzymopathy in the Pramso district and Ghana as a whole.

TIMETABLE

	2018	2019
Activity	Dec	Jan Jun
Research		
proposal		

Ethical

clearance

Literature

review

Sample

collection

Laboratory

analysis

Data

complication

Data analysis

Final thesis

writing

Thesis

submission

BUDGET

Category	Number	Unit cost (GH¢)	Total cost (GH¢)
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Reagents

Sodium nitrite	3
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50	150
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Glucose	3
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10	30
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Methylene blue	3
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50	150
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Materials

Test Tubes (50 per Box)	21
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90	1890
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5ml Syringes and Needle (50 per Box)	10
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50	500
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Medical Gloves (100 per Box)	3
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30	90
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Cotton	1
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10	10
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Methylated Spirit	1
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15	15
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Other expenses

Transportation

200

Grand Total3035

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