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COMPARATIVE STUDY ON BOTH THE SIZE, METABOLIC TYPE OF MUSCLE FIBRES AND PHYSIOCHEMICAL COMPOSITION OF MEAT IN LARGE WHITE AND LOCAL PIGS

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INTRODUCTION

Primitive pig populations -- besides as a gene pool -- are also important for obtaining cheaper production in areas of both loose and semi-intensive rearing. In the region of Strandja, local black pigs reach 85 to 90kg live weight at nine to 10 months.

Investigations on these animals are scant and mainly in a quantitative aspect (Benkov, 1962; Georgiev *et al.*, 1959). Based on meat of primitive black pigs, Hlebarov (1921) reports it is palatable, suitable for both ham and sausages.

In a series of investigations, both meat composition and quality have been established to be influenced by hereditary and environmental factors (Essen-Gustavson and Lindholm, 1984; Kempster and Cuthberston, 1975; Monin *et al.*, 1981; Monin *et al.*, 1987). Differences in genotype, mode of rearing and lack of intensive selection in primitive pigs compared to high-selected breeds suppose they reflect in vivo on the function of muscle and exert influence on post mortem changes in meat. It is in that connection the comparative study of local pigs with Large White breed was conducted.

MATERIAL AND METHODS

This study used male local black pigs and ones of the Large White Breed, divided into two groups, by 16 each. Large White pigs have been fattened traditionally, in boxes until reaching 100 to 105kg of live weight at an age of seven to 7.5 months. Local pigs have been reared in pastures from 25 to 62 to 65kg live weight, being flushed twofold on concentrates. Until reaching 87 to 90kg and nine to 10 months of age, they have been fattened intensively. Samples for histochemical analysis were taken 45 minutes post-mortem for *m.longissimus dorsi* (LD) in the area of 12/13 rib and medial part of *m.semimembranosus* (SM). For their freezing and storage liquid nitrogen was used. Determination of both type and size of muscle fibres took place on cross serial cuts of 16m thickness and coloured for both succinatdehxdrogenase, à- glycerophosphatdehydrogenase (Nachlas *et al.*, 1960) and myofibrilar adenosine triphosphatase (Padykula and Gauthier, 1967) activities. For grading the metabolic type of fibres, nomenclature of Peter *et al.*, (1972) has been used. Muscular cell diameter has been measured through an eye-lens micrometer and this being the mean one of two perpendicular determinations of 50 fibres of So type and by 200 ones of both FoG and FG types of five randomly chosen fields of vision. Glycogen content was determined in homogeneity with HCl after the method of Dalrymple *et al.*, (1973).

Samples for physiochemical analysis were taken from the same muscles 24 hours post-mortem. Meat pH was determined directly through combined electrode, meat colour through Speckol at 525nm wave length, water binding capacity after the method of Grau and Hamm (1952), myoglobin after Hornsey (1956), collagen after Hergman *et al.*, (1963)and intramuscular fats after Soxhlet.

Results were treated statistically using analysis of variance procedures.

RESULTS AND DISCUSSION

Data obtained concerning the size of muscle cells in LD and SM show significant differences between single types, in both groups and in the group of animals (Table 1). In three types of fibres in local pigs, So-fibres are of lowest diameter, FG ones the greatest. Such differences between single types of fibres have been also established in Large White, but at a higher level of significance for both muscles. On comparing both genotypes, local pigs are characterized by significantly less size of muscle cells than FoG and FG metabolic types.

In our previous and other investigations there was also reported a less size of oxidative type of muscle fibres in both Large White and in other high-selected breeds (Essen-Gustavson and Lindholm, 1984; Pinkas *et al.*, 1985; Rahelic and Puac, 1980), indicating also such a differentiation in local pigs. In a comparative study of six swine breeds, Rahelic and Puac (1980) found that in more primitive pigs So fibres' size is greater than that of Large White and Swedish Landrace, the FoG- and FG fibre size increasing with selection intensity. With certain deviations for So fibre type, results obtained by us in these investigations are one-way to the above-mentioned authors.

