Frequency of G6PD Deficiency in General Population at District Bannu, Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

Background: Glucose-6-phosphate dehydrogenase (G6PD) deficiency is an X-linked disease and it is a common enzymatic disease of RBCs in humans X linked recessive condition are more common in males than females. The said deficiency leads to affecting >400 million people worldwide Individuals, normally males, with deficient alleles are helpless to neonatal jaundice and intense hemolytic anemia, usually during disease, after treatment with specific medications or subsequent to eating Fava beans..

Objective: To measure the frequency of Glucose-6-Phosphate-Dehydrogenase deficiency in general population at district Bannu, Khyber Pakhtunkhwa Pakistan.

Material and Methods: This cross-sectional descriptive study was conducted on 500 human subjects, who were referred for G6PD assay, in Samad clinical Laboratory, District Bannu Khyber Pakhtunkhwa, Pakistan, from July 2018 to July 2019. 500cc venous whole blood was collected in EDTA containing vial, for G6PD Test. (Span Diagnostic S.A.R.L, France). Patients of any Age, Sex & area having fever, hematuria, headache, visible jaundice, family history, malaria and anemia were included in this study, while patients suffering from renal disease, any malignancy & not willing persons were excluded.

Results: Out of the total 500 hundred, 370 (74%) were males and females were 130 (26%). Total 64/500 (12.8 %) were G6PD deficient, with 55 male and 09 were female. Malaria positive with G6PD deficiency were 13/64 (20.31%), with 12 males and one female. Statistically significant difference among each group (p= 0.0022) was noted. Mean age of the G6PD deficient persons was (2.8 ± 1.03) years. Anemia was graded as Hemoglobin less than 11.5g/dl was taken as anemia. Severe anemia as Hb < 7 g/dl, moderate anemia as Hb ranged between 7-10 g/dl and mild if Hb ranged between 10-11.5 g/dl.

Among 370 males, 86 persons had hemoglobin of less than 11.5 g/dl, 42 had hemoglobin 7-10 g/dl and 7 patients had hemoglobin less than 7 g/dl, only 235 patients had hemoglobin more than 11.5, among 130 females, 33 patients had hemoglobin of less than 11.5 g/dl, 17 patients had hemoglobin 7-10 g/dl and 05 patients had hemoglobin less than 7 g/dl, only 75 patients had hemoglobin more than 11.5 g/dl.

Conclusion: This study shows high frequency of G6PD Deficiency in district Bannu Khyber Pakhtunkhwa Pakistan especially very high frequency in males than females.

Key words: G6PD, Prevalence, Khyber Pakhtunkhwa, Bannu.

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INTRODUCTION

G6PD deficiency is a X-linked sickness and it is the regular enzymatic problem in people, X- linked passive condition are more typical in males than female, the said inadequacy lead to influencing >400 million individuals around the world. However most insufficient people are asymptomatic. persons with insufficient alleles are prone defenseless to neonatal jaundice and extraordinary hemolysis. Pallor, ordinarily during disease, after treatment with explicit drugs or resulting to eating Fava Beans.[1] At present, the main medication for malaria vivax is Primaquine (a 8-aminoquinoline), High prevalence is seen ordinarily in Africa, Asia, Mediterranean nations and Latin America. Recent investigation demonstrated a worldwide prevalence of 4.5% G6PD deficiency and demonstrated a rate of 1.8% in Pakistan.[2]

Acute hemolytic anemia, neonatal jaundice and chronic non spherocytic hemolytic anemia are the major clinical manifestations associated with G6PD Deficiency.[3] Individuals with G6PD deficiency are around 20 to 30 times more sensitive to the hemolytic action of primaquine than the general population with typical G6PD, and can incite hemolytic reaction[4]Henna is a restorative color that is utilized for passing on hair, nails. A few examinations recognized that henna can instigate hemolytic anemia. Lawsone (2-hydroxy-1,4-naphthoquinone) is a synthetic substance in henna, and its structure and redox potential is like naphthalene metabolites that incite oxidative harm in red blood cell particularly in G6PD-deficient individual.[5]

