

A Review Article on the Human Blood Groups in Relation to Healthy Longevity

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Abstract

After significant discovery of the ABO blood groups of human beings by Karl Landsteiner, a number of works have been carried out on different types of blood groups like MN type, Q types, etc. and in the same time, number of researches were also carried regarding different aspects of blood groups like its genetic analysis, its inheritance, its role in paternity test, its role in blood transfusion and general physiology etc. Not only this, many literatures and reports are also available on blood groups and their relation to susceptibility of infection, heart diseases. In the COVID-19 pandemic, number of works also have been carried out and their reports available reveal the role of blood groups in relation to bacterial and viral infections. No doubt many reports are also available on the blood groups and their relation to health and longevity. But very little information is available regarding blood groups and their relationship with healthy longevity. Further, in most of the review articles, workers mostly emphasize the ABO blood groups and their relationship with several said topics or issues, but little information is available regarding the role of Rh antigen in relation to healthy longevity. So, there is a need to review the work related to blood groups and its relation to healthy longevity. In this context, the present research work has been taken.

Keywords: ABO blood groups, Rh antigen, healthy longevity, diseases, immunity

INTRODUCTION

Blood is a vascular or fluid connective tissue of mesodermal origin. Blood is directly and significantly associated with several body physiology and homeostasis. It is the main transporting material in the body. Blood components have different types of corpuscles or cellular elements and plasma as liquid part. Commonly, it is recognized as red color due to the presence of Red Blood corpuscles (RBC). Blood plays many roles, for example, transport of oxygen & carbon-dioxide, hormones, glucose, body defense, thermoregulation, blood clotting and wound healing etc. Due to its many functions, blood studies are always the most favorite topic for the researcher. Earlier to the report of Karl Landsteiner in 1901, it was a general observation that every human being in a population has the same type of blood.

Therefore, at the time of urgency to save the lives of people, Doctors transfuse the blood of one healthy person to the required person. In all cases where blood transfusion done to save lives was not given hundred percent results in some cases the results were not satisfactory and revealed the need for more study. Later Karl Landsteiner in 1901 based on classical experiments of RBC reaction with serum of some selected one, described the ABO blood groups. In the context of blood groups, another very important Rh blood group known in the past decade, it is one of the most polymorphic and immunogenic systems. The Rh blood group was first described 75 years ago in a woman who shows severe blood clotting reaction during blood transfusion from her

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husband. Such couples have children with problems with erythroblastosis fetalis. Further investigation reported her serum agglutinated RBCs (Red Blood corpuscles) from her husband and from eighty percent (80%) of Caucasian ABO compatible donors. The present paper discussed the blood groups and their relation to healthy longevity under different headings as follows.

BLOOD GROUPS

By literature reviews it is observed that the blood group of human beings also have their own history and it is also as old as man himself. According to the research paper of Farhud and Yeganeh (2013), at least three hypotheses stated the emergence and mutation of the human blood group. These researchers further reported in the world that in the human population the pattern of blood group distribution also depends on various factors like altitude, climate, humidity, diseases and others. First, in 1901 Landsteiner discovered the ABO blood group based on the results of mixing of the red blood cells (RBC) and serum of some peoples. Based on agglutination results, Landsteiner identified three types of blood A, B and C. The blood type C, later to be renamed type O, is taken from German word Ohne which means without or zero in English, means Blood type O have no agglutination substance. The fourth blood type AB was discovered a year later [1–3]. Some workers reported other types of blood groups also like MN types, K types, D types etc. As per literature reviews, it is observed that the 30 types of blood groups are reported by workers. These blood groups are identified based on presence and absence of some specific proteins on the surface of RBC of concerned people. For example, in these 30-blood group system antigen, 5 are identified by their carbohydrate structures (ABO, H, PIPk, I and GLOB), 2 are identified from the plasma (LE, CH 1RC). The remaining 23 are characterized by the protein sequence of the RBC membrane protein. The ABO blood groups and the MN types are commonly known by people and these blood groups also show very clear markers for their identification, the ABO blood groups significantly consider in blood transfusion while MN types in genetic studies. The other blood groups do not show clear identifiable markers, and these blood groups also do not show significant problems during blood transfusion except in rare cases, so they are not commonly known by people.

