METABOLIC TYPE OF MUSCLES AND MEAT QUALITY IN STRESS-SENSITIVE AND STRESS-RESISTANT PIGS

PENKA MARINOVA, PAVEL KAMENOV
Institute of Animal Science, 2232 - Kostinbrod, Bulgaria

SUMMARY: The experiment has been conducted on 20 male Camborough pigs. For dividing the animals in both stress-sensitive and stress-resistant,Halotan-test was used. Pigs havee been fattened up to 100 kg of live body. Contents of enzymes and metabolites have been determined and physico-chemical analysis of muscles Longissimus dorsi /LD/, Semimembranosus /SM/ and Rectus abdominis /RA/ performed. Results obtained concerning glycolitic activity of muscles show that it is not influenced by stress-sensitivity of animals. Glycolitic potential is associated with metabolic type being higher in glycolitic muscles. In stress-sensitive animals glycolitic potential level is increased. Quality characteristics characterizing PSE-syndrome in stress-sensitive pigs are related to muscle type being best expressed in glycolitic type of muscles.

INTRODUCTION: Many pigs/in number/of commercial form derived from two-line hibrid Camborough for meat producing increased the interest to investigations on both stress-sensitivity and quality of production obtained. Spread of stress-ssyndrome in that population is 13 to 20 % /1, 2/. Studies on pphysico-chemical composition of meat are numerous and mainly in genetic aspect /5, 6, 7, 9, 10, 16, 17, 22/. Data are less about enzymatic activities of muscles which would indicate capacity of both glycolisis and mitochondrial occidation /18, 24, 25/. The aim of study was to establish the level of metabolic processes and glycolitic ability of three muscles post mortem regarding the meat quality in both stress-resistant and stress-sensitive pigs.

MATERIAL AND METHOD: Trial was conducted on 20 male Camborough pigs. For separating the animals in stress-resistant and stress-sensitive, Halotan-test has been used. Final live weight was 100 kg. Samples of muscles Longissimus dorsi /LD/, Semimembranosus /SM/ and Rectus abdominis /RA/ have been taken 45' min.p.m. for determining enzymes and metabolites. Activity of lactat dehydrogenesis /LDH/ was determined after Ansay's method /1974/, contents of glycogen and lactic acid according to Bergmeyer's method /1974/. For determining the glycolitic potential /GP/ formula recommended by Monin et al. /1985/ was used. Samples for physico-chemical analysis from the same muscles have been taken 24 h p.m. Results obtained were treated through one-factor variance analysis.

RESULTS AND DISCUSSION: Enzymes and metabolites. In Fig.1 is given LDH-activity in all the three studied muscles for both groups of animals. It is highest in m.LD, being even lower in m.SM it is close to that in m.LD. Significantly lower are the values for that characteristic in RA muscle, differences between muscles being significant /p$\leq$ 0,05/. A tendency to higher LDH-activity is observed in stress-sensitive pigs. Glycogen content in a descending series is: m.LD, m.SM, m.RA. Differences between m.LD and m.SM are given /table 1/. Stress-sensivity has not influenced that characteristic. Quantity of lactic acid is practically the same in m.LA and m.SM, and lower in m.RA. An effect of positive animals was established, for m.LD and m.SM it is proven at a higher significance degree /p$\leq$ 0,05/ compared to m.RA /p $\leq$ 0,100/.

