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# Biometric and rheologic parameters and qualitative properties of meat from "Sarda" breed pigs: Preliminary results

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**Abstract.** The aim of the present study was to evaluate the impact of different breeding systems on the quality parameters of meat from Sarda pigs. Twelve male pigs, aging 15 months, were subdivided in three groups (A,B,C) homogeneous in number of subjects and mean weight (98.4±13.8 kg). Groups A and B were reared in *plein-air* and fed with commercial concentrate *ad libitum* and ground barley (1.8 kg/head/day) respectively. Group C was grazed on pasture and received a daily supplement of 500 g/head/day of barley grain. All the subjects were slaughtered after 7 months. A section between L2 to L5 was used to evaluate the lean, fat, rind, connective and bone yield. Samples of muscles *Longissimus dorsi* and *Psoas major* and inner fat were used to determinate colorimetric (CIELab) and rheologic (TPA test: 24h – 7days) parameters. Group A showed highest yields in fat (71.8%) and lowest in connective (1.2%) linked to lowest values in terms of hardness. Group B showed highest yields in lean (41.1%) and connective (2.6%) and lowest in fat (48.9%) linked to highest hardness and lowest springiness values. Group C showed intermediate values in lean (34.6%), fat (55.9%) and connective (1.5%) yields but the samples resulted more firm.

**Keywords.** Sarda breed pig – Colorimetric and rheologic parameters – Meat picking yield – Meat quality.

***Paramètres biométriques, propriétés rhéologiques et qualitatives de la viande du porc autochtone de race Sarde: Résultats préliminaires***

***Résumé.*** *L'objectif de ce travail est l'évaluation de l'impact des techniques d'élevage sur les caractéristiques qualitatives de la viande du porc autochtone de race Sarde. Douze mâles (15 mois), divisés en trois groupes (A,B,C), de poids (98,4 ±13,8 kg) et d'âge comparables ont été soumis aux techniques d'élevage suivantes: en plein air, avec administration d'un aliment commercial* ad libitum *(A) ou d'une ration d'orge moulue (B); au pâturage dans un bois (C), avec une complémentation quotidienne de 500 g d'orge en grain. À l'abattage (22 mois) ont été mesurés les rendements en maigre, gras, couenne, conjonctif et os sur une section de la région L2-L. Les paramètres colorimétriques (CieLab) et rhéologiques (TPA test: 24h - 7 jours) ont été étudiés sur les échantillons des muscles* Longissimus dorsi *et* Psoas major*. Le groupe A montrait des rendements élevés en gras (71,8%) et faibles en conjonctif (1,2%), corrélés à des valeurs faibles de dureté. Le groupe B présentait des rendements élevés en maigre (41,1%) et conjonctif (2,6%) et faibles en gras (48,9%), qui s'accompagnaient de valeurs de dureté supérieures et de souplesse inférieures. Le groupe C présentait des valeurs intermédiaires en ce qui concerne les rendements en maigre (34,6%), gras (55,9%) et conjonctif (1,5%), mais les échantillons étaient plus compacts.*

***Mots-clés.*** *Porc de race Sarde – Paramètres colorimétriques et rhéologiques – Rendement de carcasse – Qualité de la viande.*

## I – Introduction

The preservation of the autochthonous breeds is an useful tool for the biodiversity safeguard in the mediterranean areas, where the economic sustainability and productivity of the ecosystem are an essential requirement for their subsistence. Moreover the autochthonous race breeding

affects some important ecological, social and cultural aspects, such as safeguard of the regions, the rural community and their traditions.

Recently, initiatives in safeguard of autochthonous Sarda breed pigs were carried out in Sardinia, (Porcu *et al*., 2007), aimed at the valorization of meat and meat products. Consumers demand and appreciate these kind of products, where recognize genuineness, sustainability, as well as environment integration. On the other hand, due to the poor productive performance, the survival of this breed is strongly linked to the development of products.

Many researches showed that chemical composition and quality of meat of autochthonous breeds vary in relation to rearing system, age and weight at slaughtering (Lo Fiego *et al*., 2007), and in general, demonstrated non homogeneous characteristics (Gentry *et al*., 2004; Gonzales *et al*., 2007).