The following paragraph provides generalized information regarding reported blood groups, along with details of their deciding factors and characteristics. In 1901, the ABO system was identified, followed by the M/N system and the P system in 1927. The Secretor/Non-secretor blood types were described in 1932, while the Factor Q blood type was reported in 1935. The Rhesus (Rh) antigen blood group was established in 1940/41, and Lutheran types were recognized in 1945. The Lewis (Le) blood type and Kell (K) type were reported in 1946, followed by the Factor S/s blood type in 1947. In 1950, the Duffy (FY) blood type was identified, and the Kidd (Jk) blood group was reported in 1951. The Diego (Di) blood type emerged in 1954, and the Yt system was recognized in 1956. The Auberger type was described in 1961, and Xg types were reported in 1962. The Dombrock (Do) blood type was established in 1965. In 1952, a rare blood group known as the Bombay blood group was detected in Bombay (now Mumbai, India). Another rare blood type, referred to as the Golden blood group, was also reported. This blood type is characterized by the absence of Rh antigens on red blood corpuscles (RBCs) and is also recognized as the Rh-null blood group [4–12].

Importance of Blood Groups

Each blood group is reported or comes into light due to physiological discomfort or severe problems related to life during blood transfusion or some reactions, for example ABO blood groups and Rh blood system. Each blood group is based on antigenic biomolecules of the concerned person, for example MN types, P system, K type, etc. The blood group and FY blood play a significant role in blood transfusion and also in immunity, genetic analysis and in search of biomarkers for control of diseases, physiological problems. Further these antigenic substances that are associated with blood groups also reveal some relation to aging, longevity and health [5–6, 13–27].

Blood Groups and Healthy Longevity

Most workers consider the ABO blood groups and Rh antigen criteria for the various correlation of blood groups with diseases, immunity, health, ageing and healthy longevity. The Rh antigen is associated with ABO blood groups with Positive and negative groups in respect of its presence and absence [8, 9, 10]. The other blood groups are not considered for the correlation study because they are not very common and do not show some serious clinical problems except some reports, for example in the Lutheran system antibodies against this blood group are very rare and not considered clinically significant. Likewise, in the Kell system a particular mother's serum reacts to her newborn infant erythrocytes and shows hemolytic reaction. Further the reports regarding other blood groups like the Duffy system and Kidd system, show that the reaction restricted to few people only [6–7]. During literature reviews of the present paper, it is observed that only very little reports are available regarding blood groups and healthy longevity. It is also observed that in some specific cases a particular ABO blood group may contribute to helping longevity via biological mechanisms [11]. In literature review, some research papers clearly stated the relationship between the ABO blood groups and longevity of people, but these papers mainly consider centenarians and molecular methods during study. One of the UK reports shows some positive features associated with blood group A and longevity [12]. But in another study related to the Turkish population, no association was found between blood groups and longevity [13]. In contrast few recent reports based on study of the Japanese population suggested a correlation between the ABO blood groups and life expectancy [14]. Further in support some reports also stated that there are associations between the ABO blood groups and longevity. The report based on work on centenarians and low age groups also calculated the results on application Chi square analysis [15].

