AGF AND GFNOTYPF VARIATIONS IN DIAGNOSED MAFARIA CASFS: A CASF STUDY OF YUSUF DANTSOIIO MEMORIAL HOSPITAL, KADUNA

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Abstract

A hundred and seventy cases of falciparum parasitaemia were identified based on thick and thin blood films report. Their ages and genotypes were established retrospectively. 60% cases were aged 0 - 5 years; 20%, 6 - 1 4 years; 12%, 1 5 - 2 5 years; and 8%, 25 - 40 years. The different genotypes occurred in the following order: HbAA, 81% > HbAS,17% > HbSS, 2%. A significant relationship was shown to exist between the age and genotype of cases at " = 0.05 using x^1- lest. Children having normal haemoglobin,
HbA, (67.65%) were mostly affected compared with those having the sickle cell haemoglobin, HbS, (12.94%), while adults with normal haemoglobin (13.53%) showed low susceptibility than children with the same genotype.
Adult sickle cell traits showed the least susceptibility to malaria.

Introduction

Miliaria, one of the greatest health problems in many tropical and sub-tropical regions, is caused by lour species of *Plasmodium: P. falciparum, P. ovale, P. malariae and P. vivas.* The' pathogenesis and clinical manifestation of these parasites in man vary according to the parasite[1] involved. Common survival strategies adopted by plasmodia are those for attachment/adherence to host cell/tissue, invasion of host cell/tissue, access to host nutrient, avoidance to host defence system and transmissibility (Brubakar, 1985; Brooks, *et a!.*, 2001). Out of the various forms of malaria, falciparum or malignant tertian malaria caused by *P. falciparum* is far more serious with a much higher rate of severe and frequently fatal complications and is the most widespread accounting for up to 80% of malaria cases worldwide. It also accounts for as many as 95% of all deaths from malaria (Encyclopaedia Britannica, 1994). Around 3000 children die of malaria every day and the rate of death is high in rural areas where malaria also leads to death of pregnant women (Cheesbrough, 1987; Brooks, ***et*** *al*,. 2001; WHO, 2000). This situation may be due to lack of acquisition of active immunity against the infection as in infants and young children less than 5 years, suppression of acquired immunity in pregnancy, certain infection and serious illnesses, and when taking immunosuppressive drugs (Cheesbrough, 1987). Susceptibility or resistance of individuals to malaria also seems to depend upon the absence or presence of mutation, that is, base-pair substitutions of P or « globin gene and the position of such mutation (Brock, 1979; Huang, *el al.*, 2001; and Sanchalsuriya, *et al.*, 2001). The genetic variation is done predominantly against *P. falciparum* infection. Aside inheritance of Haemoglobin S gene and Thalassemia genes, other inheritable resistance genes expressed in red cells include Glucose-6-phosphate dehydrogenase (G6PD) deficiency genes and Ovalocytosis gene (Cheesbrough, 1987; Brooks, *el al.*, 2001; Badiga and Parola, 2002). The choice of falciparum parasitaemia for the present study was due to the epidemiologic factors mentioned above. The aim of this retrospective study therefore, was to demonstrate age and genotype variation among cases of malaria, and by means of x^2-test find out if there is a relationship between the two variables.

Materials and Methods

Records of 170 diagnosed cases of malaria were consulted from Yusuf Dantsoho Memorial Hospital, Kaduna, which were collected and compiled during a particular period of a wet season. The diagnosis of malaria was based on detection of ring forms of *P. falciparum* in peripheral blood using Giernsa and Leishman stained thick and thin blood films. Data on ages and genotypes of these cases were subsequently obtained retrospectively from the records. Genotypes were identified based on number of bands that appeared on electrophoretic cellulose acetate strips. Variation in age and genotype was then determined and y-test used to establish any existing relationship between the two variables. The two hypotheses set were:

a) H_0 = Age and Genotype are unrelated in the population of malaria cases, i.e., the two variables are independent.

b) H| - Age and Genotype are related in the population of malaria cases, i.e., the two variables are dependent.

I lien decision to accept or reject Null Hypothesis (Ho) was based on:

a) II calculated $x^{'s}$ lesser than the critical *x* value of 12.6 at df = 6 and ~ = 0.05 of a two tailed test, then 11_0 is accepted.
b) If calculated *x* is greater than the critical *x* value of 12.6 at df = 6 and ~ = 0.05 of a two tailed test, then $H_{(}$, is rejected and Hi is accepted.

Results

Hie ages and genotypes of I 70 diagnosed cases of malaria parasitaemia due to *P. falciparum* were determined retrospectively from consulted records kept in one governmental hospital. The age composition and different genotypes that occurred of the study group are shown in table 1 below.

