The Effect of Postmortem Myotomy on Glycolysis and Ultimate Qualitative Characteristics of Porcine Longissimus Muscles

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The rates of postmortem pH decline, levels of some glycolytic metabolites, and qualitative properties of the longissimus muscles from 22 pigs were studied in relation to the effects of myotomy at the time of exsanguination. The effects of postmortem time of myotomy upon the levels of the glycolytic metabolites were compared among pigs with normal and low quality longissimus muscles. Myotomy at or shortly after exsanguination stimulated contractile activity, significantly increased the rate of postmortem glycolysis, and tended to decrease ultimate qualitative properties. Longissimus muscles incised at the time of exsanguination had lower pH values, glycogen, ATP, and creatine phosphate, and higher lactate levels at all postmortem time periods studied through 2 hr than muscles not incised until 45 min postmortem. The effects of myotomy were greater among normal than low quality muscles.

Much research has recently been directed toward elucidating the factors responsible for the variable rates of postmortem pH decline, as well as the wide range of ultimate qualitative properties of porcine muscle (Briskey, 1964; Briskey *et al.*, 1966). Most of these studies (Briskey and Lister, 1968; Kastenschmidt *et al.*, 1968) used muscle samples excised at or shortly after the time of exsanguination. Stimulation (electrical) of excised muscles has been reported to greatly accelerate postmortem glycolytic rate (Bendall, 1966; Forrest and Briskey, 1967; Hallund and Bendall, 1965). McLoughlin (1969) attributed the increased postmortem glycolytic rate to muscle contraction. Forrest and Briskey (1967) and Hallund and Bendall (1965) reported a more rapid postmortem pH decline in response to electrical stimulation from muscles undergoing a relatively slow pH fall at the time of stimulation than those undergoing a fast pH fall. Forrest *et al.* (1966) reported that muscles which subsequently underwent slow postmortem glycolysis had a lower excitability threshold, a greater strength of contraction, and a longer duration of contractility than muscles which subsequently underwent rapid glycolysis.

While it has been recognized that myotomy at or shortly after exsanguination results in violent muscle contraction, the effects of these observations upon biochemical events have not been reported previously. Thus, the present study was conducted to determine the effects of myotomy at the time of exsanguination on postmortem glycolytic rates and ultimate qualitative characteristics of the longissimus muscle. This muscle was selected since it has predominately white fibers (Beecher *et al.*, 1965) and has been described as being susceptible to rapid postmortem glycolysis (Briskey and Wismer-Pedersen, 1961; Lawrie *et al.*, 1958).

EXPERIMENTAL PROCEDURE

Twenty-two market weight Yorkshire pigs were used for this study. The sampling schedule followed is shown in Table I. The 0-hr samples were obtained as soon as possible at exsanguination (approximately 2 min). The numerical designation of the three sampling groups of pigs (0–45, 0–15, and 15–45) employed in this study represents the initial postmortem time period of sample excision from the right and left longissimus muscles, respectively. Thus, in the 0–45 group, initial samples (approximately 100 g) of the right longissimus muscles (RL) were excised at 0 hr, while the left longissimus muscles (LL) were not incised until 45 min postmortem. Likewise, in the 0–15 and 15–45 groups, initial samples of the RL muscles (approximately 100 g) were excised at 0 hr and 15 min postmortem, respectively, and the LL at 15 and 45 min postmortem, respectively. Subsequent samples were excised from the RL and LL muscles at the postmortem time periods as indicated in Table I for each sampling group. The carcasses were placed in the chill room (3° C) at 2 hr postmortem. Prior to freezing in liquid nitrogen, all samples were trimmed free of epimysial connective tissue and cut into strips so that a maximum thickness of approximately 1.5 cm was obtained to facilitate rapid freezing. The frozen muscle samples were powdered with a Waring Blendor in a −20° C room, as described by Borchert and Briskey (1965). The powdered samples were stored in polyethylene bags at −20° C until used for analyses.

