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Blood Group Determination Based on Immunoglobulin and Saliva Content

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Abstract - Serum and salivary immunoglobulin concentrations play a major role in blood group determination. This paper describes a method to classify the different blood groups using the concentrations of serum and salivary present in human body. The immunoglobulin content of the intestinal secretions, such as saliva, differs from that of serum in containing an unusually high concentration of IgA. We have, therefore, sought to confirm that salivary immunoglobulin concentrations differ according to a person's ABO blood group. This paper provides the way to classify the different types of blood groups with the help of a software known as MATLAB considering the concentrations.

Keywords - Alloantibodies, Immunodiffusion, Immunogen, Mucosa

I. INTRODUCTION

Blood groups are antigenic determinants on the surface of red cells, platelets and granulocytes, but the use of the term is often restricted to antigens on red blood cells. Blood groups are defined by antibodies, usually alloantibodies produced by individuals who lack the corresponding antigen. Some blood group antibodies, such as anti-A and anti-B, are present in the plasma of everybody whose red cells lack the corresponding antigen, but most blood group antibodies are formed only in response to antigen positive red cells as the result of transfusion or pregnancy. Almost all blood groups are inherited characters, although some blood group phenotypes may be modified by environment, development or disease. Some blood group antigens are detected on only one type of blood cell, such as the Rh antigens on red cells; others may also be present on other blood cells and in other tissues. Those with wide distribution throughout the body, such as the ABO antigens, are referred to as histo-blood group antigens. Immunoglobulin also plays a major role in blood group determination. Immunoglobulins are glycoprotein molecules that are produced by plasma cells in response to an immunogen and which function as antibodies. The immunoglobulins derive their name from the finding that they migrate with globular proteins when antibody-containing serum is placed in an electrical field IgA is the predominant immunoglobulin in various secretions (saliva; tears; colostrum; bronchial, genitourinary, and intestinal secretions). IgM is the first antibody that an immunologically committed B lymphocyte can produce. IgG is the major immunoglobulin in human serum.[2]

II.BIOLOGICAL CONCEPT

In 1900, Landsteiner showed that people could be divided into three groups(now called A, B, and O) on the basis of whether their red cells clumped when mixed with separated sera from people. A fourth group (AB) was soon found. This is the origin of the term 'blood group'.

A blood group could be defined as, 'An inherited character of the red cell surface, detected by a specific alloantibody'.

The primary function of blood is to supply oxygen and nutrients as well as constitutional elements to tissues and to remove waste products. The hormones and other substances to be transported between tissues and organs are enabled by the blood. Problems with blood composition or circulation can lead to downstream tissue malfunction. The main function of blood is maintaining homeostasis by acting as a medium for transferring heat to the skin and by acting as a buffer system for bodily pH. The blood is circulated through the lungs and body by the pumping action of the heart. The blood is pressurized by the right ventricle to send it through the capillaries of the lungs, while the left ventricle repressurizes the blood to send it throughout the body. Pressure is essentially lost in the capillaries, hence gravity and especially the actions of skeletal muscles are needed to return the blood to the heart.

The ABO blood group system is the most important blood type system (or blood group system) in human blood transfusion. Blood groups are antigens and, by definition, a molecule cannot be an antigen unless it is recognised by an antibody (or T-cell receptor). So all blood group specificities are defined by antibodies. Most adults have antibodies to the A or B antigens, or to both;

that is, they have ‘naturally occurring’ antibodies to those ABO antigens they lack. For most other blood groups corresponding antibodies are not ‘naturally occurring’, but are only formed as a result of immunisation by transfused red cells or by fetal red cells leaking into the maternal circulation during pregnancy or childbirth. Blood group antibodies are usually IgM or IgG, although some may be IgA. ‘Naturally occurring’ antibodies are usually predominantly IgM, whereas ‘immune’ antibodies are predominantly IgG. As a general rule, IgM antibodies will directly agglutinate antigen-positive red cells in a saline medium, whereas most IgG antibodies require anti-human globulin to effect agglutination.

