

Relationship Between ABO and Rhesus Blood Groups and Susceptibility to Asthma Within Sokoto Metropolis, Nigeria

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Abstract: Asthma is the result of chronic inflammation of the airways which subsequently results in increased contractability of the surrounding smooth muscles. This among other factors leads to bouts of narrowing of the airway and the classic symptoms of wheezing. As at 2011, World Health Organisation (WHO) reported that approximately 235 million people worldwide were affected by asthma. This study aims to evaluate and determine the susceptibility of ABO and Rh blood groups to asthma. A total of 200 clinically confirmed asthmatic patients and 100 apparently healthy individuals within Sokoto metropolis were prospectively enrolled and their blood group status were determined using red blood cell agglutination method. In this research work, the result obtained shows that 74 asthmatic patients constituting 37.0% out of the total 200 patients who participated in the study are blood group A, 56 (28.0%) are blood group B, 26 (13.0%) are blood group AB and 44 (22.0%) are blood group O. For Rh blood group, out of the 200 study subjects, 181 (90.5%) are Rh positive and 19 (9.5%) are Rh negative. Among 100 control participants 26 (26.0%) have A blood group, 24 (24.0%) have B blood group, 2 (2.0%) have AB blood group, and 48 (48.0%) have O blood group. No statistical difference was observed between Rh system in study subjects and controls, but blood group A was significantly higher in asthma patients compared to controls ($P < 0.05$).

Keywords: Asthma, ABO Blood Group, Rhesus Blood Group, Nigeria

1. Introduction

Asthma is known to be a common chronic inflammatory disease of the airways and the cause is incompletely understood [3]. This continuous inflammatory response may result to a permanent airway obstruction. Several hypothesis have been put forward on the cause of asthma and many point to the interaction between many genetic and environmental factors which influence the tone or reactivity of the airways [14, 15]. The condition is characterised by recurring wheeze, shortness of breath, chest tightness and cough which varies with time and intensity, and often severe at night [3, 4, 23]

The ABO histo-blood group system is one of the genetic risk factors linked to the susceptibility to asthma in some

populations. Independent studies have analysed the importance of this system in both children and adults in respect to asthma. One such study found statistically significant differences in the frequencies of the ABO and related secretor phenotypes in Australian adults [16] and another reported a greater incidence of A and B red blood cell phenotypes in patients with different atypical conditions compared to controls [8]. Associations between the ABO and Secretor systems and asthma have also been observed in Italian [17] and Taiwanese children [7] but not in Indian adults [9]. In a study in Georgians, markers for bronchial asthma and pollinosis showed that the risk for the development of severe bronchial asthma was higher in

patients with blood type B whereas in blood type O, a mild to moderate degree of severity of was more characteristic [13].

The composition of the glycoconjugate profile of the respiratory epithelium and of the exocrine secretions is controlled, at least in part, by epistatic interactions between the ABO (ABO; 9q34.1) and Secretor (FUT2; 19q13.3) genes and influenced by their polymorphisms [18]. As these profiles represent important risk factors for the adherence of microorganisms and allergens, it is possible that the action of the set of ABO and FUT2 genes influence the susceptibility to other respiratory diseases apart from asthma [19].

Studies evaluating the relationship between ABO blood group status and atopic diseases have appeared in the literature since the late sixties. Apparent discordant results have been reported. In 1964, the observation that ABO agglutinins are present in a wide variety of pollens from grasses, flowers and trees, raised the possibility that these agglutinins might interact with cells containing blood group antigens in the respiratory epithelium, an effect that would be neutralized in secretor patients [5].

According to World Health Organisation (WHO), approximately 235 million people worldwide were affected by asthma in 2011 [20] and approximately 250,000 people die per year from the disease. Low and middle income countries make up more than 80% of the mortality [20]; rates vary between countries with prevalence between 1 and 18%. It is more common in developed than developing countries. One thus sees lower rates in Asia, Eastern Europe and Africa. Within developed countries, it is more common among those who are economically disadvantaged while in developing countries, it is more common amongst the affluent. The reason for these differences is not well known [20].

The prevalence of childhood asthma in the United States has increased since 1980, especially in younger children. Rates of asthma have increased significantly between the 1960s and 2008 [21] and have been recognised as a major public health problem since the 1970s. In 2005, asthma affected more than 22 million people, including 6 million children, and accounted for nearly 500,000 hospitalizations that same year [22].

The studies assessing the relationship between ABO and Rhesus blood groups and asthma is very scarce in Nigeria. Therefore, this research was designed to explore the relationship of blood group type and susceptibility to asthma in Sokoto Metropolis, Nigeria.

2. Materials and Methods

2.1. Study Design

This study involves 200 asthmatic patients and 100 adults (control group) who attend the Pulmonary Unit of Usmanu Danfodiyo University Teaching Hospital, Specialist Hospital and Maryam Abacha Women and Children Hospital, all in Sokoto metropolis, Nigeria. Patients with renal or liver diseases, patients with diabetes mellitus or pregnant females, and asthmatic individuals living outside Sokoto Metropolis

were excluded from this study.