Muscle pH was obtained on 5 g of powdered muscle suspended in 25 ml of 0.005*M* sodium iodoacetate (Aberle and Merkel, 1968). Transmission values (Hart, 1962) were determined on 10 g of fresh, finely-ground longissimus muscle (24 hr postmortem) to objectively assess quality. At 24 hr postmortem, the longissimus muscles of both sides were subjectively evaluated at the tenth rib using a score of 0 to 5 (whole number increments) for each of the following three factors: structure and firmness, marbling, and color. Highest values for each of these characteristics were assigned as follows: dry and firm, moderate or higher degrees of marbling, and grayish pink color. Scores of 0 were assigned to very soft exudative muscles which were devoid of visible marbling and very pale in color.

Some of the metabolites involved in the glycolytic pathway [glycogen, glucose, glucose 1-phosphate (G-1-P), glucose 6-phosphate (G-6-P), fructose 6-phosphate (F-6-P), lactate, adenosine triphosphate (ATP), adenosine diphosphate (ADP), adenosine monophosphate (AMP), and creatine phosphate (CP)] were extracted from the frozen, powdered muscle samples according to a slight modification of the procedure of Lowry *et al.* (1964). The modification involved the proportions of 3*M* $HClO_4$, 2*M* $KHCO_3$ and Tris base; the proportions used were 2.86, 3.14, and 4.0 ml per g of muscle, respectively.

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Table I. Postmortem Sampling Schedule of the Right and Left Longissimus Muscles

Sampling group[b]	No. of pigs	Side	Postmortem sampling time[a] 0 hr	15 min	45 min	2 hr	24 hr
0–45	12	Right	X	X	X	X	X
		Left			X	X	X
0–15	5	Right	X	X	X	X	X
		Left		X	X	X	X
15–45	5	Right		X	X	X	X
		Left			X	X	X

[a] X indicates the postmortem time of myotomy. [b] Group designation refers to the initial sampling time for the right and left longissimus, respectively.

The metabolites were fluorometrically determined in an Aminco-Bowman spectrophotofluorometer using enzymatic techniques. Lactate was determined according to the procedure of Hohorst (1963), while all others were determined according to the procedures of Lowry *et al.* (1964) and Maitra and Estabrook (1964). All analyses were conducted on 1 ml of solution in 7 × 40 mm fused quartz fluorometer tubes.

RESULTS AND DISCUSSION

Table II summarizes the pH patterns and some glycolytic metabolites of the right (RL) and left (LL) longissimus muscles. In this study differences between means were not considered significant if the probability level was >0.05. Analyses of variance were determined on the data within sampling groups, and Duncan's Multiple Range test was applied when significant differences were observed.

Myotomy at 0 hr had a marked effect on the rate of pH decline. In the 0–45 group, the LL 45 min pH was higher than RL 0 hr, 15 or 45 min pH. The LL pH at 2 hr was comparable to the RL at 0 hr. A difference was observed between right and left sides at 2 hr. In the 0–15 group, the LL 45 min pH was greater than that of the RL at 45 min. When comparing pH values among the three sampling groups, the longissimus muscles which were not incised at 0 hr maintained higher pH values through at least 2 hr postmortem than those incised at 0 hr. No differences in 24 hr pH values were observed among any of the longissimus muscles, indicating that the rate and not the extent of pH decline was affected.

Glycogen levels (Table II) of the LL at 45 min were greater than the RL muscles at 0 hr, 15 or 45 min in the 0–45 sampling group. The 2 hr glycogen content of the LL muscles (0–45 group) was higher than that of the RL muscles. While there were no differences in glycogen levels between the RL and LL muscles at comparable time periods in either the 0–15 or 15–45 groups, the glycogen levels of the LL muscles remained slightly higher than the corresponding RL. When comparing glycogen levels of the LL and RL muscles in the 15–45 group, at all time periods, with levels in the other sampling groups, it is apparent that glycogen content remained higher if no 0 hr incision was made. No difference in glycogen content was found among any of the muscles at 24 hr, thus further indicating that the rate and not the extent of glycolysis was affected by sampling schedule.

