Relationship between Hb and HbA₂ Concentrations in healthy and Iron deficient Subjects

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Summary

In 23 healthy subjects and in 115 patients with various degrees of chronic iron deficiency anaemia without congenital abnormalities of globin synthesis, Hb ranged from 3.4 to 16.3 g/100 ml. HbA₂ ranged from 0.055 to 0.525 g/100 ml. Hb and HbA₂ were statistically correlated, as shown by linear regression analysis (a = 0.1387; b = 0.0372; r = 0.8198; P < 0.001). The second degree parabola was not statistically different, but it gave a biologically preferable Figure for intercept (a = 0.0006; b = 0.0070; c = 0.0015; r = 0.8324; P < 0.001). The second degree parabola was to be preferred also on the basis of previous literature results. Shortness of iron seems to reduce more the HbA₂ than the Hb levels.

The concentration of HbA₂ (α₂δ₂) in normal human adults is remarkably constant and constitutes approximately 2.5 per cent of total haemoglobin. This amount is genetically determined and it may be altered both in thalassaemia because of abnormal genetic control of globin synthesis, and in conditions due to environmental factors like iron deficiency. In 1964 Chernoff [2] reported cases of iron deficiency with reduced levels of HbA₂ and similar observations have been subsequently made by others [4, 5]. Large scale studies have been published by Wasi et al. [9] and Steiner et al. [8] in 172 and 100 subjects respectively. However, from these reports no clear information may be obtained on the relationship between synthesis of haemoglobin and that of HbA₂. Steiner et al. [8] concluded that a quantitative correlation between the degree of anaemia and a corresponding decrease in HbA₂ concentration

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Recently, we have found a statistical correlation between Hb and HbA₂ (g/100 ml) in 29 subjects with iron deficiency anaemia (IDA) and Hb ranging from 5.5 to 11.1 g/100 ml [1]. After iron therapy Hb ranged from 11.4 to 16.3 g/100 ml and the correlation still existed; however in the presence of greater Hb amounts a relatively greater synthesis of HbA₂ was observed [1].

In this paper the absolute concentration of HbA₂ has been compared to that of Hb in 138 subjects without congenital defects in globin synthesis, either normal or with various degrees of iron deficiency anaemia.

Material and Methods

Haematological assessment in 23 healthy subjects and 115 patients with various degrees of chronic IDA was based on the following tests, performed with routine techniques: Hb, RBC, PCV, MCV, MCH, MCHC; reticulocyte count; total and unconjugated bilirubin, iron, TIBC and haptoglobin in the serum; red cell osmotic fragility; Hb electrophoresis and HbA₂ quantitation [7] and HbF percentage.

Chronic IDA was secondary to chronic blood losses due to either gynaecological (62%) or gastroenterological (38%) benign conditions.

Results

Hb levels ranged from 3.4 to 16.3 g/100 ml and those of HbA₂ from 0.0550 to 0.5250 g/100 ml. In Fig. 1 Hb and HbA₂ levels have been correlated. Analysis for linear regression gave: \(a = -0.1387; b = 0.03719; r = 0.8198 (P < 0.001)\); and that for second degree parabola gave: \(a = -0.0006; b = 0.0070; c = 0.0015; r = 0.8324 (P < 0.001)\). There was no statistical difference between the two r-valuations.

![Fig. 1: Relationship between Hb and HbA₂ concentrations in 138 subjects without congenital defects in globin synthesis.](image)