Table 1: Frequency of Occurrence of Cases of Diagnosed Malaria According to Their Age and Genotype Compositions

Age Category in Years

Genotype	0-5	6-14	15-25	26-40	Total
HbAA	90(88.24/65.22*)	25(71.43/18.12)	16(80.00/1 1.59)	7(53.85/5.07)	138(81.18)
HbAS	10(9.80/34.48)	9(25.71/31.04)	4(20.00/13.79)	6(46.15/20.69)	29(17.06)
HbSS	2(1.96/66.67)	1(2.86/33.33)	.1	-	3(1.76)
Total	102(60*)	35(20.59)	20(1 1.65)	13(7.65)	170(100)

* Rates of occurrence are given in parentheses and expressed in percent. The computation is for each genotype within a specific age category and for each age category within a particular genotype.

§ Rate of occurrence computed for each age irrespective of type of genotype.

V Rate of occurrence computed for each type of genotype irrespective of age variation.

I Number of homozygotes of sickle cell is zero, that is, no single case was observed in respect of the specified age category.

From table 1, out of 170 cases of malaria parasitaemia, 102 (60%) were young children aged 0 - 5 years, 35 (20.59%) older children 6 - 1 4 years, 20(11.76%) adolescents/adults 1 5 - 2 5 years and 13(7.65%) older adults 25 - 40 years. Those affected by malaria infection were predominantly young children while older adults seemed to have enjoyed how prevalence. Also from the same table, out of 170, 138 (81.18%) cases had normal haemoglobin, HbA, 29(17.06%) heterozygous sickle cell haemoglobin, HbS and 3(1.76%) were sickle cell homozygotes, HbSS. Individuals with normal haemoglobin genotype, HbAA, had high rate of malaria parasitaemia occurrence and those with sickle cell haemoglobin, HbAS and HbSS, a low occurrence of the infection.

The observed and expected number of cases of malaria at different ages and various genotypes

Table 2: Observed and Expected Number of Parasitaemia Cases by Age and Genotype

Genotype	0-5	6-14	15-25	26-40	Total
HbAA	90(83)+	25(28)	16(16)	7(11)	138
HbAS	10(17/18*)	9(6)	4(4/3)	6(2)	29
HbSS	2(2)	1 (1 1)	-	-	3
Total	102/103*	35	20/19*	13	170

are shown in table 2 below .

Age Category in Years

The calculated value of y^2 - 14.4 and the critical value at df = 6 and « = 0.05 of a two tailed test is 12.6. Therefore, the Null Hypothesis is rejected and the alternative hypothesis is accepted. This

* Problem of rounding up
Expected frequencies in parentheses

means there is significant relationship between the observed and expected values of age and genotype of parasitaemia cases.

Discussion

The result of this retrospective study showed a reduction in the general number of those affected by, falciparum malaria with increase in age. Most of the malaria cases (60%) were young less than 6 years of age while the least occurrence of the infection (about 8%) was observed among the older generation aged 25 years and above. In adults generally, the resistance against *P. falciparum* infection may be due to an active immunity which according to Cheesbrough, 1987, is acquired from the age of 5 years following repeated exposure to the infection. On the contrary, only infants who for the first few months (3 - 5) of their lives are afforded protection against malaria by means of transferred IgG antibodies from immune mothers and their high concentration of foetal haemoglobin, HbF, in the red cells. The result also showed that susceptibility or resistance of an individual to falciparum malaria is influenced by the type of genotype possessed. Malaria cases with only normal haemoglobin i.e., HbAA (81%) were predominant as compared with those with only sickle haemoglobin i.e., HbSS (about 2%). It has been reported that the prevalence of malaria is lower in sickle cell children than in normals (Allison, 1954; Walters and Chwatt, 1956). The sickle cell haemoglobin advantage may offer only a partial immunity in HbSS patients because the infection triggers off haemolytic and infarctive crisis which incidentally is a common cause of their death (Fleming, *el al.,* 1979). For the adult sickle cell traits, this advantage becomes obscure. In this case, resistance of the individual may be due to combined action of sickling and acquired immunity.

Conclusion

Result of this retrospective study showed that falciparum parasitaemia occurred predominantly in young children (60%), followed by older children (20%), then by adolescents/adults (12%) and the least in older adults (8%). And susceptibility or resistance of an individual to infection seemed to be influenced by the genotype factor: HbAA - 81%, HbAS - 17% and HbSS-2% rate of occurrence respectively. It was obvious that children having normal haemoglobin had the, highest rate of falciparum parasitaemia occurrence about 67.65% while adult sickle cell traits about 4%.

Recommendations

The result has showed that age and genotype of an individual influence the susceptibility or resistance of such a person to malaria infection. Based on this fact the following recommendations are proffered by the author:

- Correct and prompt diagnosis of falciparum malaria particularly in young children, sicklers and pregnant women as such practice may be lifesaving.
- Availability of knowledge of this kind to intended couples and spouses. During genetic counselling, awareness should be created that generation of progenies with inherited selective resistance genes may not only be a potential measure against malaria but possibly for disorders of haematologic system originally brought about by nature in an attempt to avoid malaria infection.

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