Lactate levels (Table II) of the LL 45 min muscles in the 0–45 group were lower than those in either the 0 hr, 15 or 45 min RL samples. Also a difference between sides was observed at 2 hr. No difference in lactate content between the RL and LL muscles within the same time periods was observed in either the 0–15 or 15–45 groups. Lactate levels of the 15–45 group were consistently lower than those of the 0–45 and 0–15 groups through at least 2 hr. No difference in lactate levels was evident at 24 hr. These data are consistent with the observations of pH and glycogen.

Levels of G-6-P (Table II) were relatively high at 0 hr, reached a low between 15 min and 2 hr, and increased again to a high at 24 hr. This pattern agrees with that reported by Kastenschmidt *et al.* (1968); however, they reported slightly higher values than those observed in the present study. The 24 hr G-6-P values for all muscles were similar and are in agreement with the observations of glycogen and lactate levels. In the 0–45 group, the 45 min and 2 hr G-6-P levels of the LL muscles were lower than the corresponding RL muscles.

The LL 45 min ATP levels of the 0–45 group (Table II) were markedly higher than those of the 0 hr, 15 or 45 min RL muscles. The 2 hr LL muscles had higher ATP levels than the 2 hr RL. While no significant differences existed between sides within the same time periods in the 0–15 group, the LL muscles had higher ATP levels than the corresponding RL muscles. The differences in ATP levels between sides (RL *vs.* LL) of all three sampling groups indicate that 0 hr sampling resulted in ATP diminution. The loss of ATP is probably attributable to the vigorous muscle contraction accompanying myotomy at the time of exsanguination.

It should be emphasized that violent muscle contraction accompanying myotomy was observed only at 0 hr. While the contractile response occurred during resection at the 15 and several 45 min sampling time periods, its severity was markedly reduced and essentially absent among the 45 min samples. Additionally, it should be pointed out that while contractile activity occurred in the portion of the longissimus muscle left attached to the carcass, the response was considerably less than that in the excised sample.

Diminution of ATP undoubtedly resulted from the activation of myofibrillar ATPase which is required to operate the contractile mechanism. The lower ATP levels, in turn, could account for the increased glycolytic rate that accompanied sample excision at 0 hr. These observations are consistent with the controlling influence that ATP level has on glycolysis, especially on the phosphofructokinase reaction, as reported by Scrutton and Utter (1968) and Wood (1966). Electrical stimulation of the contractile mechanism also has been reported to activate the phosphorylase and phosphofructokinase enzymes (Karpatkin *et al.*, 1964; Ozand and Narahara, 1964).

In the 0–45 group, LL 45 min CP levels (Table II) were higher than the RL muscles at 0 hr, 15 or 45 min, as well as that at 2 hr. In the 0–15 group, LL 15 min CP levels were also higher than the RL muscles at 0 hr, 15 or 45 min, and the 2 hr values. The CP levels at 2 hr were not significantly different in any of the sampling groups for both the RL and LL muscles. When comparing all sampling groups, it is apparent that myotomy at 0 hr drastically reduced CP levels. Thus the relatively high CP levels of the muscles not incised at 0 hr provided for a ready source of ATP which, in turn, probably contributed to the slower glycolytic rate.

The average transmission values and subjective quality scores as affected by 0 hr muscle resection are presented in Table III. While none of these values was significantly different, the muscles incised at 0 hr (0–45 group) had lower quality scores. One of the carcasses in the 0–45 group had 2 hr pH values of 5.31 and 6.31, transmission values of 95.0 and 18.5, and subjective quality scores of 5 and 10 for the RL and LL, respectively. Two other carcasses from the same group had transmission values of 85.2 and 38.8, and 56.0

Table II. The Effect of Myotomy (0 hr) on Postmortem pH Decline and Some Glycolytic Metabolites of the Longissimus Muscle[a]