RESULTS AND DISCUSSION

As per the review study, it is observed that approximately 33 types of blood groups are reported but except the ABO and Rh blood groups the other blood groups' relations with longevity, immunity are not established [6, 7]. The reports of Caudia Rizzo et al. stated the importance of blood groups in health issues, immunity that influences longevity. His study was based on serum soluble E-selectin protein level and related inflammatory response. Further states show relation to susceptibility of diseases that affect ageing. The ageing of human beings and their longevity is marked by different genetic, stochastic, epigenetic and environmental factors. Many workers strongly suggested that in longevity there is a role of genetics. But many workers believe it only plays some restricted role because in many cases socio-economic factors in different age groups also affect ageing and longevity [10]. In general, in society, it is observed that those who have a good nutritional diet and have a healthy lifestyle have good immunity. But the socio-economic factors really give more longevity. It is still not clearly established because during COVID-19 pandemic numbers of very aged peoples of poor socio-economic groups survived and good socio-economic groups of even young people died [16]. Further the role of blood groups in longevity, immunity and susceptibility for diseases are well studied and in general many workers reports established clear connections between the blood groups and longevity. But some workers' reports do not establish the relations [11–15]. Shimizu and Colleagues found that Blood group B was associated with the individual's longevity [17]. In this continuation of the works of Mengoli et al., Brecher and Hay strongly stated that blood group B inversely correlated with life expectancy or ageing/longevity [18, 19]. Further the reports of Murray S. and Sturgen P. and of Bellar S. and Bates E., emphasize the relation of blood groups O and A with aging of people [20, 21]. Many workers also reported biochemistry of biomolecules associated with homeostasis, Willebrand Factor (vWF), Factor VIII, thrombosis, myocardial infarction are shown a direct relation with ABO blood groups and longevity, particularly blood groups O and non-O blood groups [22–24]. reports stated the ABO blood groups directly influence the hemostasis of the body physiology. The reports explained that the ABO blood group affected the quantitative titer of plasma level of von Willebrand Factor (vWF) and consequently of factor VIII (FV III), since vWF works as a specific carrier of FVIII and protects it from proteolytic degradation [22]. The vWF and VIII factors associated as markers for longevity, their lower value in blood group O shows more longevity in comparison those having higher level in blood group O. Many

more investigations have studied the clinical implications of this biological interaction, including the influence of the ABO blood group on the risk of developing bleeding or thrombotic events [22, 23, 24]. In case of Rh blood groups that reported after the women problems related to transfusion of blood agglutination reaction, in this relation the work of Landsteiner and Wiener [2] found that sera from rabbits (and later guinea pigs) immunized with RBCs samples from *Macaca mulatta* (*Macacus rhesus*) agglutinated 85% of human RBCs samples that collected from population. The human antibody and other animal protein that shows a common reaction to a surface protein that present on RBC of rhesus and human marked as Rh and anti Rh factor (the term coined by Landsteiner and Wiener) latter it marked as Anti D, its role in longevity is not well worked. Further reports stated the Rh blood group system is polymorphic, and it consists of about forty-five independent antigens. The Rh blood groups system is the second most significant blood groups clinically than the ABO blood group in case of blood transfusion. Bombay blood group is a very rare blood group, this blood group mimics O blood group of ABO blood groups, in Bombay blood group no antigen presents but it shows incompatibility with O blood group during cross matching. The Rh-null blood group is rare in human populations; it is also named as Golden blood; it is also historically related to Greek mythology as the blood present in God. Rh-null phenotype or golden blood clinically associated with chronic hemolytic anemia of varying degrees; it also readily forms alloantibodies when exposed to Rh antigen. Its relation to healthy longevity is not clear [25–30].

SUMMARY

About 30 different types of blood groups are reported by the numbers of workers in these blood groups mainly based on the presence and absence of specific molecules of carbohydrates and amino acids that are called antigens or agglutinins. The most important blood groups for blood transfusion are The ABO blood system and Rh group. Many studies show relationships between blood groups and different aspects of body physiology, for example longevity, susceptibility and immunity but many workers denied the direct roles.

CONCLUSION

ABO blood groups reported by Karl Landsteiner based on presence and absence of specific antigen that present on the surface of RBC and its counter agglutinable substance antibody in plasma, the blood groups decided by agglutination results. The ABO system and Rh factor are playing a significant role in blood transfusion and others study.

Conflict of Interest

Author ensures no conflict of interest.

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