THERMAL AND NUTRITIONAL STATUS AND THE DEVELOPMENT OF POSTNATAL RISE IN MINIMUM METABOLIC RATE OF THE RABBIT

M. Székely, E. Pétervári and J.F. Andrews, Department of Pathophysiology, Faculty of Medicine, University of Pécs, Hungary.

In the process of transition from intrauterine to extrauterine life, resting metabolic rate (RMR) is known to increase postnatally. The mechanism of this adaptation phenomenon is not known; it can be connected probably to the changing conditions, mainly to the change in thermal environment (for cold extrauterine environment) and to the change in nutrition (for enteral nutrition). In the present studies the effects of environmental temperature and feeding status on postnatal metabolic rate were analyzed. RMR values of 72 newborn New Zealand White rabbit pups were measured on a total of 149 test occasions. At tests the pups belonged to one of the following age groups: 0-6 h, >6-12 h, >12-36 h, >36-72 h, >72-120 h and >120-168 h. Between tests the pups were (with some exceptions) returned to the maternal nest, which was relatively cold and in which feeding started relatively late (usually by the end of the first postnatal day, with great variability). Feeding status was judged by appearance of the pups and by their weight gain in the course of increasing postnatal age. At tests, the pups were placed into an open-circuit metabolic chamber immersed in a water-bath, which was warmed from 23-25°C by a rate of 1°C/10min. During this warming, colonic temperature was measured by thermocouples, metabolic rate by diaferometer. Metabolic rate was expressed on body mass basis. The lowest metabolic rate observed in this process was regarded RMR, provided the animal was quiet. No RMR change was observed between the first 2 age groups. However, by the age of >12-36 h RMR exhibited a 27% rise, irrespective whether the animals were fed or unfed. A group of 9 pups was not returned to the doe after test at age 0-6 h, they were transferred to an artificial nest in a thermostat of 35-36°C (thermoneutrality). Pups of this group were unexposed to cold, and they exhibited no significant RMR rise by the age of >12-36 h (afterwards they were not returned to the doe, they had a narcotic overdose). In case the pups were not fed even beyond the age of 36 h, they could not sustain the high RMR. In 6 such fasting pups RMR had risen by the age of >12-36 h, but declined to the immediate postnatal level by the age of >36-72 h. In contrast, 7 pups, unfed at the age of >36-72 h were successfully fed later, by the age of >72-120 h their weight gain was 31% and their RMR rose to the level seen in normally fed pups of the same age. This is remarkable, since the consumed milk was not yet absorbed and incorporated into metabolically active body mass. It is concluded that 1) In the rabbit, cold exposure is necessary for the early postnatal rise in RMR, while the feeding status has no role in the development of this rise. This RMR-rise is thought to be connected with cold-induced changes of thyroid functions. 2) The high RMR cannot be sustained without onset of enteral nutrition. Fasting leads to a decline of the already high RMR. 3) Late-onset feeding of previously fasting pups results in large increase of RMR (per body mass, including gastric content), despite the still low active body mass. This RMR-rise may be connected with stretch and other gastrointestinal signals.

Supported by OTKA 026511.

mszekely@apacs.pote.hu