Sampling group	No. of pigs	Side	Postmortem sampling time: 0 hr	15 min	45 min	2 hr	24 hr
			pH Decline				
0–45	12	Right	6.18^{e} ± 0.04	6.15^{e} ± 0.06	6.01^{e} ± 0.08	5.62^{f} ± 0.11	5.20^{g} ± 0.04
		Left			6.46^{d} ± 0.09	6.02^{e} ± 0.18	5.23^{g} ± 0.04
0–15	5	Right	6.20^{d,e,f} ± 0.04	6.12^{e,f} ± 0.07	6.04^{f,g} ± 0.10	5.69^{h} ± 0.20	5.18^{i} ± 0.04
		Left		6.49^{d} ± 0.09	6.34^{d,e} ± 0.11	5.81^{g,h} ± 0.26	5.19^{i} ± 0.04
15–45	5	Right		6.57^{d} ± 0.04	6.45^{d} ± 0.07	5.80^{e} ± 0.15	5.27^{f} ± 0.03
		Left			6.50^{d} ± 0.11	6.00^{e} ± 0.23	5.29^{f} ± 0.04
			Glycogen[b]				
0–45	12	Right	38.1^{e} ± 3.33	40.7^{e} ± 3.67	37.4^{e} ± 5.28	18.5^{f} ± 5.53	2.1^{g} ± 0.52
		Left			55.2^{d} ± 5.96	33.6^{e} ± 8.10	3.5^{g} ± 1.18
0–15	5	Right	42.9^{d} ± 6.09	39.4^{d,e} ± 3.58	40.5^{d} ± 6.60	23.3^{f} ± 9.40	2.9^{g} ± 1.51
		Left		51.7^{d} ± 7.65	48.5^{d} ± 7.76	26.2^{e,f} ± 10.84	4.7^{g} ± 3.16
15–45	5	Right		55.2^{d} ± 3.00	55.1^{d} ± 3.61	28.3^{e} ± 5.23	2.2^{f} ± 1.05
		Left			57.0^{d} ± 4.13	34.6^{e} ± 7.56	2.4^{f} ± 0.49
			Lactate[c]				
0–45	12	Right	42.3^{g} ± 4.54	48.9^{f,g} ± 6.13	55.4^{f} ± 6.38	74.2^{e} ± 8.71	91.3^{d} ± 5.00
		Left			30.3^{h} ± 7.46	53.1^{f,g} ± 11.22	93.1^{d} ± 0.36
0–15	5	Right	40.8^{f,g} ± 1.86	45.6^{e,f,g} ± 2.34	53.0^{e,f,g} ± 5.19	69.3^{d,e} ± 13.50	88.0^{d} ± 6.68
		Left		32.3^{g} ± 7.86	35.0^{g} ± 5.84	65.9^{d,e,f} ± 17.24	89.2^{d} ± 2.35
15–45	5	Right		22.1^{f} ± 2.46	31.3^{f} ± 3.76	57.0^{e} ± 3.24	89.8^{d} ± 8.49
		Left			25.7^{f} ± 5.32	49.0^{e} ± 10.00	96.9^{d} ± 6.42
			Glucose 6-Phosphate[c]				
0–45	12	Right	5.64^{e,f} ± 0.96	3.76^{g,h} ± 0.82	2.66^{h,i} ± 0.76	5.06^{f,g} ± 0.83	6.78^{d,e} ± 0.93
		Left			1.29^{i} ± 0.74	2.19^{i,j} ± 0.91	7.18^{d} ± 0.95
0–15	5	Right	5.95^{d,e,f} ± 0.48	4.45^{e,f,g} ± 0.68	2.66^{g} ± 0.08	4.23^{f,g} ± 1.14	6.69^{d,e} ± 1.03
		Left		2.97^{g} ± 1.24	2.18^{g} ± 1.00	4.03^{f,g} ± 1.47	7.02^{d} ± 1.45
15–45	5	Right		1.56^{f,g} ± 0.40	0.62^{g} ± 0.20	3.71^{e} ± 1.01	7.29^{d} ± 0.59
		Left			0.53^{g} ± 0.18	2.50^{e,f} ± 1.29	7.48^{d} ± 0.97
			ATP[c]				
0–45	12	Right	2.10^{e} ± 0.37	2.00^{e} ± 0.41	1.58^{e} ± 0.44	0.43^{f} ± 0.22	
		Left			3.72^{d} ± 0.69	1.52^{e} ± 0.49	
0–15	5	Right	2.16^{d,e} ± 0.56	2.03^{d,e} ± 0.62	1.65^{d,e} ± 0.70	0.92^{e} ± 0.49	
		Left		3.26^{d} ± 0.83	3.46^{d} ± 1.76	1.16^{e} ± 0.91	
15–45	5	Right		3.62^{d} ± 0.53	3.28^{d} ± 0.77	0.88^{e} ± 0.40	
		Left			3.48^{d} ± 0.85	1.63^{e} ± 0.90	
			Creatine Phosphate[c]				
0–45	12	Right	0.49^{e} ± 0.26	0.36^{e} ± 0.16	0.24^{e} ± 0.13	0.19^{e} ± 0.17	
		Left			1.85^{d} ± 0.87	0.30^{e} ± 0.19	
0–15	5	Right	0.30^{e} ± 0.16	0.10^{e} ± 0.10	0.11^{e} ± 0.08	0.13^{e} ± 0.08	
		Left		1.81^{d} ± 1.06	0.59^{e} ± 0.48	0.20^{e} ± 0.05	
15–45	5	Right		2.20^{d} ± 1.06	0.92^{d,e} ± 0.54	0.04^{e} ± 0.01	
		Left			1.56^{d,e} ± 1.04	0.09^{e} ± 0.01	