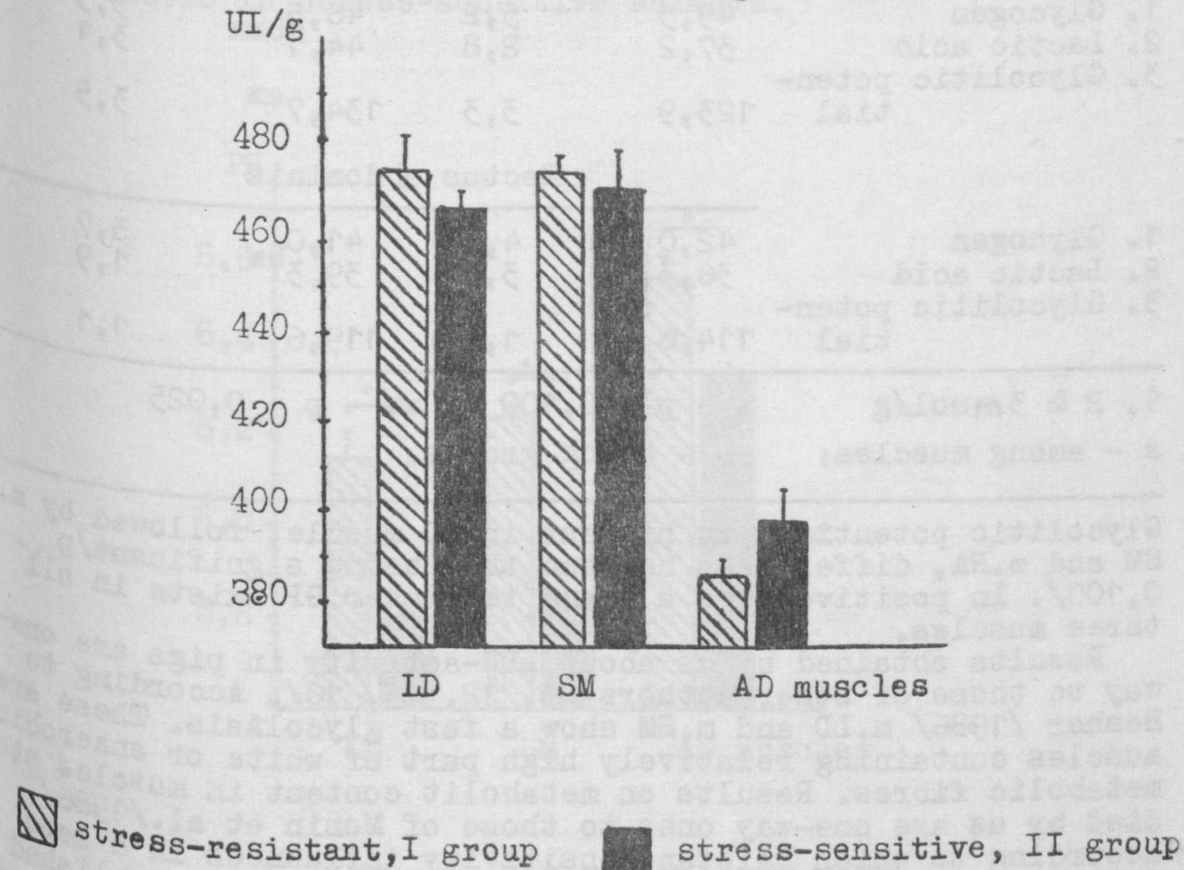

Fig.1. Values for LDH-activity in LD, SM, & RA muscles

Table 1. Metabolites and glycolitic potential in LD, SM and RA muscles.

Groups / Characteristics	I $\bar{X}$	$\pm \sigma$	II $\bar{x}$	$\pm \sigma$
		Longissimus dorsi		
1. Glycogen	67,5[a*]	6,1	60,0	4,9
2. Lactic acid	37,5	3,2	44,8[b**]	3,0
3. Glycolitic potential	142,5	5,2	149,6[a*]	4,2
		Semimembranosus		
1. Glycogen	49,5	5,2	46,5	5,5
2. Lactic acid	37,2	2,8	44,1[b**]	3,1
3. Glycolitic potential	123,9	3,3	134,7[a*]	3,5
		Rectus abdominis		
1. Glycogen	42,0	4,5	41,0	3,7
2. Lactic acid	36,3	3,5	39,3[b*]	1,9
3. Glycolitic potential	114,6	1,2	119,6	1,1

1, 2 & 3 mmol/g * - $p \angle 0,100$; ** - $p \angle 0,025$

a - among muscles; b - among groups.

Glycolitic potential is highest in LD muscle, followed by m. SM and m.RA, differences between them being significant/p ∠ 0,100/. In positive pigs a trend to higher GP exists in all three muscles.

Results obtained by us about LDH-activity in pigs are one-way to those of other authors /5, 12, 15, 16/. According to Besher /1986/ m.LD and m.SM show a fast glycolisis. These are muscles containing relatively high part of white or anaerobic metabolic fibres. Results on metabolit content in muscles studied by us are one-way ones to those of Monin et al./1986/, according to which Halotan-sensitivity influences in a less extent on them compared to muscle type. Tendency established by us toward a lower glycogen content in Halotan-positive animals shows that glycolisis post mortem in them has taken faster. In this respect results of Tarrant et al., /1972/ on a musclé sample taken imediately post mortem show that lactat level in white muscles is 80 μ mol/g the red ones 120 μ mol/g, i.e.extent of anaerobic glycolisis is nearly equal. After death glycolisis is more active in glycolitic muscles and pH-value is associated with formation of lactat.

Meat quality. pH_1-values /45' post mortem/ are given in Fig.2 and are lower for glycolitic muscles /LD & SM/. In oxidative-glycolitic muscles /RA/ these vales are higher /over 6,0/ and significant /$p \leq 0,05$/. Effect of stress-sensitivity has excerted different influence on that characteristic in single type of muscles. In m.LD and m.SM differences are significant at $p < 0,05$, while in m.RA $p < 0,100$. Results obatained by us for pH_1 in m.LD and m.SM are higher than these reported by Pinkas et al., /1987/ and Yablansky /1988/ for two-line hybrid pigs, but are one-way for lower values of this chacteristic in stress-sensitive animals.

