Inspiring Excellence

Bio101: Introduction to Biology

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Section:09

Lab Report

Experiment Name: Blood Grouping

TITLE: BLOOD GROUPING

Abstract:

Karl Landsteiner, an Austrian immunologist, and pathologist, discovered the blood grouping system in 1900. He identified the presence of different antigens on the surface of red blood cells, which led to the classification of blood into different groups: A, B, AB, and O.[1] This discovery was a significant milestone in medicine and transfusion science, as it laid the foundation for safe blood transfusions and helped reduce the risk of fatal reactions during blood transfusions. After discovering the ABO blood group system, further research and discoveries were made, including the Rh (Rhesus) blood group system, identified in 1937 by Karl Landsteiner and Alexander S. Wiener. However, to approach blood group-related disorders, which are still in the research stage, an understanding of the blood group system is required.

Introduction:

Very early in the study of blood transfusion, it was found that the blood of one species of animal agglutinated or clumped the cells of the blood from an animal of a different species.[2] Blood is made up of red blood cells, white blood cells, and platelets in a liquid called plasma. The term “blood group” refers to the entire blood group system comprising red blood cell (RBC) antigens whose specificity is controlled by a series of genes that can be allelic or linked very closely on the same chromosome. “Blood type” refers to a specific pattern of reaction to testing antisera within a given system. So, the blood group is identified by antibodies and antigens in the blood. Plasma contains proteins called antibodies. They are a component of the body's built-in defenses. They recognize foreign substance such as germs and alert their immune system which destroy them. Protein molecules called antigens can be detected on the outer layer of red blood cells. The ABO and Rh blood grouping system is based on an agglutination reaction.

The ABO System:

The ABO group system consists of four antigens (A, B, O, and AB). The 4 major blood types are:

- **blood group A** – Has A antigens on the red blood cells with anti-B antibodies in the plasma.
- **blood group B** – Has B antigens with anti-A antibodies in the plasma.
- **blood group O** – Has no antigens, but both anti-A and anti-B antibodies in the plasma.
- **blood group AB** – Has both A and B antigens, but no antibodies.

The ABO group antigens are one of the most important issues in transfusion medicine to evaluate the adaptability of donor cells with bone marrow transplantations and the lifespan of the hemocytes.[3]

RhD System:

The Rh blood group system is the most polymorphic of the human blood groups, consisting of at least 45 independent antigens and, next to ABO, is the most clinically significant in transfusion medicine.[4] Red blood cells sometimes have another antigen, a protein known as the RhD antigen. If

this is present, your blood group is RhD-positive. If it's absent, your blood group is RhD-negative.

- **A positive (A+):** The individual has A antigens on their red blood cells and Rh factor present.
- **A negative (A-):** The individual has A antigens on their red blood cells, but the Rh factor is absent.
- **B positive (B+):** The individual has B antigens on their red blood cells and Rh factor present.
- **B negative (B-):** The individual has B antigens on their red blood cells, but the Rh factor is absent.
- **AB positive (AB+):** The individual has both A and B antigens on their red blood cells and Rh factor present. AB+ is considered the universal recipient of Rh-positive blood.
- **AB negative (AB-):** The individual has both A and B antigens on their red blood cells, but the Rh factor is absent.

- **O positive (O+):** The individual has no A or B antigens on their red blood cells, but Rh factor is present. O+ is considered the universal donor of Rh-positive blood.
- **O negative (O-):** The individual has no A or B antigens on their red blood cells, and the Rh factor is absent. O- is considered the universal donor for all blood types, as it can be given to individuals with any Rh status.

The goal of the experiment :

To identify the blood group the examiner belongs to as well as the presence of RhD, A, B, and anti-A/B antibodies.

Materials and Methods:

Materials:

- Toothpicks
- Blood sample
- Alcohol Swabs
- Lancet
- Clean glass slide

- Sterile cotton balls
- Biohazard disposal container
- **Blood Grouping Reagent:**
    I. Anti-A (Blue color)
    II. Anti-B (Yellow color)
    III. Anti-D (Clear)

Methods:

1. First, we need to take a clean glass side and then need to mark the slide into three parts.
2. Keeping the slide aside safely without disturbing it.
3. Then we need some human blood drops so we should clean the fingertip to be pierced with spirit or 70% alcohol (usually ring or middle finger) and gently massage the finger to increase blood flow.
4. Pricking the fingertip and as blood starts oozing out, allow it to fall on the three circles of the glass slide by gently pressing the fingertip.

