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Prevalence of Abnormal Hemoglobins among Students in Bahrain: A Ten-Year Study

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Background: Sickle cell disease (SCD) and thalassemia are common in the Arab countries.

Objective: The aim of this study is to evaluate the prevalence of abnormal hemoglobin in secondary school students in Bahrain and to compare the prevalence rates from 1999-2008.

Design: Prospective study.

Setting: Hematology Laboratory at Salmaniya Medical Complex.

Method: The students of the 11th grade (2nd grade in secondary schools), during 1999-2008 were screened. Hb Chromatography was done by HPLC. Informed consents were obtained from the parents.

Result: Sixty thousand and four hundred twenty-four (60,424) students were screened. The most common type of hemoglobin was hemoglobin A, found in 50756 (84%) of the students. The second was Hb S, the average prevalence of SCD was 1.13%, sickle cell trait was seen (SCT) in 13.3%. SCT in 1999 was 13.81 and in 2008 it was 12.8.

Hb D heterozygous was found in 306 (0.51%) of the screened individuals. Hb D homozygous was found in 17 (0.03%). Hb EA heterozygous was found in 84 (0.14%), while Hb E homozygous was found in 3 (0.005%) of the students.

Conclusion: The prevalence of SCD among the age groups (16-18 years) revealed a significant decline during these ten years period *P= .000*. The continuation of the screening and education efforts might reduce the prevalence further, if not eliminate it. SCD in 2000 was 1.3 and in 2008 it was 0.81.

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Falciparum malaria was endemic in Bahrain until 1970, but great efforts by the government to eliminate it proved to be eventually successful. The malaria associated genetic defects of red cells, such as SCD, thalassemia and glucose 6-phosphate dehydrogenase deficiency (G6PD), were expected to be common[1-4].

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The newborn screening study conducted in Bahrain during 1984-1985 revealed 2.1% prevalence rate of SCD. According to the statistics, 200 babies born every year suffered from SCD, with 11.2% being carriers of the abnormal gene for SCD, and 20% have G6PD deficiency. The carrier status for beta thalassemia was 2-4% in a premarital counseling study conducted in 1994[2-5].

The aim of the study was to determine the prevalence of common genetic blood disorders (thalassemia and sickle cell anemia) among students.

METHOD

This is a cross sectional interval study, performed annually for a period of ten years. Nearly six thousand students were screened each year for thalassemia and sickle cell anemia. Sixty thousand and four hundred twenty-four (60,424) students were screened.

Informed consent was taken from the parents of children under 18 years of age and those over the age of 18 years were given the choice. The test was applicable for all students of the 11th grade. The results were kept confidential between the researcher's team, the student and his family.

Personal characteristics were documented. Each student received a card with the result which could be maintained throughout life. The schools received reports about the prevalence of these diseases in their school.

The obtained data were coded, processed and analyzed by SPSS.

RESULT

Sixty thousand and four hundred twenty-four (60,424) students were screened. About 85% of the parents granted permission to test their children. The numbers of students screened yearly during 1999-2008 were 5685, 5694, 6244, 5894, 5418, 6237, 6358, 6352, 6376 and 6166. Male to female ratio was 1:1.2. Hb A was the most common type of hemoglobin.

The average prevalence of SCD was 1.13%, and the average prevalence of SCT was 13.3%, see Table 1.

Table 1: Sickle Cell Prevalence among Students in Bahrain (1999 – 2008)

Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Disease										
SCD	68 1.20%	75 1.32%	68 1.09%	64 1.09%	74 1.37%	78 1.25%	73 1.15%	59 0.93%	67 1.05%	50 0.81%
SCT	785 13.81%	787 13.82%	886 14.19%	838 14.22%	706 13.03%	873 14.00%	805 12.66%	803 12.64%	788 12.36%	789 12.80%
No. of students	5685	5694	6244	5894	5418	6237	6358	6352	6376	6166

The difference between the years was found to be statistically significant for both SCD and SCT p value .000, the 95% confidence interval of the difference for SCD (0.79-1.3), and that for SCT (12.8-13.8). In 2000, SCD was 1.3 and 0.81 in 2008.

The average prevalence of Hb D heterozygote was 0.52%, and of Hb D homozygote was 0.028%, see table 2.

The average prevalence Hb E heterozygous was 0.14%, whilst Hb E homozygote was 0.005, see table 2. Hb O Arab and Hb C were not found in the screened students.

Table 1 and Figure 1 reveal the prevalence of SCD among the studied students during the study period. Table 2 and Figure 2 portray the prevalence of the other abnormal hemoglobin.