Based on muscle fibres distributed in metabolic types, it is clear that local black pigs have significantly higher percentage content of So-fibres. It is to be noticed that in both muscle differences in FG-fibres parts between both genotypes are insignificant and the part of FoG-fibres in local pigs is reduced at the expense of those ones of So-type. Lower glycogen content established in local pigs gives also a reason to accept that LD and SM have more expressed oxidative features compared to those of the Large White. According to Essen-Gustavson and Lindholm (1984), wild pigs have lower glycogen content, since they utilize it aerobically and there is no need for rich resources. The same authors found that besides genetic factors, activity of animals also influences and induces higher content of I type fibres, IIA/IIIB ratio and aerobic capacity. Selection of pigs, according to a number of authors, increases the percentage of glycolitic fibres, in Mangalits the red/white fibres ratio being 1:3, in Large White and Landrace it is 1:5 (Rahelic and Puac, 1980).

Results of physiochemical composition of LD and SM muscles presented in Table 2 show that no significant differences exist concerning the pH45 and pH24 values between both genotypes. A certain trend to higher pH45 was observed in LD of local pigs, where lower glycogen content was also established. For all that, lower glycogen content in local pigs has been sufficient for reaching final pH24 about 5.5 to 5.6, like in other pig breeds (Ramsbottom and Trandine, 1948). Better water binding capacity in local pigs (high significance) in both studied muscles seems to be due to higher content of So-fibres and their better expressed oxidative character. Investigations of Goutefongea and Charpentier (1966) of 45 muscles in pigs and Linke (1972) based on histochemical analysis, show that metabolic type of muscles exerts an influence on WBC, in predominant type of red fibres Water Binding Capacity being better. Lack of significant differences in meat colour between both groups of animals, at a significantly higher myoglobin content in local pigs, in our opinion, is connected to a certain extent with higher intramuscular fat content. Similar results have been reported by Lawrie (1952) which considers that at a given age of animals and similar final pH values, higher fat content seems to reduce meat colouring intensity. The lack of significant differences in collagen content between local pigs and Large White in both muscles, we would hardly consider these results to support the data of Laurent *et al.* (1978) and Kovenen *et al.* (1980), according to which in slow contractive muscle type collagen content would be higher. Rede *et al.* (1986) summarized that primitive pig breeds in Europe have a tenderer meat than highly-selected breeds, being due to higher intramuscular fat content, a more succulent and aromatic meat approaching that of wild pigs.

CONCLUSION

Results obtained in the comparative study on primitive black pigs with the Large White Breed, show differences concerning the size of muscle cells, their metabolic type and in some physiochemical characteristics of ***m.longissimus dorsi*** and ***m.semimembranosus***.

Primitive pigs are of a significantly less size for both FoG and FG fibres, as well as higher percentage content of oxidative muscle fibres. Significantly higher is the content of both myoglobin, intramuscular fat and better water binding

capacity in primitive pigs compared to Large White Breed.

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Please note: Irregularities occurred throughout this reference listing. Contact the authors for assistance.

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Table 1. Size and metabolic type of muscle fibres in m.longissimus dorsi and m.semimembranosus.

Traits \ Muscles Groups	longissimu dorsi Large White X	longissimu dorsi Local Pigs X	semimembranosus Large White X	semimembranosus Local Pigs X
Diameter, µm				
So	53.13	52.76	54.02	53.04
FoG	57.38	54.70	59.81	55.54
FG	60.69	55.26	63.36	57.66
Types of fibres, %				
So	10.00	20.00	13.00	28.00
FoG	51.00	42.20	52.00	34.40
FG	39.00	37.80	35.00	37.60

[Ed.Note: Unable to establish location of significant differences. Please contact authors.]

Table 2. Physiochemical composition in m.longissimus dorsi and m.semimembranosus.

Traits \ Muscles Groups	longissimu dorsi Large White X	longissimu dorsi Local Pigs X	semimembranosus Large White X	semimembranosus Local Pigs X
pH45	6.02	6.14^{c***}	6.28	6.32
pH24	5.64	5.65	5.48	5.69
colour/525/	34.42	36.27	31.77	32.89
WBC, %	40.80^{c***}	34.57	39.84^{c***}	34.50
myoglobin, mg/g	1.25	1.74^{c***}	1.91	2.85^{c*}
lipids, %	1.40	3.31^{c***}	1.50	2.08^{c***}
collagen, mg/%	3.90	4.32	3.30	3.79
glycogen, µmol/g	71.80	64.80	68.00	55.60

Significance: c = between groups
*** P<0.025; ** P<0.05; * P<0.1.