[a] Mean values ± standard error of the mean. Means within a sampling group with the same superscripts do not differ significantly ($P > 0.05$). Values expressed as micromoles of glucose equivalents/g of muscle. [c] Values expressed as micromoles/g of muscle.

Table III. Effect of Myotomy (0 Hr) on Qualitative Properties of the Longissimus Muscle[a]

Sampling group[d]	Transmission values[b]: RL[e]	LL[e]	Subjective scores[c]: RL	LL
0–45(12)	49.7 ± 15.42	30.9 ± 13.68	8.4 ± 0.09	9.9 ± 0.12
0–15(5)	21.4 ± 12.19	24.3 ± 11.75	11.2 ± 0.23	11.0 ± 0.22
15–45(5)	22.7 ± 9.58	20.7 ± 8.43	10.4 ± 0.01	11.6 ± 0.16

[a] Mean values ± standard error of the mean. [b] Lower values correspond to more normal musculature. [c] Higher scores correspond to more normal musculature. [d] Number of pigs per sampling group shown in parentheses. [e] RL and LL correspond to right and left longissimus muscles, respectively.

and 19.2 for the RL and LL, respectively. Thus, ultimate qualitative properties of some longissimus muscles were markedly affected by 0 hr incision.

In order to determine if the effects of myotomy at 0 hr were a function of predisposed qualitative characteristics, three pigs (0–45 group) with the most desirable muscle properties were categorized as "normal" and three with the poorest quality were designated as "low" quality, based upon rates of postmortem pH decline, 24 hr transmission values, and subjective quality scores. Normal longissimus muscles had slower pH declines, lower transmission values, and higher subjective quality scores than low quality muscles (Table IV). Data from the three pigs in which the RL was adversely affected by 0 hr sample excision, as previously discussed (low-normal quality), are also included in this table. This designation (low-normal) was used to indicate the lower quality of the RL as opposed to the more normal quality of the LL muscles, which observations are opposite to those of all the other pigs. The pH, transmission values, and subjective quality scores of the RL muscles (0 hr incision) of the low-

Table IV. The Effect of Myotomy (0 hr) on Certain Qualitative Assessments of Normal and Low Quality Longissimus Muscles[a]

