Anatomy of brown adipose tissue in neonate reindeer

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Brown adipose tissue (BAT) is referred to as a separate specialized thermogenic organ, since it effectively functions as a main site of nonshivering thermogenesis (NST). Metabolic importance of BAT/NST in the defence against cold has been pointed out in reindeer calves in recent works (Markussen et al. 1985, Soppela et al. 1986).

Anatomy of BAT was studied in 15 neonate reindeer during 1985 and 1986. Material was collected from 13 calves, which had died soon after birth. Most calves were examined within a day to two days *post mortem*. In addition two calves were sacrified for the immediate study. All calves were weighed, dissected and locations of appreciable BAT depots were identified anatomically. Adipose tissue was carefully removed from each location and the fresh weight determinated. Electron microscopy was used to identify and characterize BAT microanatomy.

Adipose tissue from each location showed typical characteristics of BAT under electron microscopy. BAT comprised 1.2% of the body weight in normal calves (4.8 kg, n=7) and 0.9% of the weight in underweight calves (2.8 kg, n=8). There was a significant ($P<0.025$) difference between the groups. No difference existed in BAT contents between sexes. Total BAT and body weight correlated in normal ($r=0.988$) and in underweight ($r=0.907$) calves.

BAT was composed of either diffuse or discrete depots in various sites of the body, especially close to vital organs. In wellnourished calves dissected immediately after death BAT was light brown or yellowish and in most others it was dark brown or red. Largest BAT depot in normal calves was in the perirenal-abdominal region (26.9% of total BAT); this depot covered kidneys and abdominal lymph nodes extending dorsally to the pelvis. Second large depot was in the interscapular region (17.5%). Considerable BAT depots were found in the intralumbar area (13.4%), in the vertebral region (11.7%) and on the both sides of sternum (12.1%). A more diffuse mass was found in the peritracheal region (7.5%). Smaller depots existed around the heart, in the mesenterium, in the occipital, axillar and inguinal regions. Usually there was no visible subcutaneous fat. Distribution of BAT in underweight calves did not differ from that in normal calves, except that percent of perirenal-abdominal depot was greater ($P<0.05$) than in normal calves.

Main characteristics of BAT microanatomy were a high granular structure and a rich network of capillaries and nerves. Typical brown adipocytes were polygonal cells with round, central nucleus and few small fat droplets. Cytoplasm was tightly packed with large, highly invaginated mitochondria proximal to lipid droplets. Brown adipocytes of the underweight calves had often almost entirely depleted of fat. Fat droplets were very few and small, and capillaries were expanded and filled with red corpuscles. Fat depletion or athrophy may result from prolonged cold exposure or starvation or both. BAT persists normally weeks in neonatal ungulates, although quantity and capacity of the tissue for NST declines with age. This is a target of our interest in further studies in reindeer BAT.