Prevalence of Beta-thalassaemia Trait in 1124 Students from Aegean Region of Turkey

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Summary
Although the beta (β) thalassaemia carrier frequency in Turkey was stated to be 2 per cent, the prevalence rate varies widely in different regions and there is limited data confirming the disorder in Aegean region. This prevalence study was planned to determine frequency of β thalassaemia trait in the Aegean region among 1124 high school students, between 13 and 18 years old, who were selected as target population. Sensitivity of mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) in prediction of β thalassaemia trait were evaluated. Venous blood samples were obtained for haemoglobin electrophoresis, HbA₂ and HbF, serum iron and total iron binding capacity from students in whom the levels of haemoglobin (Hb), haematocrite (Hct), MCV, or MCH, were low compared to normal values. The prevalence of β thalassaemia trait in Aegean region was 3 per cent. Sensitivity of MCV and MCH for determining β thalassaemia trait were 100 and 96 per cent, respectively.

Introduction
Although it is clear that β thalassaemia is a common health problem in Turkey,¹ the size of the problem is not known. Local epidemiological data are needed for determining the prevalence of the condition in Turkey. Haemoglobinopathy control program for prevention of this common inherited disease at the community level can only then be established.

Materials and Methods
This prevalence study was planned to determine frequency of β thalassaemia trait in Aegean region. A total of 1124 high school students, between 13 and 18 years old, were selected as target population. Sensitivity of mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) in prediction of β thalassaemia trait were evaluated. The students in whom the levels of haemoglobin (Hb), haematocrite (Hct), MCV, or MCH, as measured by electronic cell counters, were low compared to normal values,²³ were considered for further evaluation. Lower limit of Hb level in 13–14 years of age was accepted as 12 g/dl for girls and 12.5 g/dl for boys, and in 15–18 years of age 12 g/dl for girls and 13 g/dl for boys. Lower limit of Hct value for girls and boys in 13–14 years of age were accepted as 34 and 35 per cent, respectively. It was defined as 35 per cent for girls and 39 per cent for boys between 15 and 18 years old.¹ The accepted lower limit of MCV was 80 fl, and of MCH it was 27 pg for both sex and age groups.⁵ In this group of students haemoglobin A₂ (HbA₂) was measured by DE-52 microcolumn chromatography method (beta-thal HbA₂ Quick Column, Helena Laboratories) and fetal haemoglobin was calculated by alkali denaturation technique (modified Betke method), haemoglobin electrophoresis was performed by using agarose gel (Beckman) electrophoresis (PH 8.6), and iron and total iron binding capacity (TIBC) were analysed.¹⁴ Statistical analysis was performed using Student t-test. P value less than 0.05 was considered statistically significant.

Results
Of the 1124 students from Aegean region, 669 were boys and 455 girls. Mean age of the study group was 15.7 ± 2.3 years. At least one of the haematological datas (Hb, Hct, MCV, MCH) was found to be low compared to reference values in 137 out of 1124 students. Thirty of 137 students were defined as high HbA₂ (3.5–8.0 per cent) β thalassaemia trait. The prevalence rate of high HbA₂ β thalassaemia carriers was 3 per cent. Moderately elevated HbF levels (2–5 per cent) accompanied high HbA₂ values in 9 of 30 β thalassaemia carriers. Only one student was determined to have high HbF level (7 per cent) together with normal HbA₂ value and she was considered as δβ thalassaemia trait. One student was found to have an abnormal band in haemoglobin electrophoresis showing an electrophoretic mobility similar to HbS. This subject also had a positive sickling test. She was defined as HbS carrier. The prevalence rate of carriers for haemoglobinopathies was 3 per cent in Aegean region (Table 1).

Reduced MCV (<80 fl) was the common finding in all β thalassaemia carriers in this study. MCH was found decreased (<27 pg) in all β thalassaemia carriers except one. For MCV and MCH, predictive values of negative tests in detecting β thalassaemia carriers were 100 and...
99.9 per cent, and predictive values of positive tests were 34 and 29 per cent, respectively (Table 2).

Discussion

The first report about prevalence of β thalassaemia carriers in Turkey was published in 1971 in which the prevalence rate was stated to be 2 per cent. The prevalence of high HbA2, β thalassaemia carriers was found 2 per cent by Çavdar and Arcasoy covering the whole country in 1975. Dingol et al. were the first investigators to indicate regional differences in prevalence rate of β thalassaemia trait in Turkey. In the last 15 years, the studies performed in Turkey confirmed that prevalence of β thalassaemia carriers manifested regional difference varying between 1–11 per cent. In this study planned to contribute to the definition of varying rates of β thalassaemia carriers in Turkey, the prevalence rate was found to be 3 per cent. This prevalence rate was considerably low compared to prevalence rates found in some other regions of Turkey, but slightly higher than the value reported for overall Turkey (2 per cent). Other haemoglobinopathies were rare in our region (Table 1).

Many studies have reported that MCV and MCH were screening tests accurately identifying β thalassaemia carriers. In this study, the sensitivity of MCV for distinguishing β thalassaemia carriers was 100 per cent and the specificity was 94.5 per cent. This test can be used in prediction of β thalassaemia carriers in our population. Although iron deficiency yielding positive test results was frequent in our population, the specificity of the test was sufficient. Predictive value of positive test was only 34.6 per cent because the prevalence of carriers was not high in our population. The predictive value of negative test was 100 per cent. Although MCH was also a confident screening test for distinguishing β thalassaemia carriers, it was not found more reliable compared to MCV in our population (Table 2).

In conclusion, although the prevalence of β thalassaemia carriers in Aegean region is not as high as some other regions in Turkey, the ratio is sufficient to consider this region for a systematic population screening program. In this program, MCV determined by coulter counter electronically, can be a valuable indicator of microcytic anemias and a sensitive screening test for thalassaemia trait. If the MCV is < 80 fl, HbA2 should be estimated to confirm the diagnosis of β thalassaemia trait.

References