

# Prevalence of abnormal Hemoglobin in gendarmerie barracks in Abidjan, Cote D'Ivoire

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## To cite this article:

Sekongo Y. M., Kouamenan S., Siransy B.L., Ouattara B., Konan S., Dembele B., Tolo D.A., Hyda J., Kabore S., Konate S.. Prevalence of Abnormal Hemoglobin in Gendarmerie Barracks in Abidjan, Cote D'Ivoire. *American Journal of Clinical and Experimental Medicine*. Vol. 1, No. 3, 2013, pp. 58-61. doi: 10.11648/j.ajcem.20130103.14

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**Abstract:** In Ivory Coast, Sickle cell disease is a public health problem. Approximately, there are 98,000 blood donors annually to the national blood transfusion center. Among these, some holders of abnormal hemoglobins are often diagnosed. The objective of this study is to determine the prevalence of abnormal hemoglobins during a mass balance for the integration into an army corps those are asymptomatic blood donors. This prospective and descriptive study took place in a gendarmerie barracks in Abidjan, Ivory Coast, from October 01, 2011 to December 31, 2011. All candidates for inclusion in the corps army, aged 18 to 25 years, ivorian, from all regions of the Ivory Coast, were included in the study. EDTA tubes for Celluloseacetate electrophoresis alkaline pH and blood count and dry tube for biochemical and virological tests were taken during donations. A total of 9526 were enrolled in this study. The median age of our patients with abnormal hemoglobins was 23 years with extremes of 18 and 25. The overall prevalence of abnormal hemoglobins was 15.07%. The prevalence was 9.54%, for HbS, 5.6 % for HbC and 0.052% for beta-thalassemia profile. The heterozygous AS (61.56%) and AC (35.38%), predominated. We noted 25 cases of sickle cell disease, including 14 major cases (0.97%) of homozygous SS and 11 cases (0.77%) of double heterozygous SC. We also noted 14 cases (0.97%) for CC homozygotes. The beta-thalassemia profile was weakly present in 0.35%. This study of asymptomatic adults population, confirmed the high prevalence of HbS in Ivory Coast and the lack of a national program to fight against sickle cell disease. This should motivate the introduction of screening for abnormal hemoglobins to all the blood donors in Côte d'Ivoire

**Keywords:** Abnormal Hemoglobin–Gendarmerie Barracks

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## 1. Introduction

Screening for hemoglobinopathies in Ivory Coast, started in 1967 by Cabannes et al. with the medico-social action, has established in the 80s, the national prevalence of each hemoglobinopathy. According to this work 14.29% of the Ivorian population was a carrier of HbS, HbC 7.59% and 6.42% of beta-thalassemia trait [1]. Since then, no study was conducted to update these figures.

In Ivory Coast, Sickle cell disease is a public health problem. Approximately, there are 98,000 blood donors annually to the national blood transfusion center [2]. Among these, there are holders of abnormal hemoglobins that are often diagnosed during a mass balance for the integration into an army corps.

The Ivorian population having doubled in 20 years, it became important in the absence of national control

program against the hemoglobinopathies and in the absence of routine screening blood donors, to search for abnormal hemoglobins in a major population apparently healthy. The objective of this study is to determine the prevalence of abnormal hemoglobins in an adult population may be asymptomatic blood donors.

## 2. Methodology

This was a prospective and descriptive study that took place in a gendarmerie barracks in Abidjan, Ivory Coast, over a period of three months from October 01, 2011 to December 31, 2011. All candidates for inclusion in the corps, aged 18 to 25 years, Ivory Coast national, from all regions of the Ivory Coast, were included in the study. A total of 9526 candidates was taken. The samples were made in EDTA tubes for blood count and hemoglobin

electrophoresis on cellulose acetate in alkaline medium, pH 8.6 and dry tube for biochemical and virological tests.

Realization of the hemoglobin electrophoresis on cellulose acetate

### 2.1. Principle

At alkaline pH, hemoglobin is a negatively charged protein and when subjected to electrophoresis will migrate toward the anode (+). Structural variants that have a change in the charge on the surface of the molecule at alkaline pH will separate from Hb A. Hemoglobin variants that have an amino acid substitution that is internally sited may not separate, and those that have an amino acid substitution that has no effect on overall charge will not separate by electrophoresis.

### 2.2. Method

- Hemolyze 10 µl of each sample pellet in 25 µl of solution hemolyzing
- Put 5µl of each hemolysate sample in a cup
- Pour the buffer solution in the two extreme channels of the tank
- Install the paper Joseph on the inner edges of channels to establish a bridge between the two compartments of the vessel
- Soak the plate in the buffer solution contained in a tank for at least 15 minutes
- Squeeze out excess buffer by placing the plaque between two sheets of blotting paper
- Place the plate on a support
- Using an applicator, take a hemolysate amount of each sample in the wells
- Put the applicator over the plate and apply slight pressure to reach the upper surface of the plate
- Return the plate to the electrophoresis tank with the filing of the cathode
- Close the tank
- Set the generator at 350 volts and turn on for 20 minutes
- Dip the plate in red culvert for 10 minutes
- Soak in the solution then both bleaching and transpirante for 10 minutes
- Dry the plate in a hot air oven

### 2.3. Interpretation

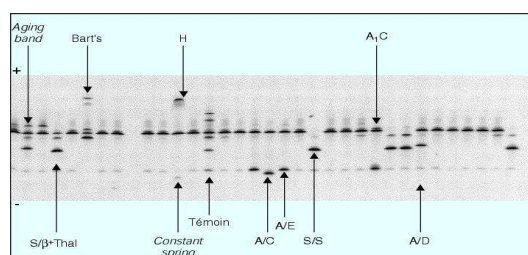


Figure 1. Cellulose acetate electrophoresis at alkaline pH.

