Journal of Molecular Biomarkers & Diagnosis
ISSN: 2155-9929

Sehlule, et al., J Mol Biomark Diagn 2015, 6:2
DOI: 10.4172/2155-9929.1000227

Research Article Open Access

Microcytosis and Alpha and Beta Thalassaemia in Prospective Blood Donors of East Indian Descent in Trinidad and Tobago

Vuma S[1*], Mayers H[1], Labastide W[1], Legall G[1], Vaillant AAJ[1], Hardy-Dessource M-D[2], Romana M[2] and Saint-Martin C[3]

[1]*Department of Paraclinical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago*

[2]*INSERM S_763, CHU de Pointe-à-Pitre, Pointe-à-Pitre, Guadeloupe*

[3]*Laboratoire de l'Unité transversale de la Drépanocytose, CHU de Pointe-à-Pitre, Pointe-à-Pitre, Guadalupe*

[*]**Corresponding author:** Sehlule V, Department of Paraclinical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago, Tel: +1-868-663-1141; E-mail: sehlule.vuma@sta.uwi.edu

Rec date: Feb 18, 2015; **Acc date:** Mar 28, 2015; **Pub date:** Mar 30, 2015

Abstract

Background: People of East Indian descent account for 40% of the Trinidad and Tobago (TT) population. Most came from Uttar-Pradesh and West Bengal in India where thalassaemia is prevalent. The thalassaemia carrier frequency and exact mutations are unknown in TT. Diagnostic DNA analysis is not routinely available.

Objective: To estimate the carrier frequency of thalassaemia among prospective blood donors.

Method: Blood samples were obtained from 125 prospective blood donors of East-Indian origin. CBC was done to screen for microcytosis(MCV≤83 fL). Microcytic samples had ferritin, transferrin saturation, haemoglobin electrophoresis, haemoglobin A2/F quantification and DNA analysis performed performed for thalassaemia.

Results: 72.4% subjects were male and 26.4% female. Microcytosis was found in 14 (11.2%) (9 males, 5 females). Among microcytic subjects, 11(78.6%) (8 males, 3 females) thalassaemia mutations were detected. The range MCV range was wider in β-thalassaemia (63.7-80.7 fL) than α-thalassaemia carriers (78.5-80.1 fL). All subjects with the α-globin gene mutation had the α3.7 deletion which is the commonest α-gene mutation in India. The people with β-thalassaemia mutations had IVS I-5 G/C (common in India) and IVS II-666 T/C.

Conclusion: There were a high percentage of thalassaemia carriers in microcytic individuals, thus showing the importance of testing for this disorder. A larger study is needed to determine the spectrum of α- and β-thalassaemia mutations, to analyze for correlation between the degree of microcytosis and specific genotype and for useful predictors of α- and β-globin gene mutations.

Keywords: Alpha; Beta Thalassaemia; Microcytosis; Mutation

Introduction

Thalassaemia has a high prevalence in the Mediterranean basin, parts of Africa, throughout the Middle East, the Indian sub-continent, South-East Asia, Melanesia and the Pacific Islands [1] and parts of the world to which people from these areas have migrated eg. Trinidad and Tobago. Trinidad and Tobago has a population of ~1.3 million people of which 40% are of East Indian descent. The majority of the Indian ancestors came from Uttar Pradesh, West Bengal, Bihar and Orissa in India with few hailing from South India [2,3]. In India the carrier rate for beta thalassaemia ranges from 3 to 17% whereas for alpha thalassaemia it ranges from 1 to 80% [4]. In Trinidad and Tobago these data are not available. The objective of this study was to determine the proportion of alpha and beta thalassaemia carriers in the East Indian blood donor population.

Materials and Methods

The protocol and the study were approved by the University of The West Indies Ethics Committee. Written consent was obtained from each subject. Blood samples (one EDTA and one clotted sample) were collected from each of 125 subjects at the main teaching hospital. All subjects were screened for microcytosis (defined here as MCV≤83 fL) using an electronic blood cell counter (Sysmex Corporation, Japan). Microcytic specimens were further investigated as shown in Figure 1.

Results and Discussion

Of the 125 subjects, 72.4% were male and 26.4% female. 14 (11.2%) had microcytosis. Of these 14, 11 (78.6%) (8 males, 3 females) were carriers of thalassaemia (Figure 2). 9 (81.8%) were carriers of alpha-thalassaemia and 2 (18.2%) were carriers of beta-thalassaemia (Figure 3).

