INTENSITY OF PROTEIN SYNTHESIS IN SKELETAL MUSCLE FIBERS WHEN THE ANDROGEN BALANCE IS DISTURBED

E. I. Kalent'eva

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Injection of testoterone propionate into castrated male Wistar rats (0.4 mg daily for 7 days) stimulates the incorporation of methionine-2-H^3 into nuclei of the fibers of the gastrocnemius lateralis muscle 3 h after injection of the labeled compound into the animals, and then stimulates its incorporation into the cytoplasm until 16 h. At these same times the incorporation of the label into nuclei of the soleus muscle fibers is inhibited.
KEY WORDS: protein synthesis; skeletal muscles; androgens.

One approach to the investigation of the mechanism of action of androgens is to examine their role in the regulation of protein biosynthesis [3-8].

This paper describes an investigation of the intensity of incorporation of methionine-2-H^3 into the nucleus and cytoplasm of functionally different skeletal muscles of castrated rats during replacement therapy with testoterone propionate.

EXPERIMENTAL METHOD

Experiments were carried out on the soleus (red) and gastrocnemius lateralis (white) muscles of 12 male Wistar rats weighing 100-110 g. All the animals were castrated by the usual method [2]; 15 days [1] after the operation six rats received 0.4 mg testosterone propionate by subcutaneous injection daily for 7 days. On the day of the last injection of the hormone, all the animals received methionine-2-H^3 in a dose of 2.5 μCi/g body weight (specific activity 120 mCi/g). The rats were decapitated 3 and 16 h after administration of the label. The muscles were fixed in Carnoy's mixture. Longitudinal sections, 6 μ in thickness, were coated with R nuclear emulsion. The autoradiographs were exposed for 38 days. The intensity of incorporation of methionine-2-H^3 was determined from the number of tracks above the nuclei and cytoplasm in 75 fibers of each muscle.

EXPERIMENTAL RESULTS

The results of counting the tracks above the nuclei and cytoplasm of the fibers of the test muscles are given in Table 1; they show that in the castrated rats the specific density of the tracks (the number of tracks per 100 μ^2 area) above the cytoplasm and nuclei of the soleus muscle 3 h after injection of the label was higher than above the same structures of the gastrocnemius lateralis muscle. By 16 h, the incorporation of the label into the cytoplasm in the fibers of the soleus muscle was the same as before, but incorporation into the nucleus was reduced; a decrease in the incorporation of the label into the cytoplasm was observed in the fibers of the gastrocnemius lateralis muscle but incorporation into the nucleus remained as before. At this time the specific density of tracks above the cytoplasm of the soleus muscle fibers remained higher than with the lateral gastrocnemius muscle. Incorporation into the nucleus was virtually identical in the fibers of the two muscles.

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TABLE 1. Intensity of Incorporation of Methionine-2-H^3 into Skeletal Muscle Fibers of Gastrocnemius Lateralis and Soleus Muscles of Castrated Rats Receiving and Not Receiving Testosterone Propionate for 7 Days

Time after injection of isotope (h)	Muscles tested	Castration		Castration + testosterone propionate	
		No. of tracks per 100 μ^2 area (M ± m)			
		cytoplasm	nucleus	cytoplasm	nucleus
3	m. gastrocnemius lateralis	1,90±0,0031	5,58±1,054	2,13±1,112	8,05±1,410
	m. soleus	2,85±0,251	9,82±0,762	2,71±0,144	7,94±0,212
	P	⩽0,01	⩽0,05	0,05	>0,05
16	m. gastrocnemius lateralis	1,65±0,121	4,31±0,354	2,27±0,242	5,14±0,842
	m. soleus	2,82±0,201	6,17±1,382	2,49±0,263	5,34±0,794
	P	⩽0,01	>0,05	>0,05	>0,05

In castrated rats receiving testosterone propionate after the operation, 3 h after the beginning of incorporation of the isotope the specific density of the tracks above the cytoplasm of the soleus muscle fibers also was higher than above the cytoplasm of the gastrocnemius lateralis muscle fibers. Incorporation into the nuclei at this time was the same for the fibers of both muscles. By 16 h the intensity of incorporation of the label into the cytoplasm of the fibers of both muscles remained at its previous level, whereas incorporation into the nuclei of both muscles was reduced and stabilized on the same, lower level.

Comparative analysis of the histoautoradiographs showed that the distribution of tracks above the nuclei and cytoplasm of the fibers of the corresponding muscles of the control and experimental animals was different. For instance, 3 h after injection of methionine-2-H^3 the number of tracks per 100 μ^2 area of the nuclei of the gastrocnemius lateralis muscle was significantly higher ($P < 0.05$) in the experimental than in the control series; incorporation into the cytoplasm took place at the same intensity in the control and the experimental animals. By 16 h the incorporation of the label into the cytoplasm was stimulated; incorporation into the nucleus was identical in the control and the experimental series.

The specific density of the tracks above the cytoplasm of the soleus muscle fibers 3 and 16 h after the beginning of incorporation of the label in the experimental group was the same as in the control. The intensity of incorporation of methionine-2-H^3 into the nuclei of the fibers of this muscle was significantly lower in the experimental than in the control series at both times.

The results of this investigation show that the effect of testosterone propionate on protein synthesis differs in muscles with different functions. Testosterone propionate, administered to castrated rats, stimulates the intensity of incorporation of the labeled amino acid and, consequently, stimulates protein biosynthesis in the fibers of the white gastrocnemius lateralis muscle, exhibiting an anabolic action. Meanwhile the decrease in the specific density of tracks above the nuclei of the soleus muscle suggests that it has an antianabolic action on red muscles. The change in the intensity of incorporation takes place chiefly in the nuclei of both the red and the white muscles; this may be evidence of the specific action of the hormone on the synthesis of nuclear proteins.

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