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## RESEARCH ARTICLE

# HAEMOGLOBIN S VARIANT AMONG SAUDI IN TAIF CITY

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**ABSTRACT**

In Saudi Arabia, the prevalence of sickle cell disease (SCD) varies significantly in different regions of the country, with the highest prevalence is in the Eastern province, followed by the southwestern provinces. In addition, sickle-cell trait range was reported from 2% to 27%, and up to 2.6% have SCD in some areas. The aim of this study was to assess the haemoglobin S variant among Saudi's who aged between 19 to 40 years old, in Taif city. The result of this study showed that the heterozygous form of Hb S was detected as the major abnormality with 96% while, the result of this study was also reported three cases with 4% of adults diagnosed with Hb S homozygous. Clear understanding the genetics and the prevalence of these disorders will provide opportunities for prevention or and reduce the incidence. Thus, this study suggests that in addition to the huge efforts already accomplished by the Saudi Ministry of Health to prevent at-risk marriages, the early diagnosis for these disorders might be offered for young adults as they can discuss the issue in the early stage of the marriage proposal.



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## INTRODUCTION

Normal haemoglobin comprises four globin chains: fetal haemoglobin (Hb F) has two α and two γ chains while adult haemoglobin (Hb A) has two α and two β chains in the a-globin and b-globin gene clusters (on chromosomes 16 and 11) which control globin-chain production. Abnormal haemoglobin might be generated as a result of production of structurally abnormal globin proteins (Hb variants) or impair globin protein subunit production (Huisman *et al*., 1997). Deletions and multiple amino acid substitutions mutations are less commonly seen and associated with Hb variants. However, genetic disorders of the globin-chain of the haemoglobin (Hb) are common mutations, which affecting an estimated 7% of the world's population (Weatherall and Clegg, 2001, Kohne, 2011). According to the World Health Organization (2008) haemoglobin abnormalities present a significant health problem in 229 countries, and these countries include 89% of all births worldwide (Modell and Darlison, 2008). Moreover, more than 330 000 affected infants are born every year and 83% diagnosed with sickle cell disorders (Modell and Darlison, 2008). In children younger than 5 years old haemoglobin disorders account for about 3.4% of deaths cases (Modell and Darlison, 2008). The haemoglobin variants could be hemoglobin opathies and associated with certain diseases such as sickle cell anaemia (SCA) (Angastiniotis and Modell, 1998). Some hemoglobin variants considered non-pathological and couldn't make any detectable disorder, which means that they are harmless and without signs or symptoms. Sickle cell disease (SCD) is one of the most important single gene disorders of human beings (Jastaniah, 2011). Production of abnormal haemoglobin S, results from a substitution of valine for glutamic acid in the sixth position of the β globin chain, is associated with the autosomal recessive disorder called sickle cell disease (SCD). In Saudi Arabia, the prevalence of SCD varies significantly in different parts of the country, with the highest prevalence is in the Eastern province, followed by the southwestern provinces (Jastaniah, 2011, Al-Qurashi *et al*., 2008). In addition, sickle-cell trait range was reported from 2% to 27%, and up to 2.6% have SCD in some areas (Jastaniah, 2011). The aim of this study was to assess the haemoglobin S variant among Saudi's who aged between 19 to 40 years old, in Taif city. This will help in complication prevention and management of various hemoglobinopathies.

## MATERIALS AND METHODS

This study was performed from January 2015 to October 2015. A total of 9008 healthy Saudi male and female (aged between 19 to 40 years old) were participating in this study. Venous blood (2-3 ml) was collected in EDTA-K2 tube (Guanazhou, Improne, Medical Instruments, Co. LTD.) and mixed well. Complete blood counts (CBC) were performed in automated cell counter (Symex-CellDyne). Samples were then analysed by High Performance Liquid Chromatography (HPLC) on the BIO-RAD VARIANT II Haemoglobin Testing System using the VARIANT II β-thalassemia Short Program. The sample

