

Immunochemical comparison between sera from the primary and secondary circulations in a salmonid fish, Sakhalin taimen (*Hucho perryi*)

Y. Tokushima¹, Y. Ito¹, M. Shimizu², N. Omoto³ and A. Hara^{1,*}

¹Graduate School of Fisheries Sciences, Hokkaido University, 3-1-1, Minato, Hakodate, Hokkaido, 041-8611, Japan; ²School of Aquatic and Fishery Sciences, Box 355020, University of Washington, Seattle, Washington, 98195, USA; ³Department of Research and Development, Hokkaido Electric Power Co. Inc., Ebetsu, Hokkaido, 067-0033, Japan; * Author for correspondence (Fax: +81-138-40-8878; e-mail: aki@fish.hokudai.ac.jp)

Accepted: January 24, 2005

Key words: albumin-like protein, immunoglobulin, lymphatic system, salmon, transferrin, vitellogenin

Abstract

Fish has a unique, non-respiratory vascular system called secondary circulation, which forms capillary networks to the internal and external body surfaces. We compared protein composition in serum from the secondary circulation with that from the primary (blood) circulation. Chromatographic and electrophoretic patterns of sera from the two circulations were essentially same. Immunochemical analysis using specific antibodies against albumin-like protein ($\alpha 1$ -protein), immunoglobulin M (IgM), transferrin, vitellogenin and choriogenin (precursor to eggshell protein) revealed that these major blood serum proteins in the primary circulation are present in the secondary circulation. Total protein concentrations in the secondary circulation were lower than those in the primary circulation. $\alpha 1$ -Protein levels in the secondary circulation relative to the primary circulation were similar to those of total protein, IgM, however, had significantly lower relative levels in the secondary circulation than total protein. Despite some differences in the protein composition between the primary and secondary circulations, the presence of major blood serum proteins in the secondary circulation suggests that the secondary circulation plays a role in transporting them from the primary circulation to the body surfaces.

Introduction

The circulatory system of mammals consists of two components: blood and lymphatic systems. The blood system is rich in red blood cells and plays the essential role in transporting oxygen to peripheral tissues. Besides its respiratory function, this system carries nutrients, hormones, enzymes, antibodies, ions and other biologically important substances. The vascular network of the blood system is further divided into the arterial and venous systems. In contrast to the blood system,

the lymphatic system lacks the arterial system and its fluid originates from the skimming of plasma from the blood system. The interstitial fluid is collected by capillaries, forms larger vessels of the lymphatic system and finally drains into the venous system of the blood. This blind-ending network of the lymphatic system is widely distributed through the body and maintains the internal fluid balance. Other important functions of the lymphatic system are distributing leukocytes and antibodies, and transporting lipids absorbed in the intestine.

Abstract

Fish has a unique, non-respiratory vascular system called secondary circulation, which forms capillary networks to the internal and external body surfaces. We compared protein composition in serum from the secondary circulation with that from the primary (blood) circulation. Chromatographic and electrophoretic patterns of sera from the two circulations were essentially same. Immunochemical analysis using specific antibodies against albumin-like protein ($\alpha 1$ -protein), immunoglobulin M (IgM), transferrin, vitellogenin and choriogenin (precursor to

eggshell protein) revealed that these major blood serum proteins in the primary circulation are present in the secondary circulation. Total protein concentrations in the secondary circulation were lower than those in the primary circulation. α 1-Protein levels in the secondary circulation relative to the primary circulation were similar to those of total protein. IgM, however, had significantly lower relative levels in the secondary circulation than total protein. Despite some differences in the protein composition between the primary and secondary circulations, the presence of major blood serum proteins in the secondary circulation suggests that the secondary circulation plays a role in transporting them from the primary circulation to the body surfaces.