GLYCOGEN CONTENT IN SKELETAL MUSCLES AND LIVER OF RABBITS IN THE ANTENATAL AND NEONATAL PERIODS

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The relative glycogen content in the liver of rabbit fetuses at the end of the antenatal period is the same as in adult rabbits but in the skeletal muscles it is twice as high. After birth both the total and the relative glycogen content in the skeletal muscles and liver fall sharply, possibly because the skeletal muscles start to perform their thermoregulatory function.

Laboratory investigations have shown that the fetal movements are an important factor determining the normal antenatal development of the organism. The skeletal muscles in the antenatal period have a tonic type of activity and perform a circulatory function but not an antigravity or thermoregulatory function [2-4]. In this connection it is important to determine the level of energy reserves (primarily carbohydrates) characteristic of skeletal muscles and the liver while they perform their various functions. This is a particularly important matter because in the antenatal period the fetus develops under conditions of physiological hypoxemia [3, 5, 6, 8], whereas in the neonatal period the conditions are those of physiological hyperoxemia [3, 5].

In this investigation the glycogen content was determined in the tissues of fetal and neonatal rabbits.

EXPERIMENTAL METHOD

Glycogen was determined by the anthrone method [10] (in the modification for tissues with a low glycogen content) in the muscles and liver of the rabbit fetuses on the 25th-30th day of intrauterine development (during normal pregnancy) and of newborn rabbits 6-8 h after birth. Glycogen was also determined in the skeletal muscles and liver of adult rabbits for comparison. To assess the energy reserves of the skeletal muscles as a whole at these age periods, not only the relative content (in mg%, i.e., expressed per 100 g tissue), but also the total content of glycogen was determined in all the muscles and in the liver. This required determination of the total muscle mass [7] and the weight of the whole liver.

EXPERIMENTAL RESULTS

The results are given in Table 1. The first feature to be noted is that from the 25th day the absolute muscle mass of the fetuses increased but the relative weight of the muscles diminished. In postnatal ontogeny the relative weight increased from 20.4 to 43.7% (in adult rabbits). Similar changes affected the weight of the liver in the antenatal period. In postnatal ontogeny, however, the relative weight of the liver, unlike that of the muscles, decreased. Both the total and the relative glycogen content in the skeletal muscles and liver were increased by the end of the antenatal period. It is interesting to note that the relative glycogen content in the liver of the 30-day fetus was the same as in adult rabbits, whereas in the skeletal muscles it was more than twice as high as the corresponding parameter in the adults. The ratio between the total glycogen content and the body weight of the fetuses before birth also was higher than in the adults.

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TABLE 1. Relative and Total Content of Glycogen in Skeletal Muscles and Liver of Rabbits (M±m)

Rabbits	Body weight (in g)	Muscles				Liver				Total glycogen content in muscles and liver (in mg)	Ratio of total glycogen in muscles and liver to body wt. (in %)
		absolute weight (in g)	relative weight (in %)	relative glycogen content (in mg %)	total glycogen content (in mg)	absolute weight (in g)	relative weight (in %)	relative glycogen content (in mg %)	total glycogen content (in mg)		
Fetuses											
25-day	19,4±0,3	6,7±0,25	35,2±0,38	1355±13,0	90,8±0,46	1,5±0,005	7,8±0,15	620±9,7	9,3±0,32	90,3±0,56	0,464±0,002
27-day	26,6±0,4	8,8±0,11	32,0±0,29	1448±13,6	127,4±0,66	1,8±0,078	6,8±0,22	1590±10,3	29,4±0,9	156,9±0,8	0,590±0,002
29-day	37,2±0,4	8,8±0,17	24,5±0,17	1710±6,3	150,4±1,0	2,2±0,08	6,0±0,06	3200±53,6	70,4±0,89	220.8±0,65	0,590±0,001
30-day	43,7±0,9	9,1±0,23	22,1±0,22	1840±10,0	167,4±0,52	2,6±0,06	6,0±0,05	4200±30,0	109,2±1,15	276,6±0,69	0,632±0,004
Newborn	47,0±0,8	9,6±0,21	20,4±0,20	1547±11,4	81,6±0,54	2,8±0,07	5,9±0,04	456±9,7	12,8±0,39	94,4±0,41	0,200±0,003
Adult	3200±73	1200±50,8	43,7±0,51	765±5,3	9180±20,3	102,8±3,1	3,2±0,17	4000±60,0	4120±22 3	13 300±22,5	0,415±0,003

A considerable change in the glycogen content both in the skeletal muscles and in the liver took place in the neonatal period. Both the relative and the total glycogen content in the liver fell almost tenfold. The relative glycogen content in the skeletal muscles changed only a little, but its total content was reduced by half. A marked decrease in the liver glycogen content immediately after birth has also been observed in rats [9]. This decrease cannot be associated with a change in the activity of any enzyme of carbohydrate metabolism in the liver [1]. This can be explained by the change of the fetus to an environment at a much lower temperature. The temperature drop is 16-18°C. The thermoregulatory function of the skeletal muscles, which commences at this age, is associated with considerable carbohydrate utilization.

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