2.2. Ethical Consideration

This research was approved by the Research Ethics Committee of the Faculty of Medical Laboratory Science of Usmanu Danfodiyo University, Sokoto, Nigeria. In addition, ethical clearance for the study was sought and obtained from the Research Ethics Committee of Specialist Hospital Sokoto, Maryam Abacha Women and Children Hospital and Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. Patients' and controls' informed consents were also obtained before the commencement of the study. All information generated in this study were kept confidential except only for the purpose of this publication.

2.3. Sampling and Laboratory Analysis

The blood samples (3 mL) were taken directly from the vein (ante-cubital vein) with the help of a medical supervisor. The samples were collected in K₂EDTA vials and brought to the Haematology and Blood Transfusion Laboratory of the Faculty of Medical Laboratory Science of Usmanu Danfodiyo University, for analysis. ABO and Rh blood grouping were performed simultaneously. Red blood cell agglutination method was used for analysis of blood group. A drop of each antisera-A, antisera-B and antisera-D were placed on to clean, labeled glass slides and a drop of blood was added to each and mixed immediately. Agglutination with antisera-A showed A blood group, with antisera-B showed B blood group and with both A and B showed AB and with neither of these showed O blood group. Agglutination of blood with D showed positive test for D antigen.

2.4. Statistical Analysis

The data derived from this study was analysed using SPSS software version 18.0. The ABO and Rh phenotype of the asthmatic patients and controls were compared using Chi Square test of independence. $P \leq 0.05$ was accepted as statistically significant.

3. Results

This study recruited two hundred patients with asthma and one hundred apparently healthy individuals attending the participating hospitals to ascertain the association between ABO Rh Blood groups and susceptibility to asthma.

Of the 200 asthmatic patients recruited, 74 (37.0%) are blood group A, 56 (28.0%) are blood group B, 26 (13.0%) are blood group AB and 44 (22.0%) are blood group O. In the controls, 26 (26.0%) have A blood group, 24 (24.0%) have B blood group, 2 (2.0%) have AB blood group, and 48 (48.0%) have O blood group (Table 1).

Out of the 200 asthma patients, 181 (90.5%) are Rh positive and 19 (9.5%) are Rh negative. Among the 100 controls, 94 (94.0%) are Rh positive and 6 (6.0%) are Rh negative (Table 2).

In comparing the number of subjects having ABO and Rh blood groups, the 74 patients with A blood group, 72 were Rh positive and 2 were Rh negative, for the 56 that had blood group B, 47 were Rh positive and 9 were Rh negative, for the 26 with AB blood group, 23 were Rh positive and 3 were Rh negative, and for the 44 patients that have O blood group, 39 were Rh positive and 5 were Rh negative (Table 3).

Table 1. The frequency distribution of ABO blood group among the asthmatic patients and controls.

ABO Blood group	Asthma patients	Controls
	Frequency (%)	Frequency (%)
A	74 (37)*	26 (26)
B	56 (28)	24 (24)
AB	26 (13)	2 (2)
O	44 (22)	48 (48)
Total	200 (100)	100 (100)

*P<0.05

Table 2. The frequency distribution of Rh blood group among the asthmatic patients and controls.

Rh Blood group	Asthma patients	Controls
	Frequency (%)	Frequency (%)
Positive	181 (90.5)	94 (94)
Negative	19 (9.5)	6 (6)
Total	200 (100)	100 (100)

Table 3. The comparison of frequencies between ABO blood group and Rh blood group.

ABO Blood group	Rh Blood group		Total
	Positive	Negative	
A	72	2	74
B	47	9	56
AB	23	3	26
O	39	5	44
Total	181	19	200

4. Discussion

Asthma is a chronic disease characterised by recurrent attacks of breathlessness and wheezing. As of 2011, approximately 235 million people worldwide were affected [20] and 250, 000 people die per year from the disease. Some of the studies conducted in Europe, Asia and United States shows that there is the relationship between ABO and rhesus blood group and susceptibility to asthma with varying rates of relationship, but limited or no publication is available in Nigeria.

In this research work, the result obtained shows that 74 asthmatic patients constituting 37.0% out of the total 200 patients who participated in the study are blood group A, 56 (28.0%) are blood group B, 26 (13.0%) are blood group AB and 44 (22.0%) are blood group O. For Rh blood group, out

of the 200 study subjects, 181 (90.5%) are Rh positive and 19 (9.5%) are Rh negative.