The ABO blood groups are defined by the presence of two alternative antigens on red blood

cells, determined by three alternative alleles at a single genetic locus. The two basic rules that governs this system are as follows:

1) The "type" of blood is defined by the presence of two red blood cell antigens, "A" and "B." RBCs of type A have the A antigen on their surface and B antibodies in their blood plasma , whereas type B have B antigen on the surface and A antibodies in their blood plasma

B, type AB red cells bear both antigens, while type O cells bear neither antigen.

2) Another type of antibodies i.e "Natural" antibodies called isoagglutinins exist in an person's serum, directed against whichever of the A and B antigens is not present on that person's red cells.[2]

Immunoglobulins (Ig) are glycoprotein molecules that are produced by plasma cells in response to an immunogen and which function as antibodies. The name immunoglobulin is derived from the finding that they migrate with globular proteins when antibody-containing serum is placed in an electrical field .[5]. An antibody (immunoglobulin) molecule is made up of two identical light chains and two identical heavy chains linked together by disulfide bonds. There are five classes of immunoglobulins present in blood . They are IgG, IgA, IgM, IgD and IgE. All the immunoglobulins differ in amino acid sequence and number of domains in the constant regions of the heavy chains. The third most common serum is IgM. These antibodies are helpful in clumping microorganisms for eventual elimination from the body. It is the predominant isotype in the primary response. IgG is the main isotype in the swine species. It is the major type found in normal serum and the most extensively investigated .It represents between 80 to 85% of total immunoglobulins in serum and colostrum. It is the most important antibody in the secondary response. The concentration of IgG in serum is from 17-29 mg/ml, in milk 1-3 mg/ml and from 30-70 mg/ml in colostrums.

The 2nd most common serum is IgA. It is the major class of Ig in secretions - tears, saliva, colostrums and mucus. It is the pig's most important immunoglobulin in regard to mucosa immunity and lactation. The serum concentration in milk is from 0.5 to 5 mg/ml.[5].

III. Technological Concept

The software ‘MATLAB’ is used here to determine the various blood groups. With the help of this software we have developed a coding scheme by taking into consideration the serum and salivary immunoglobulin concentrations.

IV. Methodology

The concentrations of IgA, IgM, and IgG in serum and of IgA and IgG in saliva were measured by the radial immunodiffusion technique (Mancini, Carbonara, and Heremans,1965) using commercially available immunodiffusion plates and standard antisera, which were suitably diluted during measurements.The slight differences detected between mean serum immunoglobulin concentrations and mean salivary immunoglobulin concentrations of IgA, IgM and IgG are stored in database.The molecular formulas of different immunoglobulins are developed. A program is coded in matlab as such when random concentrations of immunoglobulins of a particular person is entered, if does match with the stored values then it displays the particular blood group with pie charts.[1]

V. System Design and Implementation

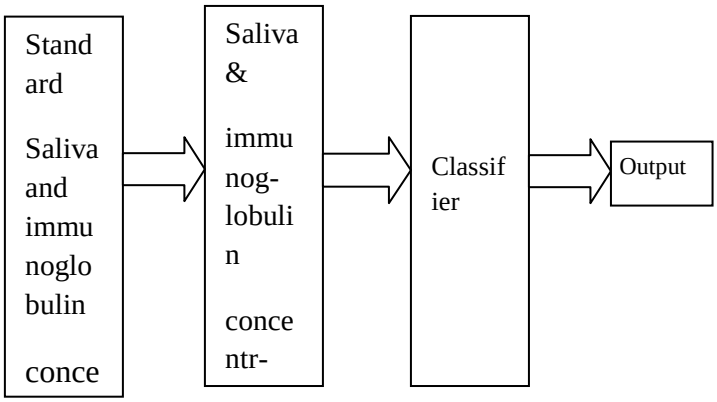

Fig: System model of the proposed work

The entire work may be summarized as:

1. Standard concentrations of saliva and three different types of immunoglobulin are stored in database.
2. The molecular formulas of different types of immunoglobulins were generated.
3. Immunoglobulin and saliva concentrations were collected from individuals’s blood.
4. The concentrations were then inputted in the software and compared.

When it matches with the database it displays the particular blood group.