5. Now with the help of a dropper, need to add the Anti-A, Anti-B, and Anti-D in the first, second, and third circles respectively in sequential order.
6. Lastly, we need to mix the blood sample gently with the help of a toothpick and wait for 1 or 2 minutes to observe the agglutination in the form of fine red granules.

Observation and Result:

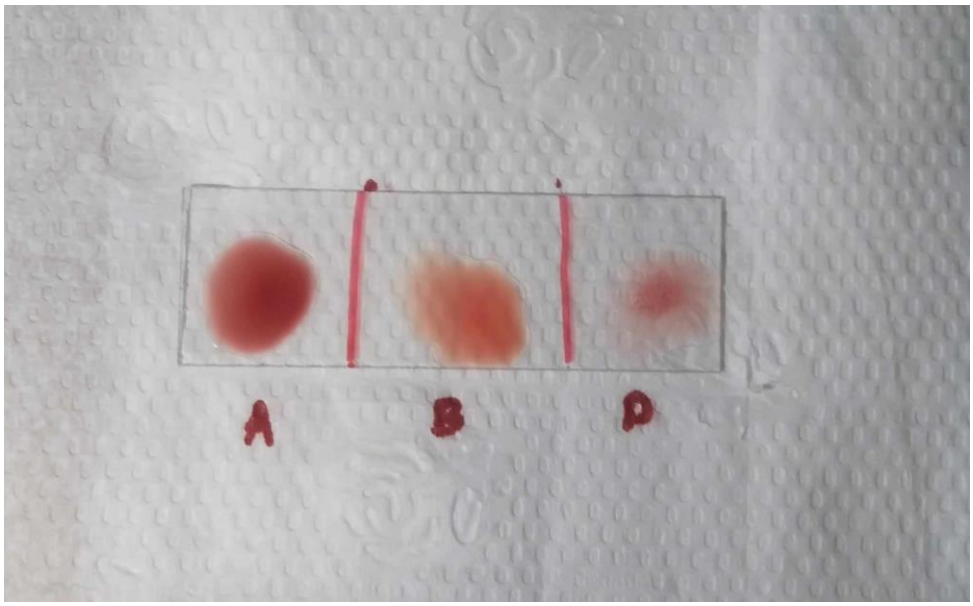

Figure: Blood Grouping Experiment and Agglutination

Sample No:	Antibodies	Agglutination	Result Interpretation	Final Result
1. O+	Anti-A	No	Has no antigen but has an antibody	Has no A and B antigens but it has anti-A and anti-B antibodies also it has RhD antigen
	Anti-B	No	Has no antigen but has an antibody	
	Anti-D	Yes	Has no A, B antigen but has A, and B antibodies	

Summary:

In this figure we can see, the result of the experiment is O+. First of all, dropping some blood on the slide and mixing it with reagents, it is shown that Part– A and B are not agglutinated but Part D is agglutinated. So, firstly, the reagent anti-A is mixed with the blood of Part-A which is not agglutinated that means the sample blood has no A antigens to react but it has anti-A antibody so that's why the blood and reagent mixed but not agglutinated. Secondly, as reagent Anti-B is mixed with the blood of Part B which is also not agglutinated that means the sample blood has no B antigens to react but it has anti-B

antibody so that's why the blood and reagent mixed but not agglutinated. Lastly, as reagent Anti-D is mixed with the blood of Part D, it is agglutinated and clumped so it means the blood has RhD antigen, which reacts with the anti-D reagent. This whole figure shows the blood sample has no A and B antigens but it has anti-A and anti-B antibodies, along with it is RhD positive. From the category shown in the introduction, we can say that the group of the blood sample is O+.

Discussion:

The Blood Sample is O+ and it has no A and B antigens but it has anti-A and anti-B antibodies also it has RhD antigens. Besides, the clumping at Part D is not properly shown in the picture because while experimenting, the sample blood dropped too much. It has created a small but ignorable error in the experiment. Because of too many, blood drops it takes more time than 1 or 2 minutes. The most important thing was that we mixed the three components carefully and used various toothpicks in order to reduce the possibility of errors.

Reference:

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3. E. Hosai 2008. Biological and clinical aspects of ABO blood group system.55(3,4). https://doi.org/10.2152/jmi.55.174
4. D. Avent N, E. Reid M. 2000. The Rh blood group system: a review.95(2).https://ashpublications.org/blood/article/95/2/375/138582/The-Rh-blood-group-system-a-review.