This result demonstrates that blood group A is more common and shows statistical significance among asthmatic patients ($P<0.05$). This is in agreement with the work by De la Vega and colleagues [6], who reported a high presence of blood group A among asthmatic patients but no difference was noted between Rh systems in both groups (study subjects and controls). Also the difference in the distribution of blood group A and O between control and asthmatic group in that study was found to be highly significant. The report of this study is also similar to the work of Brachtel et al [8], who studied 239 German patients with atopic conditions (atopic dermatitis, hay fever, allergic rhinitis, bronchial asthma, and acute urticaria) and reported that the incidence of blood group antigens A and B was potentially higher in patients than in controls. Similarly, Kauffmann and colleagues studied 228 coal miners with asthma and observed that lower lung function in blood group A, and in a lesser extent in blood group B [5]. However, Mozalevskii et al. [12], Nikitin et al. [11] and Khetsuriani et al. [13] reported that asthma from chronic lung inflammation is also more common in type B. In the same vein, the result of the current study differs from the findings by Bijanzaadeh et al [9] who observe that O blood group is more common among asthmatic patients followed by B, A, and AB blood groups. Perhaps in their study, non-significant difference between patients and controls was observed. According to Koers et al [10], blood type B tends to get pollen allergies more often than the other blood types. However, in their study no statistically significant difference between patients and controls was observed. In another study, blood group O/secretors (Se/Se) and O/Le(a-b-) were associated with childhood asthma, and may act as one of the predominant factors for environmental triggers of allergy for asthmatic children in Taiwan [7]. These differences may be as a result of different geographic location and the number of subjects studied.

Similarly, Manisha and Yadav in their study of the distribution of ABO and Rh (D) allele frequency among asthmatic patients, found that blood group O is more frequent in asthmatic patients compared to controls [2]. The O blood group was highest in asthmatic patients followed B and A. In both asthmatic patients as well as healthy subjects, they found that Rh D⁺ was more abundant than Rh D⁻. In the same vein, Yesar et al. [1] reported a significant increase in the percentage of blood group O in comparison with other blood groups with no significant differences among the other groups (i.e. A, B and AB). In a related study by El-sobky et al. [24], blood group O was also found to be more prevalent while group AB was the least prevalent among examined individuals.

Among the controls used in this study, 26 (26.0%) have 'A' blood group, 24 (24.0%) have 'B' blood group, 2 (2.0%) have 'AB' blood group, and 48 (48.0%) have 'O' blood group. The high frequency of blood group 'O' among the controls is similar to other reports from Nigeria and therefore, the controls represent the correct ABO distribution. For instance, Egesie et

al. [25] reported ABO percentage as O (49%), A (22%), B (22%) and B (7%) in a study done in the Niger Delta. In Oyo State, 50% of the population surveyed were blood group 'O', 22.9% blood group 'A', 21.3% group 'B' and 5.9% were of the 'AB' blood group [26]. In Lagos, Adeyemo *et al.* [27] reported that 'O' blood groups had the highest percentage frequency (55.35), followed by blood group 'A' (25.3%), group 'B' (16.7%) and group 'AB' (2.7%). Similarly, Omotade *et al.* [28] observed a percentage occurrence of 54.2% in blood group 'O', 21.6% in blood group 'A', 21.4% in blood group 'B' and 2.8% in blood group 'AB'. They also observed that Rh (D) gene occurred in 95.2% while 4.8% were Rh-negative in the individuals surveyed. Furthermore, Kulkarni *et al.* [29] analysed data ABO and Rhesus blood group from 43187 blood donors belonging to 34 ethnic groups, predominantly from northern Nigeria. Group 'O' was found in 46.6% of all those examined. Group 'A' was found in 23.05% and Group 'B' in 25.95. There was an overall frequency of 3.64% of Rhesus negatives.

5. Conclusion

The present study indicated that there is a possible association between blood group A and asthma susceptibility. The study revealed the importance of ABO and Rh blood typing in the demonstration of atopic diseases like asthma.

Recommendations

Since asthma is a common chronic inflammatory condition of the lung airways, affecting many people all over the world mostly children; boys and girls. This research was carried out with the aim to offer solution to this problem.

From the result of the current study, it is deem appropriate to recommend as follows;

- That more research needs to be conducted on this area with the aim of eradicating or limiting the prevalence of this disease condition.
- That more effort from government is needed to further enlighten people about predisposing factors and behaviors that can aggravate the condition in affected individuals
- A large scale and molecular based research need to be conducted to establish (if any) the genetic relationship of asthma, so that it can be incorporated in marital counseling to counsel the prospective couple who are likely to give birth to child with asthma.

Author Contributions

Moses Nnaemeka Alo, Saidu Abdulhi Yaro and Bello Jubril conceived the research and carried out the Laboratory experiments. Bello Jubril, Ukpai Agwu Eze and Nelson Nnanna Nwanoke did the journal search and prepared the manuscript. Moses Nnaemeka Alo and Saidu Abdulhi Yaro reviewed and edited the manuscript. All authors discussed the final copy of the manuscript and approved it.

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