DOES LEPTIN PLAY A ROLE IN EARLY SEXUAL MATURATION IN MALE ATLANTIC SALMON (*SALMO SALAR* L.)?

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Introduction:

Leptin has been established as a signal conveying the energy status of an individual to the reproductive axis affecting puberty onset and fertility in mammals, but the possible role of leptin in reproduction in teleost fish remains largely unexplored. In Atlantic salmon, as in most teleost fish, leptin is mainly synthesized by the liver. The lack of correlation between adiposity stores and leptin plasma levels, suggests that leptin might have a different function in teleost fish during the attainment of reproductive function than that seen in mammals where plasma leptin levels are directly proportional to the amount of adipose tissue. In this study we investigated the impact of food restriction on the prevalence of early maturing males and the pattern of hepatic leptin gene expression, brain leptin receptor gene expression and circulating plasma levels during early sexual maturation in Atlantic salmon parr.

Methods:

One-year old Atlantic salmon parr was given different feeding regimes (full or restricted feeding) during spring and summer and fish were sampled monthly. The temporal gene expression profile as well as the tissue distribution of the two leptin paralogues (lepa1 and lepa2) and the leptin receptor (lepr) was assessed using quantitative real-time PCR during the period of early puberty onset and advancement to detect possible changes in expression due to season, restricted feeding and developmental stage. Plasma leptin levels were measured by a homologous salmonid radioimmunoassay.

Results and Discussion:

Restricted feeding significantly decreased the incidence of early sexual maturation. High mRNA levels of both lepa1 and lepa2 were found in the liver only, but low or very low lepa1 gene expression was found in a few other tissues such as pituitary, gills and heart. Lepr was expressed in all tissues investigated and a differential expression pattern was observed in the testis depending on the reproductive stage. Maturation and restricted feeding increased lepa1 mRNA expression as well as plasma leptin levels, although the change in plasma leptin was not as pronounced. Increased lepa1 gene expression in maturing males could be seen only at later stages during spermatogenesis and not during onset. Lepa2 transcript levels were highest in early spring and declined during early summer in the full fed group. By mid-June, lepa2 levels were very low in both maturing and immature fish, but an up-regulation in maturing males occurred later in the season. A decline in lepa2 transcript levels were also seen in the restricted group but levels started to increase again by June and both immature and maturing fish had at this time higher levels compared to the control. Lepr in the brain was slightly but significantly up-regulated in full fed immature males by early summer, while remaining at a steady expression level in the maturing fish.

No correlation could be found between adiposity and leptin plasma concentration or hepatic lepa1 and lepa2 gene expression at any sampling occasion. Correlation between the two leptin paralogues was found at some, but not all, sampling dates, which indicate that the two genes are differentially regulated.

Conclusion:

Our results show that both lepa1 and lepa2 transcription and plasma leptin levels were increased by restricted feeding. Leptin is therefore unlikely to act as an adiposity signal to the reproductive axis in Atlantic salmon parr. The leptin system seems not to play a role in triggering, or acting as a permissive signal, for the onset of early sexual maturation in male Atlantic salmon, but may rather play a role during energy reallocation in later stages of spermatogenesis.