Data were recorded and analyzed using Statview.

## 2. Results

Table 1. Prevalence of abnormal haemoglobins

HEMOGLOBIN ELECTROPHORESIS	NUMBER	PERCENTAGE
NORMAL	8090	84,9
ABNORMAL	1436	15,1
TOTAL	9526	100

We found 15.07% of abnormal hemoglobins

Table 2. Distribution of abnormal hemoglobins according to age groups

AGE GROUPS	NUMBER	PERCENTAGE
18 - 22	702	48,9
>22	734	51,1
TOTAL	1436	100

Minimum: 18 years Maximum: 25 years median 23 years  
Subjects older than 22 years were a slight majority

Table 3. Distribution of abnormal hemoglobins

HEMOGLOBIN PHENOTYPE	NUMBER	PERCENTAGE
AS	884	61,5
AC	508	35,4
SS	14	1
CC	14	1
SC	11	0,7
AF	5	0,4
TOTAL	1436	100

Sickle cell trait was dominant with 61.5% of cases.

Table 4. Distribution by the hemoglobin

HEMOGLOBIN (g/dl)	NUMBER	PERCENTAGE
<10	0	0
10-12	345	24
>12	1091	76
TOTAL	1436	100

The majority of subjects had a normal hemoglobin level (76%)

Table 5. Distribution of abnormal hemoglobins as hemoglobin level

PHENOT YP	HEMOGLOBIN LEVEL (g/dl)					
	<10		10-12		>12	
	NUM BER	PERCENTAGE	NUM BER	PERCENTAGE	NUM BER	PERCENTAGE
AS	0	0	207	23,4	677	76,6
AC	0	0	124	24,4	384	75,6
SS	0	0	9	64,3	5	35,7
CC	0	0	2	14,3	12	85,7
SC	0	0	3	27,3	8	73,7
AF	0	0	0	0	5	100
TOTAL	0	0	345		1091	

Whatever the hemoglobin phenotype, hemoglobin levels were greater than 10g/dl.

### 3. Comments

The median age of our patients with abnormal hemoglobins was 23 years with extremes of 18 and 25 years. There was a slight predominance of patients over 22 years with 51.1%. Improving life expectancy of subjects with sickle cell disease has been widely documented both in the West africa. Indeed the work of Cabannes and al [3, 4, 5] and Sangare and al. [6] in Côte d'Ivoire, Segbena A and al. [7] in Togo and Elira and al. [8] in the Congo, reported in their series, median ages of 26 years for their sickle cell disease.

The subjects were all male because this army is open only to men.

Several studies in Africa on hemoglobin disorders have reported variability in the sex ratio. In Tolo A and al. series in Côte d'Ivoire, there was a male predominance with a sex ratio to 1.28. Sangare [6], Cissé and al. [9], found a male predominance with a respective sex ratios of 1.02 and 1.13. However, Elira Dokekias [8, 10], Bertrand and al. [11] found a female predominance with a respective sex ratios of 0.8 and 0.7. Thuilliez and Vierin [12], meanwhile, reported equal distribution between the sexes. Sickle cell disease is not a condition to autosomal sex-linked, differences observed between these series results could be explained by a recruitment bias.

The overall prevalence of abnormal hemoglobins was 15.1%. Among these abnormal hemoglobins, the prevalence of HbS was 9.5%, that of HbC 5.6% and that of beta-thalassemia profile of 0.05%. The heterozygous AS (61.5%) and AC (35.38%), predominated. We noted 25 cases of sickle cell disease, including 14 major cases (1%) of homozygous SS and 11 cases (0.7%) of double heterozygous SC. We also noted 14 cases (1%) for CC homozygotes. The beta-thalassemia profile was weakly present with five cases or 0.4%.

Our results are below those reported by the work of Fabritus et al. [13] whose are reported 12% of hemoglobin S in their series. Tiendrebeogo H. and Sangare A [14] reported 16 % of abnormal hemoglobin in their series. About Cabannes et al., they reported in all their studies in Côte d'Ivoire, prevalence of abnormal hemoglobin between 10 and 16 %. [1, 3, 4, 5, 15, 16].

The prevalence of heterozygous AS, as reported in our series, is similar to that Cabannes and Sangare noted, 8.09% of the sickle cell trait [15].

The major forms were discovered incidentally. These subjects are asymptomatic or ignoring the disease, they considered wrongly as rheumatic.

These people with abnormal hemoglobin had hb rates above 10g/dl to blood count. The majority had levels beyond 12g/dl; therefore eligible to donate blood. The haplotype of the Ivorian made by multiethnic phenomenon of migration is less serious than other haplotypes including the Bantu haplotype [16, 17]. Its expression is modulated by the frequent association with alpha thalassemia that reduces sickling phenomena. [3].

### 4. Conclusion

This study of asymptomatic adults population, confirmed the high prevalence of HbS in Ivory Coast. It revealed the existence of major form of sickle cell disease who remain undiagnosed until adulthood. The hemoglobin C as the minor forms of beta-thalassemia exist in Côte d'Ivoire but in low proportions. Considered in terms of the blood, it can be a significant problem because these topics can be from blood donors and therefore, the blood of these subjects can be transfused in sickle cell disease. The lack of a national program to fight against sickle cell disease in Côte d'Ivoire, despite whether it is a public health problem, could explain this fact. However, given the significant frequency of hemoglobinopathies and strong results achieved by our team on the preliminary study of the kinetics of hemolysis in sickle cell trait and has revealed hemolysis greater in the sickle cell trait (less than 10 days) it would be desirable to achieve at least the Emmel test or the hemoglobin electrophoresis to exclude major forms and to transfuse the pockets of people who are heterozygous AS as soon as possible.

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