Quality Assessment	Normal quality[b]		Low quality[b]		Low-normal quality[b]	
	RL	LL	RL	LL	RL	LL
Transmission value	$12.7^{d} \pm 0.53$	$11.3^{d} \pm 0.37$	$69.9^{e} \pm 1.85$	$66.8^{e} \pm 1.27$	$78.7^{e} \pm 1.31$	$25.4^{d} \pm 0.83$
Subjective quality score	$11.3^{c} \pm 0.10$	$12.3^{c} \pm 0.11$	$6.0^{d} \pm 0.01$	$6.3^{d} \pm 0.01$	$7.3^{d} \pm 0.01$	$9.3^{c,d} \pm 0.02$
pH, 45 min postmortem	$6.10^{d} \pm 0.03$	$6.56^{c} \pm 0.03$	$5.84^{e} \pm 0.04^{e}$	$6.16^{d} \pm 0.05$	$6.06^{d,e} \pm 0.04$	$6.54^{c} \pm 0.05$
pH, 2 hr postmortem	$5.85^{d} \pm 0.05$	$6.29^{c} \pm 0.06$	$5.29^{e} \pm 0.04$	$5.37^{e} \pm 0.05$	$5.53^{e} \pm 0.05$	$6.16^{c} \pm 0.06$

[a] Mean values ± standard error of the mean. Means with the same superscripts do not differ significantly ($P > 0.05$). [b] Means of the muscles of three pigs from the 0-45 sampling group with most normal and lowest quality in both the right and left longissimus (RL and LL).

normal quality group approached those of the low quality group; whereas, the corresponding values of the LL muscles more nearly approached those of the normal group. Thus, the qualitative properties of some longissimus muscles were adversely affected by myotomy at 0 hr, as evidenced by the marked variation between right and left sides.

Figure 1 shows that low quality longissimus muscles had a more rapid pH decline than normal muscles, and that normal muscles were more severely affected by 0 hr sample excision than low quality muscles. At 45 min, pH values of the LL muscles were higher than RL values in all quality groups. At 2 hr, pH differences between LL and RL muscles existed only in the normal and low-normal groups. Data from the low-normal quality group concur with the observation that normal muscles were affected to a greater extent than low quality muscles, and indicate that myotomy at 0 hr resulted in postmortem changes comparable to those naturally occurring in low quality musculature.

In addition to the glycolytic metabolites previously discussed, levels of G-1-P, F-6-P, glucose, ADP, and AMP were also determined on normal and low quality longissimus muscles. All of the glycolytic metabolite data from the normal, low, and low-normal quality groups are presented graphically (Figures 2 and 3) to show the differences in response to 0 hr myotomy.

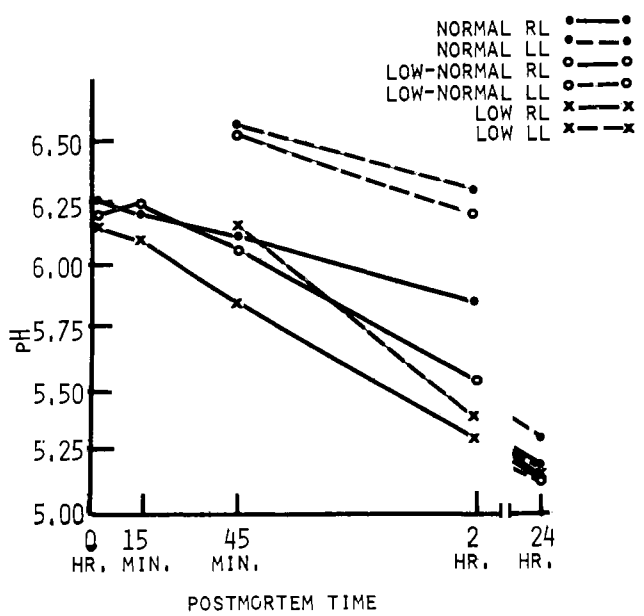

Figure 1. Postmortem pH patterns of longissimus muscles from normal, low, and low-normal quality groups as affected by myotomy at 0 hr

Glycogen and lactate levels (Figure 2) complement the pH decline, *i.e.*, glycogen diminution essentially paralleled pH drop while lactate accumulated in inverse proportion to these levels. Glycogen values were consistently lower and lactate levels uniformly higher in the low quality muscles than those from normal muscles, at least through 2 hr. At 2 hr, glycogen and lactate levels were similar for the low quality RL and LL samples, although the RL muscles of the normal and low-normal quality groups had considerably less glycogen and more lactate than the LL samples. Thus, myotomy (0 hr) had a greater effect on these metabolites in normal muscles than in those of lower quality.