There is a low haptoglobin serum in G6PD deficient people.[6] One of the basic hazard factors for pathologic hyperbilirubinemia in babies is deficiency of G6PD enzyme.[7] Deficiency of this enzyme is the most common enzymopathy in red

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blood cells that causes hemolysis and hyperbilirubinemia. Hyperbilirubinemia can be extremely serious in G6PD deficiency and prompts perpetual harm to the cerebrum and causes kernicterus and death.[8] The pathogenesis of hyperbilirubinemia in G6PD deficient infants is unique in relation to that in G6PD-ordinary ones. In the interim hemolysis is viewed as a foremost reason for bilirubinemia in G6PD-ordinary neonates; however reduced Bilirubin conjugation would be the primary driver of hyperbilirubinemia in G6PD-deficient babies.[9]

MATERIAL AND METHODS

This cross-sectional descriptive study was conducted on 500 human subjects, who were referred for G6PD assay, to Samad clinical Laboratory, District Bannu Khyber Pakhtunkhwa, Pakistan, from July 2018 to July 2019. The sampling technique used was non-probability random sampling. Persons of any age and sex belonging to district Bannu, with positive consent, having fever Hematuria, headache, visible jaundice Family History, Malaria and Anemia were included in this study. Patients suffering from renal disease, any malignancy and not willing to join the study were excluded.

500cc venous whole blood was collected in EDTA containing vial, for G6PD Test. (Span Diagnostic S.A.R.L, France). A brief clinical record including name, age, sex, place of birth, and family history including past illnesses, fever, headache and episodes of recurrent jaundice, anemia, hematuria and malaria were recorded. All the blood samples were collected in sterile syringe and mixed with Ethylenediamine tetra acetic acid (EDTA) to avoid blood from clotting. EDTA blood for G6PD screenings were placed at room temperature till the test was performed. The tests were performed within one hour of blood sampling.

Laboratory procedures: The test employed was in vitro determination of the activity of G6PD from the red cell hemolysate: Qualitative method, (Span Diagnostic S.A.R.L, France), the assay was performed according to the instruction included in the kit, as follows.

Step 1: Red cell hemolysate was prepared by mixing 2.5ml deionized water with 0.05ml blood and was allowed to stand for 5min at Room Temperature.

Step 2: For enzyme assay, 1ml of the hemolysate (Step 1) was added with 1ml of reagent 3. It was mixed gently and incubated in water bath at 37ºc for a miximum of 6 hrs . The time taken for the color change from initial deep blue to reddish purple was noted at 30 min intervals.

All the data obtained were entered in Microsoft excel 2007, some percentages were drawn manually. Data analyses were performed using online statistical calculator of Graphpad (www.Graphpad.com) website and social science statistics (www.socscistatistics.com), A p-value of less than 0.05 was taken as statistically significant.

RESULTS

In this study, 500 blood samples were processed for G6PD, males were 370 (74%) and females were 130 (26%).Total 64/500 (12.8 %) were Deficient for G6PD,while 436 were not deficient for G6PD.out of 370 males, 55 were deficient and 315 were not deficient, out of 130 females, 09 were deficient and 121 were not deficient. Out of 500,Malaria positive with G6PD deficient were total 13/64 (20.31%), out of 370 males,12 were malaria positive and 358 were negative, out of 130 females, 01 female was positive and 129 were negative and showed a statistically significant difference among each group (p= 0.0022), out of 500, G6PD Deficient Patients of age < 05 years were 10/64 (15.625 %) having mean age of (2.8 ± 1.03) years and 132 patients of same age were not G6PD deficient, from age 05 14 years were 39/64 (60.9375%) having mean age of (8.94 ± 2.61) years and 211 patients of same age were not G6PD deficient while age more than 14 years were 15/64 (23.4375%) having mean age of (23.13 ± 11.16) years and 157 patients were not G6PD deficient and showed a statistically significant difference among each other age group (p = 0.0001).