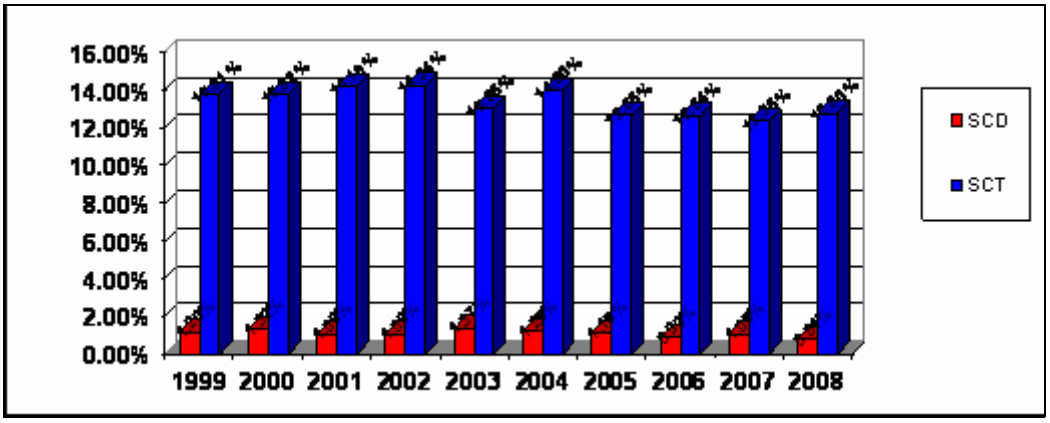

Figure 1: Sickle Cell Prevalence among Students in Bahrain (1999 – 2008)

Table 2: Prevalence of Abnormal Hemoglobin among Students in Bahrain (1999 – 2008)

Disease	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Hb D disease	2 0.04%	1 0.02%	1 0.02%	1 0.02%	0 0.00%	1 0.02%	4 0.06%	2 0.03%	3 0.05%	2 0.03%
Hb D trait	30 0.53%	32 0.56%	38 0.61%	31 0.53%	40 0.74%	32 0.51%	32 0.50%	33 0.52%	20 0.31%	24 0.39%
Hb E disease	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1 0.02%	1 0.02%	0 0.00%	0 0.00%	1 0.02%
Hb E trait	9 0.16%	12 0.21%	7 0.11%	9 0.15%	3 0.06%	8 0.13%	10 0.16%	6 0.09%	8 0.13%	12 0.19%

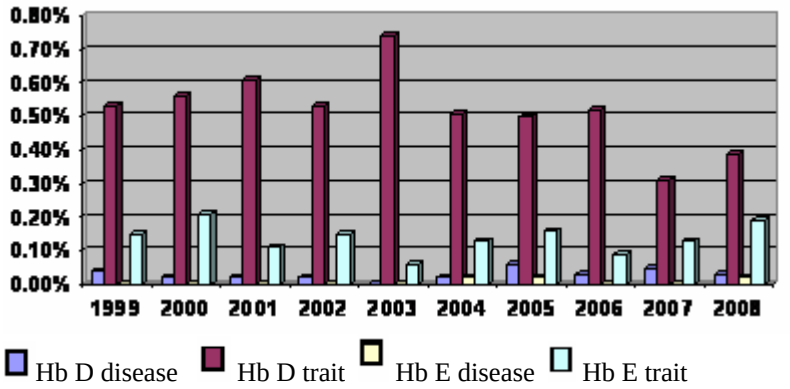

Figure 2: Prevalence of Abnormal Hemoglobin among Students in Bahrain

DISCUSSION

Hb A was found to be in 84% of the students. The average prevalence rate of homozygous state of Hb SS was 1%. The average prevalence rate of carriers (SCT) was found to be 13.3%.

The mild form of the disease was the most prevalent and DNA analysis of sickle cell mutations confirmed the presence of the Asian haplotype as the most common[6-10]. This mutation is associated with high levels of Hb F. Many of these patients lead normal life, while it is expected that 10% of all patients with SCD have the severe type of the disease[10-14]. Another decline was noted if compared with the other age groups, such as, the newborn babies who had a prevalence of 0.9%[15].

Hb D and E are rare in Bahrain, but they are relatively significant in other areas, such as, South-East Asia[6]. The prevalence of Hb D heterozygous was found to be 0.58%.

Hb D homozygous was found in 0.02% of the students. All was identified to be Hb D Punjab by performing further DNA studies.

It is important to diagnose carriers for Hb D during premarital examination. If one partner has SCT, and the other is a carrier for Hb D, there is a risk for the offspring to suffer from SCD. Furthermore, no student was found to have Hb O Arab or Hb C among 60,424 students, although it was reported in a previous study[2,16].

No significant difference was found between the prevalence of hemoglobin D and E disorders among the studied age group.

We would like to emphasize the preventive measures, as they remain the best ways of dealing with these diseases. They can be cost effective and ultimately yield significant social and health benefits[17,18].

CONCLUSION

A significant decline was observed in the prevalence of SCD. This gradual decline in prevalence of disease might be attributed to the high level of literacy and education

among the people in Bahrain and the implementation of preventive measures such as health education, carrier screening and premarital counseling, over the last 20 years in particular.

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