The hexose monophosphate (G-1-P, G-6-P and F-6-P) levels are presented graphically in Figure 2. The G-6-P levels were consistently higher among low quality than nor-

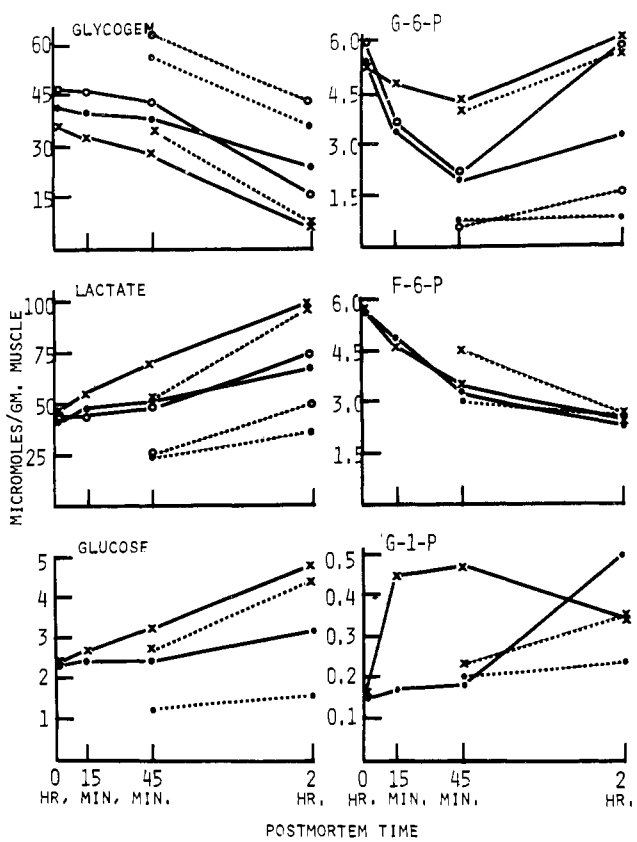

Figure 2. The effect of myotomy (0 hr) on levels of glycogen, lactic acid, glucose, glucose 1-phosphate, glucose 6-phosphate, and fructose 6-phosphate of right (solid lines) and left (broken lines) longissimus muscles from normal (solid circles), low (x's), and low-normal (open circles) quality groups

mal muscles, except at 0 hr. The effect of myotomy at 0 hr on G-6-P levels was greater among the normal muscles. The difference between the RL and LL G-6-P levels at 2 hr in the low-normal quality group was especially marked. Increased G-6-P levels would be expected at 45 min if inhibition of the phosphofructokinase enzyme occurred (Wilson *et al.*, 1967). Phosphofructokinase activity is reportedly pH sensitive and is inhibited by pH values of 6.0 or lower (Mansour, 1965). In the present study these low pH values were attained at or shortly after 45 min in all the muscles except the normal and low-normal quality LL muscles. These muscles retained higher ATP and had lower G-6-P levels than all other muscles.

The low quality LL muscles contained higher F-6-P levels, at 45 min than the other muscles. No differences in F-6-P levels were observed between quality groups. There were no differences in glucose levels at 0 hr between the normal and low quality RL muscles (Figure 2). Glucose levels increased more rapidly among the low quality muscles with postmortem time than in normal muscles, and were higher in the low quality muscles than in normal muscles at all time periods. These data are in agreement with those of Kastenschmidt *et al.* (1968). The RL muscles (0 hr incision) had more glucose than LL samples at corresponding time periods, and the differences between quality groups were greater among normal than low quality muscles.