The overall carrier proportion of alpha and beta thalassaemia in the sampled prospective blood donors of East Indian descent was 7.2%. The range of the MCVs was wider in β-thalassaemia (63.7-80.7fL) than in α-thalassaemia carriers (78.5-80.1 fL). The range for the red cell count was 4.77-5.84 x 1012/L for alpha-thalassaemia carriers and 5.48-6.59 x 1012/L for beta-thalassaemia carriers. Alpha (α3.7) was the only alpha globin gene mutation found and it was present as a single gene deletion, -α/αα (Table 1).

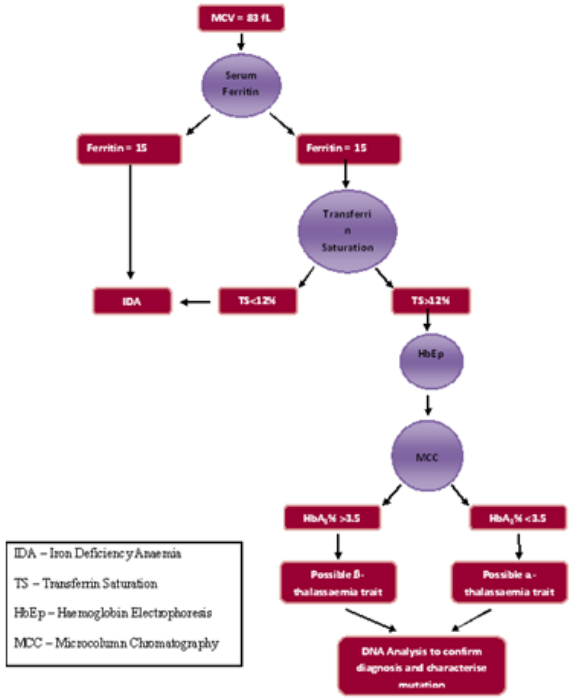

Figure 1: Methodology

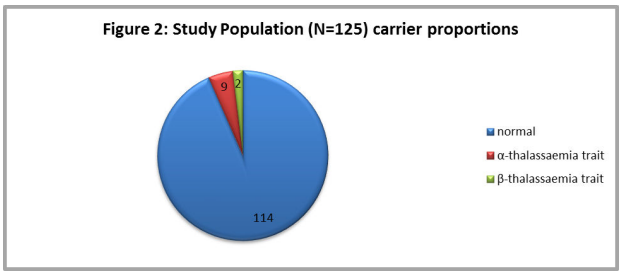

Figure 2: Study Population (N=125) carrier proportions

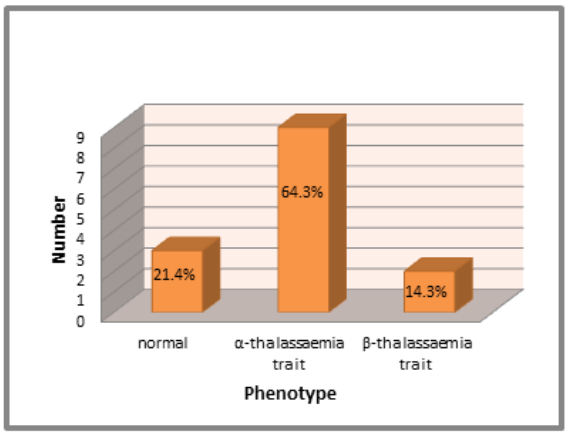

Figure 3: Carrier proportions in microcytic subjects (N = 14)

It is known to be prevalent among the Indians of Uttar Pradesh and West Bengal. IVS I-5 G/C is the most common beta thalassaemia mutation in these areas and can lead to severe β+ thalassaemia. However the IVS II-666 T/C is a neutral polymorphism previously found in Saudi Arabia and in a Japanese family [5,6]. Lin in a larger study, (where microcytosis was defined as MCV<82 FL), in China showed a high prevalence of thalassaemia carriers (both alpha and beta, with heterozygote frequency ranging from 2.63% to 9.49% in different parts of one province [7]. The gene mutations identified were - α3.7 /αα, - α4.2 /αα , - αWS /αα, -SEA/αα , - αCS/αα, - αQS/αα, and - α3.7/- α3.7 of the 3 microcytic samples that did not have thalassaemia mutations (Table 1) the haemoglobin ranged from 11.7-14.7 g/dL, the MCV: 78.7-82.8 fL, and the serum ferritin 20.2-117.4 ng/L.

