5254

Effect of Fasting Upon the Activity of the Intact Skeletal Muscle of the Rat.*

CHESTER E. LEESE, HARRY M. HINES AND DOROTHY P. JORDAN.

From the Department of Physiology and the Child Welfare Station, State University of Iowa.

The work of previous investigators has shown that fasting and undernutrition are usually accompanied by a diminished ability to perform muscular work and an increased susceptibility to fatigue. A few instances are recorded in which an individual's strength was increased for a short time during a fast and in which isolated muscles from fasting animals exhibited a diminished rate of fatigue.

These experiments were planned to determine the effect of fasting upon the rate of fatigue and the work done by the intact gastrocnemius muscle of the rat. Glycogen studies were made on the tissues of the fatigued control animals in order to determine whether a relationship existed between muscular activity and the amount of carbohydrate stores. The animals were kept under light amytal anesthesia and the muscle activated by supermaximal induction shocks at the rate of 2 to 3 per second. A lever, weighted with a load equal to one-half of the weight of the animal, was attached to the foot. The femur was held in a rigid position by a special clamp. It was found that muscles with their natural attachments performed much more work than when the cut tendon was employed as a point of attachment. The muscle was considered to be in a condition of complete fatigue when the application of a supermaximal stimulus failed to cause a perceptible movement of the lever.

TABLE I.

Fast in hours	KgM work per gm. muscle	Total No. stimuli to fatigue	% Glycogen in fatigued muscle	% Glycogen in control muscle	% Glycogen in liver (fatigued)	% Glycogen in liver (control)
0	2.8	67,420	.125	.538	.164	2.185
24	2.7	71,306	.078	.370	.067	.172
48	2.8	67,486	.056	.375	.063	.078
80	3.3	95,000	.090	.355	.072	.254
120	2.0	68,676	.109	.321	.046	.345
144	3.1	116,280	.131	.355	.084	.339

Table I summarizes the average results obtained from a study of 50 rats and an equal number of controls. The muscle glycogen was

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materially reduced by a 24-hour period of fasting and longer periods did not cause any greater degree of reduction. The lowest valves for liver glycogen were noted at the end of the 48-hour periods. In the longer periods the liver glycogen was increased over the earlier low valves. Fatigue occurred when appreciable quantities of glycogen were present in liver and muscle. It was found that the amount of work done by the muscle and the number of stimuli required to produce fatigue was independent of the initial and of the terminal glycogen content of liver and muscle. Considerable variation was noted in the number of stimuli required to produce fatigue in animals of the same group. It was found that the intact muscle from animals fasted for periods up to 144 hours in duration did as much work and required as many stimuli to produce fatigue as the muscle of well fed animals.