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Detection of Blood Group "Bombay (Oh) Phenotype" Among the Saudi Population of Taif Province, Saudi Arabia

Tariq E Elmissbah*

Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, Taif University, KSA

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Abstract

Background: *The blood type Bombay is uncommon. It was initially found in Bombay, India's Mumbai. Due to the lack of H antigen, this blood group resembles O blood group at the time of blood grouping; nevertheless, upon cross-matching, it exhibits incompatibility with O group blood. To confirm the diagnosis, serum grouping or reverse grouping is necessary. Only individuals in this blood group are eligible to donate blood to patients who carry it. Here, we report a case of subarachnoid hemorrhage in a patient with the Bombay phenotype.*
Objective*: The purpose of this study is to determine the prevalence of the Bombay phenotype among O blood group donors in Taif city-Saudi Arabia.*
Materials & Methods*: A prospective cross-sectional study was carried out at Taif. Convenience sampling was used in this study, and samples were drawn from each participant only after verbal informed consent was granted. The study had 2000 participants. Patients and donors with blood type O provided three milliliters of venous blood in an EDTA tube*
Results: *No occurrences of the Bombay phenotype were detected during the study.*
Conclusion: *No Bombay blood type was recorded in this study. A meticulous process like blood grouping must be executed with the highest level of seriousness, including both forward and reverse grouping, to avert the risk of a patient obtaining erroneous blood, which could lead to severe hemolysis from transfusion.*

Keywords*: Bombay phenotype, blood group, H antigen, Saudi population*

Introduction

The most well-known and clinically relevant blood group classification system is the ABO groups. The discovery of the Bombay blood type occurred in 1952 when serum anti-A, anti-B, and anti-H antibodies were found to be able to agglutinate all the blood groups in the ABO system **[1]**. This blood type is regarded as extremely rare within the ABO system, with prevalence estimates of 1 in 1,000,000 in European regions and up to 1 in 10,000 in Indian regions, with heightened prevalence in the Southern and Western regions of India. Blood group antigens play a crucial role in the medical field, particularly in relation to blood transfusion.

A point mutation in the H gene causes fructosyltransferase, a functional protein required for H antigen synthesis, to be produced incorrectly, which gives rise to the Bombay phenotype **[1,3]**. On the other hand, because of the protein shortage, persons with the Bombay blood group are intrinsically unable to manufacture the H antigen.

*Correspondant Author's ORCID ID: 0000-0000-0000-0000
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Therefore, blood transfusions using A, B, or O A point mutation in the H gene causes fructosyltransferase, a functional protein required for H antigen synthesis, to be produced incorrectly, which gives rise to the Bombay phenotype **[2]**. In contrast, however, in Due to a protein shortage, people with the Bombay blood type are intrinsically unable to manufacture the H antigen. Therefore, giving patients with the A, B, or O blood types through transfusion. **[4]**

Materials & Methods

A prospective cross-sectional study was carried out at Taif city. Convenience sampling was used in this study, and samples were drawn from each participant only after verbal informed consent was granted. The study had 2000 participants. Patients and donors with blood type O provided three milliliters of venous blood in an EDTA tube. Before being processed further, the collected samples were refrigerated between 2 and 8 degrees Celsius. Using tube techniques for forward and reverse blood grouping, the blood specimens were filtered and analyzed. Red blood cell antigen was detected using anti-A and anti-B sera. The appropriate antisera agglutinates

individual red blood cells, indicating the presence of antigen on the red blood cells. The Bombay blood group was confirmed by testing the sample with commercial anti-H lectin (Tulip Diagnostics, India). The tube method was employed for this serological assay, wherein one drop of anti-H lectin was combined with one drop of 5% red cell suspension, mixed thoroughly, centrifuged, and thereafter examined for agglutination. The patient exhibited no reaction and was proven to possess the Bombay blood group. The indirect antiglobulin technique (IAT) cross-match with O blood group was conducted and found to be 4+ incompatible. His rhesus phenotype was Cde / CDe (R1R1). The extended family study could not be conducted due to the unavailability of samples from the patient's relatives.

Results

A total of 2000 blood group O donors and patients—both male and female—were examined to determine whether anti-H antibodies (Bombay phenotype) were present. A 0% prevalence of the Bombay phenotype was noted. Blood samples, both male and female, were grouped according to O blood group donors and patients. Of the 2000 blood samples that were examined, 829 (78.9%) belonged to the O blood group, and 221 (21.04%) were patients, comprising 133 (12.6%) males and 88 (8.30%) females.

	Total	Male	Female	Rh +ve	Rh -ve	Bombay Phenotype
Blood Donors	750	691	59	686	64	0
Patients	1250	1150	100	1056	194	0
Total	2000	1841	159	1742	258	0

Discussion

Serology of blood groups is crucial in transfusion medicine. In 1952, Bhende et al. identified the rare Bombay (OH) blood group phenotype in Mumbai, which significantly contributed to immunohematology research. **[5]** It was later shown that the structural genes (Se) and (H) are closely related secretors, which helped Watkins and Morgan1 (1959) and Gerard et al2 (1982) to elucidate the biosynthetic pathway for Lewis (Le) antigens and ABH. Recent molecular genetic research has elucidated the function of the H, Se, and Le genes in the development of the Lewis blood group antigen on erythrocytes and the H antigen in secretions. **[6]**

The genes involved in the synthesis of Lewis blood group antigens on erythrocytes and H antigens in secretions. Red blood cells from the Bombay phenotype can be transfused to any individual within the ABO blood group system, provided there is no incompatibility with other blood factor genes, such as Rhesus. Red blood cells can solely be sourced from autologous blood or another resident of Bombay, however fresh frozen plasma and cryoprecipitate can be acquired from any institution. **[7]**

We investigated the Bombay phenotype in 2000 O blood donors and patients, discovering that its prevalence among O blood donors was 0%. Prior studies have demonstrated that the Bombay phenotype is uncommon, with just a limited number identified among hundreds of thousands or millions. Several investigations yielded null results for the Bombay phenotype, whereas our findings were entirely negative. Nonetheless, prior studies in the United States and India have recorded multiple instances **[8]**. Recent molecular genetic research has uncovered the H antigen in erythrocytes and secretions. This uncommon blood type necessitates cross matching for identification. Serum grouping or reverse grouping should be done to confirm the diagnosis. First-degree relatives of the patient with the Bombay blood group should be screened for this blood type, and the patient should own an identification card indicating their blood group for emergencies. Moreover, the maintenance of the rare blood group registry and cryopreservation methods is essential for the efficient and prompt organization of blood. **[9]**

People with the Bombay blood group are advised to have all of their family members and relatives tested for the blood group because it is highly probable that at least one of them has it.

An individual possessing the Bombay phenotype should consistently remain vigilant and cautious. They ought to register with reputable blood banks to ensure contact in the event of an emergency. As a result, every blood bank must maintain an updated uncommon donor registry. **[10]**

Data Availability.

The manuscript includes all the data needed to support the study's conclusions.

Ethics approval and consent to participate.

Ethics approval and participation consent after being approved by the Ethic committee of the college of the College of the Applied Medical Sciences (02/22).

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Consent for publication

Not relevant. There is no personal information about any individual in the work.

Conflict of Interest

The authors assert that no conflicts of interest exist that might compromise the impartiality of the reported research.

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