Few studies have been carried out about Sarda breed pigs (Porcu *et al*., 2010), that are usually reared by outdoors systems. Improve the knowledge on the quality of meat is an extremely important issue for its qualification, but you must also identify best breeding conditions to combining yields and quality.

The aim of the present study was to evaluate the impact of different breeding and feeding systems on some meat parameters of Sarda breed pigs.

## II – Materials and methods

Twelve Sarda breed male pigs, with 98.4±13.8 kg of body weight, were subdivided into three groups (A,B,C), each including four animals. Groups A and B were reared in *plein-air* and allowed *ad libitum* access to commercial feed and rationed ground barley respectively. Group C was grazed on woody pasture and received a daily supplement of 500 g/head/day of barley grain. The pigs were weighed weekly during the experiment, which lasted seven months. After slaughtering, a section of the region included between the $2^{th}$ and $5^{th}$ lumbar vertebra (Campodoni *et al*., 1999; Porcu *et al*., 2007) was isolated and dissected into the major tissues (lean, fat, connective and bone). Samples of *Longissimus dorsi*, *Psoas major* and inner fat were analyzed for: (i) Colorimetric parameters: one hour after slaughtering, L*, a*, b*, values were determined, in triplicate, by a Chroma Meter Minolta CR400, standard illuminant C; and (ii) Texture analysis: both 24 hours and 7 days after slaughtering, two cylinders (1.5 x 2 cm) were obtained for each sample of the muscle. TPA test was performed using a Universal Testing Machine TAXT plus Texture Analyser (Stable Microsystems Ltd.) with the Texture Exponent software (Vs.2.0.0.7). A double compression cycle test was performed using an aluminum cylinder probe (P/75). A time of 0 s was allowed to elapse between the two compression cycles (bite). Force–time deformation curves were obtained with a 5 kg load cell applied at a cross-head speed of 1 mm/s. The following parameters were evaluated: *hardness* (g, H), maximum force required to compress the sample; *cohesiveness* (Co), extent to which the sample could be deformed prior to rupture; *springiness* (m), ability of the sample to recover its original form after deforming force was removed; *adhesiveness* (g x s), negative parameter which represent the area under the abscissa after the first compression. The results were analyzed using GLM procedure of SAS (2001).

## III – Results and discussion

The evaluation of sample cuts (Table 1) showed the positive effects of different rearing and feeding systems on weight and fat percentage, being the mean values highest in Group A (6193.5±446 g and 71.8±2.5% respectively). Moreover samples from Group A showed lowest percentage in lean tissues (22.9%), connective (1.2%) and bone (4.1%).

**Table 1. Tissue composition of the sample cut of Sarda breed pigs reared with different systems (ls means ± S.E.)**

| | | Groups | | | |
|---|---|---|---|---|---|
| | N | A | B | C | P< |
| Sample cut weight (g) | 12 | 6193±446 a | 3396±446 b | 4086±446 b | 0.010 |
| Lean (%) | 12 | 22.9±1.4 c | 41.1±1.4 a | 34.6±1.4 b | 0.001 |
| Fat (%) | 12 | 71.8±2.5 a | 48.9±2.5 b | 55.9±2.5 b | 0.001 |
| Connective (%) | 12 | 1.2±0.3 b | 2.6±0.3 a | 1.5±0.3 b | 0.050 |
| Bone (%) | 12 | 4.1±1.5 | 7.4±1.5 | 8.0±1.5 | 0.210 |

a, b means with different letters within row were significantly different (P<0.05).

The results of the colorimetric parameters are shown in Table 2. Low values of L* (range 38.7±1.6 → 51.9±2.2) were observed, especially in the *Psoas major*, where the minimum values were showed in samples from Group A. Meat from the Sarda breed pig appears darker and redder than commercial intensive reared breeds (Gentry *et al*., 2004), and other autochthonous breeds (Gonzales *et al*., 2007). Indeed the value of a*, positively correlated to meat quality, was very high, especially in muscle *Psoas major*, in comparison to other studies (Franci *et al*., 2004).