We defined anemia as Hemoglobin less than 11.5g/dl was taken as anemia. It was classified as severe anemia if Hb was < 7 g/dl, moderate anemia if Hb ranged between 7-10 g/dl and mild if Hb ranged between 10-11.5 g/dl.

Among 370 males, 86 patients had hemoglobin of less than 11.5 g/dl, 42 had hemoglobin 7-10 g/dl and 7 patients had hemoglobin less than 7 g/dl, only 235 patients had hemoglobin more than 11.5, among 130 females, 33 patients had hemoglobin of less than 11.5 g/dl, 17 patients had hemoglobin 7-10 g/dl and 05 patients had hemoglobin less than 7 g/dl, only 75 patients had hemoglobin more than 11.5 g/dl.

Figure 1. Gender vise distribution of G6PD Deficient Patient.

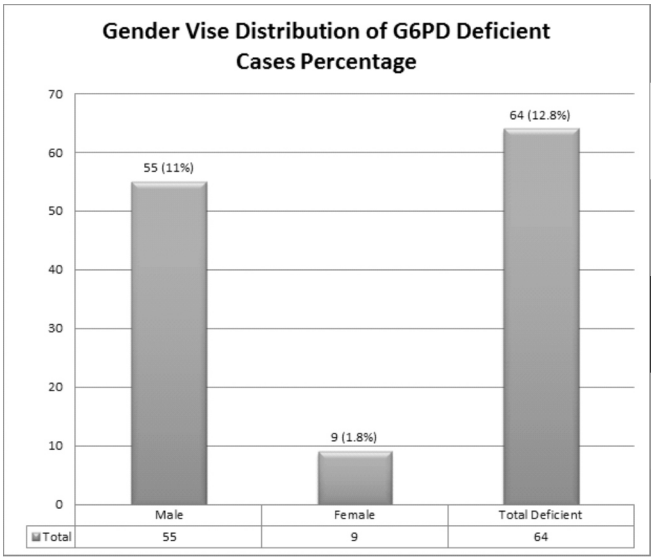
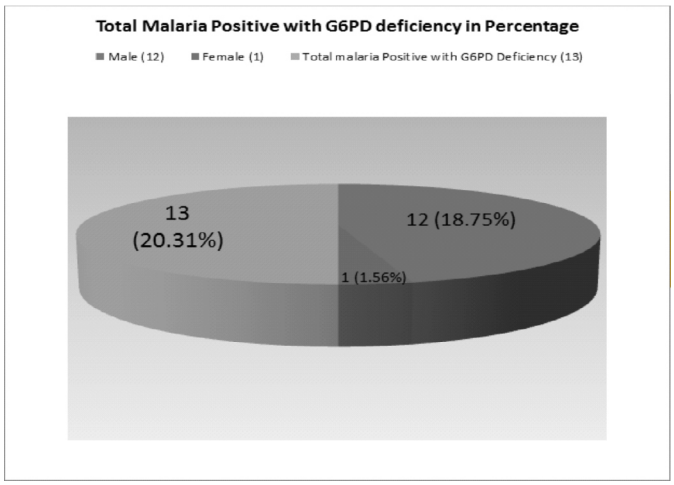


Figure 2. Total Malaria Positive with G6PD Deficient Cases in Percentage



(P. Value = 0.0022)

DISCUSSION

In this study, total 500 blood samples were processed for G6PD, males were 370 and females were 130, showing high percentage of G6PD deficiency among males as compared to females in district Bannu Khyber Pakhtunkhwa Pakistan. The higher predominance of G6PD deficiency in males than females could be because of X-linked recessives.

