GÖTEBORGS UNIVERSITET

Leptin endocrinology and energy homeostasis in salmonids

Marcus Johansson

Institutionen för biologi och miljövetenskap
Naturvetenskapliga fakulteten

Akademisk avhandling för filosofie doktorsexamen i naturvetenskap, inriktning biologi, som med tillstånd från Naturvetenskapliga fakulteten kommer att offentligt försvaras fredagen den 22 januari 2016 kl. 10.00 i Föreläsningssalen, Institutionen för biologi och miljövetenskap, Medicinaregatan 18A, Göteborg.

Opponent är Dr. Richard Londraville, Department of Biology, University of Akron, Akron, Ohio, USA

ISBN 978-91-628-9698-0 (Print)
ISBN 978-91-628-9699-7 (PDF)
Electronic version: http://hdl.handle.net/2077/41286

Dissertation abstract

Johansson, Marcus (2016). Leptin endocrinology and energy homeostasis in salmonids

Department of Biological and Environmental Sciences/Zoophysiology,
University of Gothenburg, Box 463, SE-425 30 Göteborg Sweden

In salmonids, the physiological role of leptin is not completely elucidated. Nonetheless, the anorexigenic effect of leptin indicates a role in their energy homeostasis. This thesis focuses on advancing the understanding of the involvement of the leptin system in the regulation of energy homeostasis and food intake in teleost fish. Furthermore, it examines the question if adipose tissue is a leptin-producing tissue in fish.

By modulating food availability as well as studying rainbow trout breeding-selected for different muscle lipid content, the nutritional state was manipulated. By utilizing a range of homologous analytical tools, including radioimmunoassays for plasma leptin and leptin-binding protein levels, and quantitative expression analysis (qPCR) of leptin related genes *in vivo* and *in vitro*, the functional links between leptin endocrinology, food intake and nutritional state were studied.

The results presented in this thesis reveal that the leptin system in salmonids is highly complex, and that its regulatory response to periods of catabolism may depend on environmental or physiological conditions. The leptin-induced anorexic state is modulated during periods of food shortage or fast growth. When fish develop anorexia through high plasma leptin levels, the breaking of the anorexic state appears not to be due to a decrease in plasma leptin, but rather that consumption of food decreases plasma leptin.

A disparity between plasma leptin levels and both the gene expression of the leptin receptor isoforms and plasma leptin binding protein was observed. This indicates that more data on the protein level are needed to improve our understanding of leptin endocrinology in fish, and to compliment current knowledge which is mainly derived from gene studies.
The plasma leptin source has not yet been determined in salmonids, although the liver has been suggested as a main source due to high hepatic *lep* expression. This thesis demonstrates that visceral adipose tissue both secretes leptin and expresses the *lep* gene, supporting a leptin-secreting role.

Keywords: Leptin, Leptin binding-protein, Energy homeostasis, Oncorhynchus mykiss, Salvelinus alpinus, Adiposity, Food intake, Fasting, Refeeding, Catabolism, Anorexia.