**Table 2. Colorimetric parameters (TPA) in meat (muscles *Longissimus dorsi* and *Psoas major* and backfat) of Sarda breed pigs reared with different systems (ls means ± S.E.) at 24 h after slaughtering**

| | N | Groups | | | |
|---|---|---|---|---|---|
| | | A | B | C | P< |
| *Longissimus dorsi* | 12 | | | | |
| L* | | 48.3±2.2 | 50.1±2.2 | 51.9±2.2 | 0.53 |
| a* | | 16.0±2.0 | 15.4±2.0 | 14.9±2.0 | 0.93 |
| b* | | 9.9±1.2 | 10.0±1.2 | 10.1±1.2 | 0.99 |
| *Psoas major* | 12 | | | | |
| L* | | 38.7±1.6 b | 41.3±1.6 b | 46.0±1.6 a | 0.02 |
| a* | | 21.7±0.8 | 23.3±0.8 | 22.0±0.8 | 0.33 |
| b* | | 9.3±0.6 | 10.9±0.6 | 11.7±0.6 | 0.07 |
| Inner Fat | 12 | | | | |
| L* | | 78.5±0.9 | 77.8±0.9 | 75.2±0.9 | 0.08 |
| a* | | 1.4±0.2 c | 3.6±0.2 a | 2.8±0.2 b | 0.001 |
| b* | | 2.5±0.6 | 4.7±0.6 | 4.3±0.6 | 0.07 |

a, b means with different letters within row were significantly different (P<0.05).

The results of instrumental measurement of colorimetric parameters in inner fat showed a very high value of L* (mean value >75) and a significant difference between the groups regarding the a* value, that was higher in fat from samples from group B (3.6±0.2).

The results of the texture parameters in relation to the study groups, are shown in Table 3. Regarding the TPA test, significant differences between groups were not shown (p> 0.05) at 24 h nor 7 days after slaughtering. As expected, the hardness value decreased significantly with time in all samples. The springiness was higher in the samples from group A, and underwent a small increase during the maturation of meat at low temperatures. In samples from group C lowest values in terms of hardness were linked to the low percentage of connective. In group B highest hardness and lowest springiness values were correlated with the highest yields in lean

(41.1%), connective (2.6%) and lowest in fat (48.9%). The samples from group C resulted more firm and showed intermediate values in lean (34.6%), fat (55.9%) and connective (1.5%).

**Table 3. Texture parameters (TPA) in meat (muscles *Longissimus dorsi* and *Psoas major*) of Sarda breed pigs reared with different systems (ls means ± S.E.) at 24 h after slaughtering**

| | | Groups | | | |
|---|---|---|---|---|---|
| | N | A | B | C | P< |
| *Longissimus dorsi* | | | | | |
| Hardness (g) | 12 | 11229±2764 | 16888±2764 | 14628±2764 | 0.38 |
| Springness | 12 | 0.7±0.05 a | 0.5±0.05 b | 0.6±0.05 b | 0.05 |
| Cohesiveness | 12 | 0.5±0.05 | 0.4±0.05 | 0.5±0.05 | 0.65 |
| Chewiness (g/cm$^2$) | 12 | 3284±735 | 3031±735 | 3703±735 | 0.81 |
| Adhesiveness (g x s') | 12 | -98.51±22 | -66.5±22 | -73.69±22 | 0.58 |
| *Psoas major* | | | | | |
| Hardness (g) | 12 | 13317±1375 a | 9300±1375 b | 8133±1375 | 0.05 |
| Springness | 12 | 0.5±0.04 | 0.5±0.04 | 0.6±0.04 | 0.39 |
| Cohesiveness | 12 | 0.4±0.05 | 0.4±0.05 | 0.4±0.05 | 0.98 |
| Chewiness (g/cm$^2$) | 12 | 3263±854 | 1829±854 | 1756±854 | 0.41 |
| Adhesiveness (g x s') | 12 | -60.11±10 | -32.28±10 | -26.54±10 | 0.08 |

a, b means with different letters within row were significantly different (P<0.05).

## IV – Conclusions

Although the preliminary results, Sarda breed pigs are incline to deposit subcutaneous fat when have greater food supply, as demonstrated in other autochthonous breeds. The data resulted comparable with other trials realized under similar conditions. However, further studies, aimed to identify the rearing and feeding systems suitable to obtain meat with high nutritional and technological values, will be carried out.


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