

Title	The direct effect of lactic acid and pH in glycerinated muscle fibers
Sub Title	
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Publisher	共立薬科大学
Publication year	1992
Jtitle	共立薬科大学研究年報 (The annual report of the Kyoritsu College of Pharmacy). No.37 (1992.) ,p.58- 58
JaLC DOI	
Abstract	
Notes	抄録
Genre	Technical Report
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AN00062898-00000037-0058

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The Direct Effect of Lactic acid and pH in Glycerinated Muscle Fibers*

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It is well known that muscle fatigue after heavy exercise is accompanied by an increased concentration of lactic acid (LA), and a decreased pH, in skeletal muscle tissues.

We examined the direct effects of LA and pH, using a MES buffer solution, on the contractile protein system in glycerinated muscle fiber. The tension development of fiber declined with treating in LA for 30 min at 35 °C, concentration of 10, 20, 30mM, and pH 6.5, 6.0, 5.5, respectively. However, only pH decreasing from 6.8 to 5.5 with no LA, under the same condition of LA-pH-treatments, tension also declined, particularly remarkable at pH 5.5, although it was milder than the effects of LA and pH together. When the tension height decreased with LA and pH, a rate of rise of tension tended to be slower considerably than that of the normal one. However, the declined-fiber of the tension height and of the rate of rise recovered to the normal after soaking in a MES buffer solution. On the other hand, keeping pH at 6.8 in the presence of LA (containing 30 mM), it did hardly affect to contractility in muscle fiber. Furthermore, sucrose solution, 0.1-0.4M was added to buffer solution, could fairly protect the declining effects of LA and pH, preserving injury of hydrogen bonds in the contractile protein. From these results, it was assumed that a chemical obstruction due to LA and pH together produced reversibly at the molecular level of actin-myosin interaction in the myofilaments of glycerinated muscle fiber.

* 本報告は *J. Muscle Res. Cell Motil.* 13, (4), 479 (1992) に発表.

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