Normal longissimus muscles had consistently higher ATP levels than low quality muscles, with the differences being especially marked among the LL muscles (Figure 3). Within quality groups the LL contained consistently more ATP than the RL muscles. This difference was greater among the normal and low-normal quality groups than in the low quality group. No detectable CP levels were observed for any of the low quality muscles. The LL muscles of both the normal and low-normal quality groups had considerably more CP at 45 min than the RL at 0 hr, 15, or 45 min. Normal LL muscles had appreciably less ADP than the other muscles (Figure 3). While ADP levels were relatively constant among the normal RL and low quality RL and LL muscles through 2 hr, ADP levels of the normal LL muscles increased between 45 min and 2 hr. The AMP levels were similar among all the muscles studied, except that normal RL muscles had higher AMP levels than the low quality RL muscles at 15 min. While the LL muscles had higher AMP levels than the RL muscles at 45 min and 2 hr, AMP levels of all muscles gradually decreased during this time interval.

These data show that myotomy of the longissimus muscles at 0 hr increased the rate of glycolysis and altered qualitative muscle properties. Normal muscles or those exhibiting a relatively slow rate of glycolysis were affected more by sample excision at 0 hr than low quality muscles or those which showed a relatively fast rate of glycolysis. Myotomy (0 hr) stimulated contractile activity within the entire incised muscle; however, the contractile activity of the excised sample *per se* was especially marked before it was frozen in liquid nitrogen. While ATP and CP are utilized by the contractile mechanism (Bendall, 1966; Lawrie, 1966), "slow-glycolyzing" muscles have been reported (Briskey and Lister, 1968, Kastenschmidt *et al.*, 1968) to contain more ATP and CP at the time of exsanguination than "fast-glycolyzing" muscles. Thus, stimulation of contractile mechanism by myotomy, especially in the excised sample in the present study, undoubtedly led to greater ATP and CP diminution than normally observed in "fast-glycolyzing" muscles. The reduced glycolytic rates in normal muscles not incised at 0 hr were, in all likelihood, attributable to relatively high ATP levels. The data presented in Figures 1 to 3 show that glycolytic rate was essentially inversely proportional to ATP level.

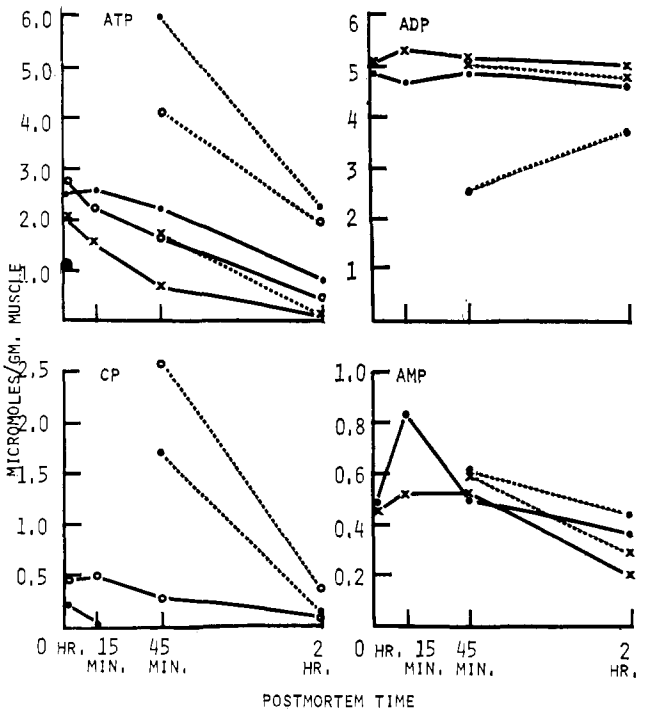

Figure 3. The effect of myotomy (0 hr) on levels of ATP, ADP, AMP, and creatine phosphate of right (solid lines) and left (broken lines) longissimus muscles from normal (solid circles), low (x's) and low-normal (open circles) quality groups

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