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tubes were loaded into sample racks and placed on the sampling station. A whole Blood Primer was used at the beginning of each run to condition the cartridge for analysis. Haemoglobin $A_2$/F calibrator and two levels (Level 1 and 2) of controls (BIO-RAD Laboratories) were used at the beginning of each run. The haemoglobin control level 1 containing $A_2$ and F (normal) and level 2 containing $A_2$, F and S (Abnormal). The total area acceptable was between one to three million µVolt/second. The Variant II Clinical Data Management (CDM) Software (BIO-RAD Laboratories) performs reduction of raw data collected from each analysis. To aid the interpretation of results. For each sample a chromatogram/ sample report is generated by CDM showing all haemoglobin fractions eluted. The integrated peaks are assigned to manufacturer-defined windows derived from specific retention time (RT) of normal haemoglobin fractions and common variants (Table 1).

**Table 1. Manufacturer Assigned Windows for BIO-RAD Variant II HPLC System**

| Window | Retention Time (Min) |
|---|---|
| $P_1$ | 0.63 – 0.85 |
| F | 0.98 – 1.20 |
| $P_2$ | 1.24 – 1.40 |
| $P_3$ | 1.40 – 1.90 |
| $A_0$ | 1.90 – 3.10 |
| $A_2$ | 3.30 – 3.90 |
| S | 4.30 – 4.70 |

**Table 2. The number and percentage of Hb S variants among Saudi male and female participants**

| HB variants | Number | Male | Female |
|---|---|---|---|
| Sickle cell trait | 69 (96%) | 32 | 37 |
| Sickle cell anemia | 3(4%) | 1 | 2 |
| Total | 72 | 33 | 39 |

### Ethical Considerations

This study was approved by the research ethical committee of the health affairs and the committee of college of applied medical sciences, at Taif University. The study purpose was explained to the all participants, then, an informed consent was taken from them.

### Statistical Analysis

Data was analyzed by SPSS version 19. Frequencies and percentages were calculated.

## RESULTS

In this study 9008 blood samples were studied and out of these, 72 (0.8%) cases displayed abnormal haemoglobin S fractions when investigated with HPLC. The heterozygous form of Hb S was detected as the major abnormality with 96% (69 cases). The result of this study also reported three cases (4%) of adults were diagnosed with Hb S homozygous, which indicated the presence of sickle cell anaemia (Table 2).

## DISCUSSION

In Saudi Arabia, the information about the prevalence of SCD is still patchy and probably underestimated (Jastaniah, 2011). However, it has been reported that the prevalence of SCD varies significantly in different parts of the country, with the highest prevalence is in the Eastern province, followed by the southwestern provinces (Jastaniah, 2011, Al-Qurashi *et al*., 2008). This study was performed in the Taif city in the western region of the Kingdome of Saudi Arabia to detect Hb S variants among Saudi male and female during six months from January 2015 to October 2015. The result of this study showed that the Hb S heterozygous was presented as the major abnormality with 96% compared with the Hb S homozygous with 4% only. Similarly, AlHamdan has been found that 4.20% patients had sickle cell trait and 0.26% had sickle cell disease (AlHamdan *et al*., 2007). Another study done in 2007, has been reported that the highest rates of sickling at Al-Ahsa region compared with Qunfudah and Jazan and sickle cell trait was detected with 16.89% and sickle cell disease reported with 1.20% (Zaini, 2016, AlHamdan *et al*., 2007). Clear understanding for the genetics and the prevalence of these diseases will provide opportunities for prevention or /and reduce the incidence. Thus, this study suggests that in addition to the huge efforts already accomplished by the Saudi Ministry of Health to prevent at-risk marriages through premarital screening program, the early diagnosis for these disorders might be offered for young individuals such as at the high school level and among at high risk population. Subsequently, they can discuss the issue in the early stage of the marriage proposal.This study also suggests that further studies on the prevalence of SCD may help predict disease severity and risk stratification of patients to determine whether to receive early intensive care or continued symptomatic care.

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