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VI. RESULTS

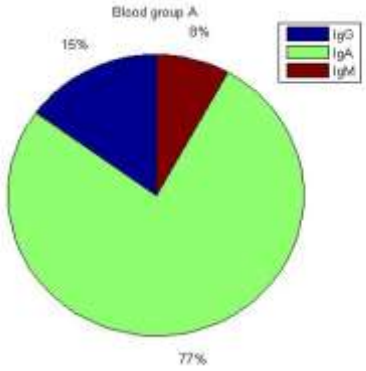

Fig.1:Blood group A in percent

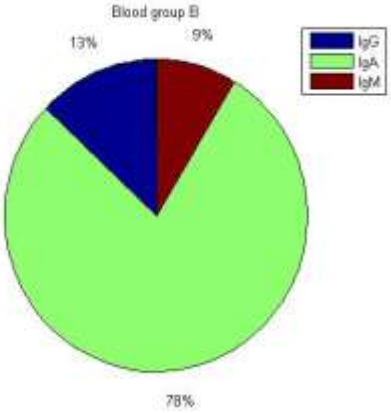

Fig.2:Blood group B in percent

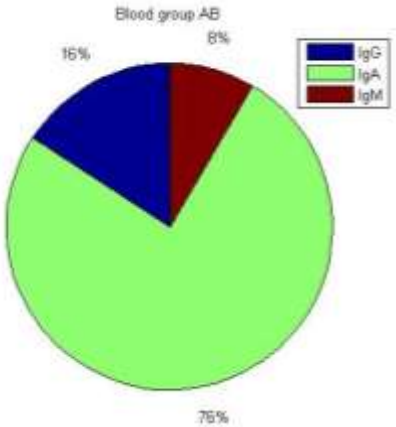

Fig.3:Blood group AB in percent

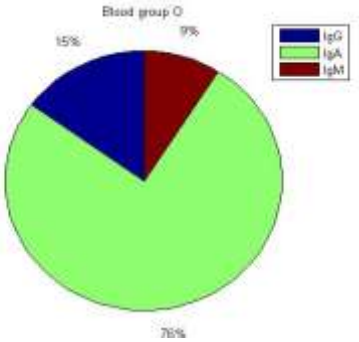

Fig.4:Blood group O in percent

It is observed that all the blood groups A,B, AB and O have different concentrations of IgG, IgA and IgM which are shown in percentage.

VII. DISCUSSION

The results of this investigation have confirmed the earlier finding that individuals of group A have higher salivary protein concentrations than those of group O and, probably, of groups B and AB whereas the serum concentration is highest in individuals of blood group O. However, no clear differences have been found in serum protein concentrations associated with the ABO blood groups.[3]

VIII. CONCLUSION

Blood group determination based on serum and immunoglobulin concentrations is a confirmatory test because sometimes error occurs in patholabs while determining blood groups which may lead to death of an individual.So blood groups of individuals can be identified and confirmed with this software model. The ease with which the simulation using MATLAB approach provides the detection of different types of blood groups and makes it possible for similar applications. The success rate achieved in the determining blood group makes the proposed approach reliable for use in medical science.

IX. ACKNOWLEDGEMENTS

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X. REFERENCES

[1] J. G. Waissbluth and M. J. S. Langman, From the University Department of Medicine, General Hospital, Nottingham, ABO blood groups, secretor status, salivary protein, and serum and salivary immunoglobulin concentrations

[2] Geoff Daniels, Blood Group Genetics Bristol Institute for Transfusion Sciences Services, Bristol, UK

[3] Izumi Kumagai, Kouhei Tsumoto, Tohoku University, Sendai, Japan, Antigen–Antibody Binding

[4] Roitt, Brostoff, male immunology. 6th edition. chapter 4. pg. 65-83

[5] Dr. Gene Mayer, Immunoglobulins - structure and function, Immunology – chapter four

Weblinks

[1] pathmicro.med.sc.edu/mobile/m.immuno-4.htm

[2] www.funtrivia.com/askft/Question119772.html

[3] www.ncbi.nlm.nih.gov › ... › Asian J Transfus Sci › v.5(2); Jul-Dec 2011

[4] eeves.mmg.uci.edu/immunology/CoreNotes /Chap10.pdf

[5] www.sanidadanimal.info/cursos/inmun/ cuarto3.htm