In our results at figure 1 revealed that the frequencies of the G6PD enzyme deficiency in total general population were 64/500 (12.8%). This finding of our study is consistent with other studies which reported the frequency of G6PD deficiency as 10.65% in Iraq [10] and 12.6% in Saudi Arabia.[11] In Pakistan, the frequency of G6PD deficiency was reported as 10% by Alvi *et al* [12] and 13% by *Khan et al* [13] Khattak *et al* at Peshawar, observed G6PD deficiency in 12% of patients with hemolytic anemia.[14] In contrast to our study, some other studies showed a higher frequency of G6PD deficiency; and has been reported to be 16% in in Peshawar [15] and 26% in DHQ Timargara Dir.[16]

The study also shows that frequency of G6PD Deficiency were higher in males than females, out of 64/500 (12.8%), 55/64 were males and 09/64 were females, the percentage in males (11%) and in females (1.8%) respectively. In the study of Arjumand S *et al*. (2001), also showed high frequency in males, of the total 1807 deficient, 1249 (69.12%) were male and 558 (30.87%) were females.[17]Another study of Ramin Iranpour, (2008), of the 2501 (1307 males, 1194 females) screened, 79 were found to have G6PD deficiency (67 (84.81%) males, 12 (15.18%) females).[18]

Table 1. Age vise distribution of G6PD deficient patients.

G6PD Deficiency	< 5 years	5-14 years	> 14 years	Total	*p*-value
Yes	10	39	15	**64**	**Significant (0.0001)**
No	132	211	157	**436**	
Mean/SD		8.94 ±	23.13 ±	.	
Total	**142**	**250**	**172**	**500**	

Table 2. Hemoglobin level (n =500).

Hemoglobin	Male	Female	Total
Less than 11.5 g/dl	86	33	**119 (23.8%)**
7-10 g/dl	42	17	**59 (11.8 %)**
Less than 7 g/dl	07	05	**12 (2.4%)**
More than 11.5	235	75	**310 (62%)**
Total	**370**	**130**	**500 (100%)**

In our study at figure 2, shows the total G6PD deficient patients with malaria cases are 13/64 (20.3125 %), out of which, 12/64 (18.75%) were male and 01/64 (1.56%) were female and showed a statistically significant difference among each group (p= 0.0022), the occurrence of P.Vivax malaria were noted in our total 13 G6PD deficient patients. In another study of Moytrey Chatterjee *et al* (2016), 583 patients screened for G6PD deficiency, among the G6PD deficient cases 1 (12.50%) case was P. falciparum positive and 7 (87.50%) cases were P. vivax positive. The occurrence of G6PD deficient cases was higher in P. vivax malaria cases (2.3%) than P. falciparum cases (0.4%). [19] which is an agreement to our study. However in our study no cases of P.falciparum were reported. In our study at table 1.0 shows the G6PD Deficient Patients of age < 05 years were 10/64 (15.625 %) having mean age of (2.8 ± 1.03) years, from age 05 14 years were 39/64 (60.9375%) having mean age of (8.94 ± 2.61) years and age more than 14 years were 15/64 (23.4375%) having mean age of (23.13 ± 11.16) years and showed a statistically significant difference among each other age group (p = 0.0001). Table 1.0, showed higher Frequency at age between 5-14 years (62.5%). Almost close similar study of IZ Isaac *et al* (2013) indicated that highest prevalence occurred in the 2 to 5 year (41.20%) age group.[20] Another study of Mohd Jafar Memon *et al* (2016). Out of 100 patients, higher frequency were noted at age range of 11-20 years and 0-10 years [21]

CONCLUSION

This study showed significant percentage of G6PD deficiency in district Bannu especially in male as compared to females. G6PD deficiency with malaria positive patients in males are found high when compared to females. It is recommended that G6PD test must be implemented in public & private Medical/Clinical laboratory throughout the Khyber Pakhtunkhwa Province as well as in Pakistan. Beside this, the availability of safe anti-malarial and other oxidizing drugs in G6PDS deficient patients and proper awareness among general populations as well as physicians about Fava beans are required.

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