The Limitations of This Study

In Trinidad and Tobago the majority of blood donors are replacement donors with few being voluntary donors. This causes the sample population to be biased. The sample size was small. A larger size is required to make further meaningful statistical analysis of the level of microcytosis and other red blood cell parameters and the specific gene mutations.

Subject	AGE years	Gender	Hb g/dL	RCC x1012/L	MCV fL	MCH pg	MCHC g/dL	RDW-SD	RDW-CV	Ferritin ng/L	TS %	HbA2%	Mutation
1	30	F	12.2	4.83	78.3	25.3	32.3	38.7	13.6	97.9	5.2	3.1	-α/αα
2	25	F	11.7	4.51	78.7	25.9	33.0	39.5	13.9	38.6	8.8	4.6	none
3	41	F	14.2	4.80	82.7	29.6	35.8	41.8	13.8	117.4	20.2	2.7	none
4	45	F	12.8	4.77	82.8	26.8	32.7	42.6	14.1	19.0	NA	2.2	-α/αα
5	22	F	12.8	4.87	78.0	26.3	33.7	41.0	14.4	73.6	NA	2	-α/αα
6	25	M	13.8	6.59	63.7	20.9	32.9	37.3	17.2	114.7	28.8	3.4	IVS I-5 G/C
7	29	M	15.4	5.48	80.7	28.1	34.8	39.2	13.3	17.9	NA	4.3	IVS II-666 T/C
8	37	M	13.4	5.22	80.1	25.7	32.1	40.8	13.9	59.5	29.8	4.0	-α/αα

9	25	M	14.5	5.58	78.9	26.0	33.0	38.7	13.8	-	NA	1.8	-α/αα
10	36	M	15.3	5.68	78.5	26.9	34.3	39.0	13.9	128.2	NA	1.3	-α/αα
11	29	M	15.1	5.84	79.3	25.9	32.6	41.1	14.3	90.6	11.1	2.5	-α/αα
12	36	M	14.8	5.52	82.4	26.8	32.5	46.0	15.2	42.2	NA	2.2	-α/αα
13	35	M	14.7	5.41	82.8	27.2	32.8	39.4	13.2	20.2	NA	2.3	none
14	29	M	14.2	5.41	78.6	26.2	33.4	39.0	14.0	34.7	NA	2.8	-α/αα
(NA- results not available)													

Table 1: Results of microcytic subjects (N = 14)

Conclusions

A significant number of microcytic people in this study were carriers of thalassaemia. This information is important to prevent unnecessary iron supplementation since iron deficiency is the commonest cause of microcytosis. A larger study is required in order to determine the population frequency in Trinidad and Tobago, the spectrum of alpha and beta globin gene mutations in Trinidad and Tobago, as well as to determine, in carriers the correlation between the degree of microcytosis and specific genotype. Ultimately this information is useful for the wider population, eg genetic counseling purposes. A future study will look at the thalassaemia mutations in transfusion dependent thalassaemia patients and results will be compared.

Acknowledgement

- This study was awarded a grant by the University of the West Indies (Trinidad)
- The authors are very grateful to Dr Althaiea Jones, Dr Waveney Charles, the nurses at the blood bank, and to the donors that participated in the study.
- HbA2 estimation kits were supplied by INSERM and DNA analysis was performed by the sickle cell center at the University Hospital as well as INSERM. (Guadeloupe)

References

1. Weatherall D J, Clegg J B (2001) Inherited haemoglobin disorders: An increasing global health problem. Bull World Health Organ 79: 704-712.
2. High Level Committee on the Indian Diaspora (2001) Report of the high level committee on the Indian diaspora. Ministry of External Affairs.
3. (2000) The Indians. Newsday's Mellennium Special.
4. Panigrahi I, Marwaha R K (2007) Mutational spectrum of thalassemias in India. Indian J Hum Genet 13: 36-37.
5. El-Harth EH, Kühnau W, Schmidtke J, Stuhrmann M, Nasserallah Z , et al. (1999) Identification and clinical presentation of β-thalassaemia mutations in the eastern region of Saudi Arabia . J Med Genet 36: 935-937.
6. Fujihara N, Tozuka M, Ueno I, Yamauchi K, Nakagoshi R, et al. (2003) Novel β-thalassaemia trait (IVS I-1 G→C) in a Japanese family. Am J Hematol 72: 64-66.
7. Lin M, Zhong TY, Chen YG, Wang JZ, Wu JR , et al. (2014) Molecular epidemiological characterization and health burden of thalassemia in Jiangxi Province, P. R. China. PLoS One 9: 101505.