

Identification of Gut Bacterial Enzymes for Conversion of Donor Blood Groups to Universal O Type

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Abstract

Using an α -galactosidase, B erythrocytes can be converted to blood group O without affecting their viability in vitro nor their survival after transfusion to individuals of groups O, A, and B. This technique has the potential to generate enzymatically converted group O cells for transfusion therapy. 1 Similarly, by using the appropriate α -N-acetylgalactosaminidase, it should be possible to convert A cells to group O cells.

Objective

Correct matching of blood types is a central requirement of blood transfusion since the plasma of individuals of blood group A contains antibodies against the B antigen and vice versa. Thus, incompatible transfusions can result in the activation of complement and red blood cell (RBC) lysis, which can be lethal. Access to effective enzymes capable of converting A and B-type red blood cells to 'universal' donor O would significantly increase the amount of blood available for transfusions.

Method

A literature review was conducted by searching data on Pubmed, Google Scholar, Nature, and Science using keywords like ABO Blood Groups, Blood Transfusion, and Gut Microbiome.

Result

The functional metagenomic screening of the human gut microbiome for enzymes that can remove the cognate A and B type sugar antigens was reported. Among the genes encoded, 19,500 expressed fosmids bearing gut bacterial DNA. 2 An enzyme pair from the obligate anaerobe *Flavonifractor plautii* was identified to efficiently convert the A antigen to the H antigen of O-type blood, via a galactosamine intermediate. The X-ray structure of the N-acetylgalactosamine deacetylase reveals the active site and mechanism as the first member of an esterase family. 3 The galactosaminidase extends activities within the CAZy family GH36. Their ability to completely convert A to O of the same rhesus type at very low enzyme concentrations in whole blood simplifies their incorporation into blood transfusion practice, broadening blood supply. 2

Conclusion

The discovery of enzymes from *Flavonifractor plautii* capable of converting A-type RBCs to O-type represents a significant advancement in transfusion medicine. The ability to convert blood types simplifies the process of generating universal donor blood. This finding has the potential to increase blood supply, enhancing the safety and availability of blood for transfusions. Further research and development of these enzymes could lead to practical, cost-effective solutions for broadening the universal blood supply and improving patient outcomes in transfusion medicine.

Keyword

ABO Blood Groups, Blood Transfusion, Gut Microbiome