Seasonal reproduction is strongly influenced by metabolic status. Matching reproductive activity to nutritional reserves is fundamental to the survival of a species. Many factors that affect reproduction, appetite, and energy expenditure have been described. Many of these factors are adipokines, hormones produced mainly by white adipose tissue. New roles for adipokines in fertility, reproduction, and metabolism have recently emerged, particularly since the description of leptin, and resistin. The effects of many of these peptides are dependent on the photoperiod. In spring and summer, when food is plentiful and readily available, sheep show an increased appetite and seem to be resistant to the high concentrations of leptin that result from increased adiposity. Leptin resistance can either be a pathological state, for example, in diet-induced obesity, or a hyperleptinaemia state, or it can be an adaptive response and a physiological phenomenon to allow for shifts in the body weight set point, for example, in seasonal animals. Although the cellular and molecular mechanisms underlying the maintenance of energy balance in seasonal sheep have been studied extensively, how the photoperiod and metabolic status impact the interaction between leptin and resistin has not yet been explored. The blood-brain barrier (BBB) is a key player in adipokine signaling from the periphery to the central nervous system (CNS). The short form of the leptin receptor (LeptRa) plays a key role in the transport of leptin to the central nervous system CNS. Here, MTS-leptin and recombinant ovine (ro) leptin-mediated expression of LeptRa and VEGFA and VEGFR2 in selected hypothalamic nuclei, the choroid plexus (ChP), and anterior pituitary (AP) were analyzed considering the photoperiod and acute fasting (experiment 1) and nutritional status (experiment 2) of ewes. In experiment 1, sixty sheep were fed normally or fasted for 72 h and received one injection of saline, MTS-leptin or roleptin 1 h prior to euthanasia. LeptRa mRNA transcript levels and VEGF system protein concentrations were detected in the arcuate nucleus (ARC) and ChP predominantly in the short day (SD) period and in the AP in the long day (LD) period without detection of LeptRa in the preoptic area (POA) and ventro- and dorsomedial nuclei (VMH/DMH). In experiment 2, an altered diet for 5 months created lean or fat sheep. Twenty sheep were divided into four groups: the lean and fat groups were given saline, while the lean-R and fat-R groups received resistin 1 h prior to euthanasia. The results of the experiments showed for the first time the effect of MTS-leptin/roleptin on the expression of LeptRa, protein concentrations of VEGFA, and VEGFR2 in selected brain regions, namely, the AP, ChP, and ARC, in the context of nutritional status, resistin, and photoperiod. Changes in adiposity influenced the lowering effect of resistin on the expression of LeptRa and VEGF system protein concentrations. There were no differences between the expression of mRNA for LeptRa and concentrations of the VEGF system in lean and fat sheep. Overall, both photoperiodic and nutritional signals influence the effects of MTS-leptin/roleptin and resistin-mediated leptin transport to the CNS via LeptRa, and resistin seems to be another adipokine involved in the adaptive and/or pathological phenomenon of not only central but also peripheral leptin resistance in seasonal sheep.