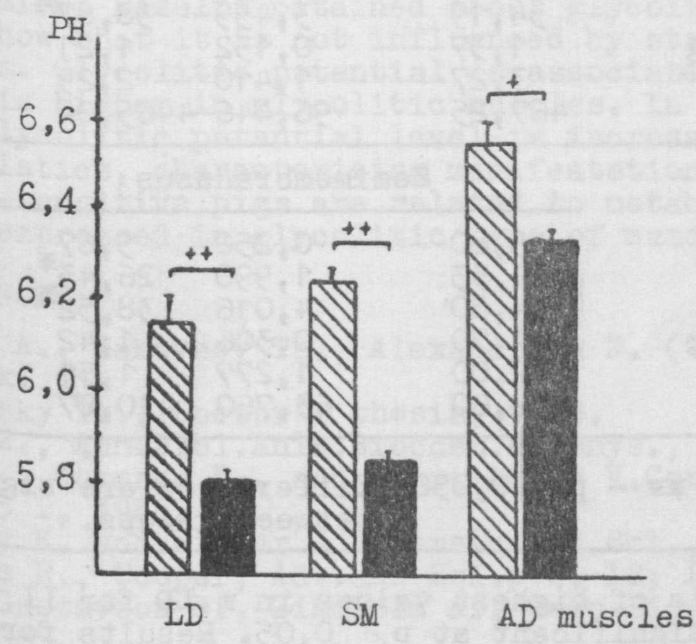

Fig.2. pH_1 - values /45 min.post mortem/

GP established by us shows a trend toward a higher level in animalsc of pH lower than 6,0, reducing in a course glycolitic toward a oxidative-glycolitic muscle, but relationship between these two characteristics is not yet well elucidated. Data about pH_2 measured 24 h post mortem are lower in m.LD and m.SM compared to m.RA /table 2/. Values for this characteristic show difference in the velocity of processes in animals of both groups. According to Lister /1971/ glycolisis stopping is associated with pH-value called "boundary". It is nearly 5,2 - 5,2 in glycolitic muscles in pigs.

Table 2. Physico-chemical analyisis of LD and SM muscles

Characteristics / Group	I $\bar{x}$	I $\pm\sigma$	II $\bar{x}$	II $\pm\sigma$
		Longissimus dorsi		
pH 24h	5,75	0,262	5,69	0,205
Colour, 525 nm	25,56	2,346	29,63**	1,911
WBC, %	34,19	3,459	38,87*	3,508
Myoglobin, mg/g	1,37	0,152	1,21	0,277
Fats, %	3,27	1,410	2,29	0,612
Collagen, mg %	467,25	96,446	4465,04	59,644
		Semimembranousus		
pH 24h	5,80	0,250	5,67	0,196
Colour, 525 nm	21,33	1,990	26,43*	3,000
WBC, %	34,80	4,016	38,52*	2,185
Myoglobin, mg/g	1,70	0,306	1,42	0,296
Fats, %	2,00	1,277	1,51	0,934
Collagen, mg/%	452,60	63,760	410,07	67,000

* - $p < 0,100$; ** - $p < 0,050$; differences are significant between groups.

Meat colour is of highest values in m.LD for II group, differences being significant at $p < 0,05$. Results for m.SM are one-way to these for m.LD, difference between groupsbeing significant at a lower significance degree /$p < 0,100$/. This characteristic depends in a great degree on both myoglobin content and on the proportion of its three forms /9/. Paler colour in II group animals is associated with denaturation of muscle proteins, which changes colour due to myoglobin.

The lack of significant differences in myoglobin content between groups in m.LD and m.SM confirms the results of a series of authors according to which changes in meat colour for stress-sensitive animals are associated to structural changes in muscular proteins /3, 14, 16/.

Fast post mortem glycolisis in II group animals has created conditions for increasing free water in both muscles as well, differences between groups being significative / p <0,100/.

Quantities of all qualitative characteristics of meat in animals of II group characterize it as Pale, Soft, Exudative meat.

Results obtained by us have established no significant differences between groups for both fats and collagen. They are close to those of Ollivier et al., /1978/ and Monin et al., /1981/, which do not find differences in that characterristic in m.LD, between stress-sensative pigs, being known that the first ones are of a better developed musculature.

CONCLUSION: Results obtained about glycolitic activity of muscles show that it is not influenced by stress-sensitivity of animals. Glycolitic potential is associated with metabolic type and is higher in glycolitic muscles. In stress-sensitive animals glycolitic potential level is increased. Qualitative characteristics, characterizing manifeatstion of PSE-syndrome in stress-sensitive pigs are related to metabolic type and are best expressed in glycolitic type of muscles.

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