Utilization and evaluation of the Italian heavy pig carcass

Russo V.

in

Aumaître A. (ed.).
The production of pig meat in Mediterranean Countries

Paris : CIHEAM
Options Méditerranéennes : Série Etudes; n. 1989-I

1989
pages 187-193

Utilization and evaluation of the Italian heavy pig carcass

Vincenzo RUSSO

University of Bologna - Italy

Italian pig breeding differs from that of other countries in that pigs for slaughtering have a live weight of between 150-170 kg and provide carcasses of 125-140 kg.

This kind of production is determined by the salami industry in Italy, which specializes in the production of seasoned, salted and raw ham, coppa (neck joint) and other prestigious types of salami.

Only pigs slaughtered at an age of about 10-12 months can provide the heavy cuts of mature meat required for this type of industry. This higher weight may surprise foreign breeders and experts as it is well-known that it involves an increase in the quantity of carcass fat and a decrease in the feed efficiency; these negative aspects, however, are offset not only by market demand, but by the possibility of amortizing the cost of the weaned piglet more effectively and of utilizing some dairy by-products, such as whey from milk. Indeed, the typical heavy pig production area is the Po plain, where there are numerous dairy factories which process most of the milk produced in Italy into typical cheeses (e.g. the renowned Parmesan).

Almost all cuts of the heavy pig carcass are processed.

Some industries produce all types of salami, while others specialize in the production of one or only few. The former generally carry out both the slaughtering and successive utilization of the carcasses, while the latter simply buy fresh cuts from other firms specialized in slaughtering. In other words, although a market for single cuts exists, there is no market for the entire heavy pig carcass.

Over the last 20 years, the production of a light pig has also developed in Italy. This represents a maximum of about 20% of the national production and is mostly used for meat consumption.

I - Carcass dissection and utilization of the joints

Jointing is carried out while the carcass is still warm, within 30-60 minutes of slaughtering. After removal of the feet (*zampetti*) and head, each side is divided into four lean cuts: ham, loin, neck (*coppa*) and shoulder; and four fat cuts: backfat (*lardo*), belly (*pancetta*), collar fat (*guanciale*) and flare fat (*sugna*). The most common method of jointing in use is known as *Modena* which is outlined here. The head is removed by cutting between the occipital bone and atlas and the feet are cut off at the area between the carpal and tarsal joint. The ham joint (*prosciutto*) is removed by performing a cut which is parallel to the sacral vertebrae and halfway between these and the symphisis pubica/symphisis ischiatica. The ham joint is composed of the pelvic-trochanteric muscles, the muscles of the thigh and buttock and of the legs with corresponding bones. The cut is then trimmed in different manners according to utilization. The loin is composed of the muscles of the dorsum, loin and rump along with the corresponding vertebrae and ribs, starting with the 5-7 thoracic vertebra. The neck joint is made

up of the cervical and dorsal muscles and corresponding vertebrae and ribs up to and including the 4-6 thoracic vertebra. The bones are then removed. The shoulder joint includes the muscular groups and the shoulder, arm and forearm with corresponding bones and is obtained by cutting the subscapular muscles from the trunk. The backfat is composed of the abdominal wall, which extends from the retro-sternal to the inguinal region and is separated from the backfat by a cut which is made halfway between the dorsal and ventral margin of the halfcarcass. The collar fat is formed by the adipose covering of the cheek and throat area. Peri-renal fat constitutes the flare fat.

With the exception of the loin, which is consumed as fresh meat, all joints are used to produce fresh, seasoned or cooked salami, as seen in **Table 1.** Since older heavy pigs yield more mature meat, lose less weight during seasoning and provide tastier end-products, they are especially suitable for typical seasoned hams, for *coppa* and quality salami products such as *Felino* and other types, which are less famous but greatly appreciated in their area of production.

The characteristics of heavy pigs are particularly important for Parma ham, the production of which requires an initial weight of 13-15 kg which is then reduced to 11-13 kg after trimming, so that after at least 12 months of seasoning with limited quantities of salt only, a sweet end-product of 8-10 kg is obtained.

II - Carcass characteristics

It has already been said that the salami industry considers a warm carcass weight of beween 120 and 140 kg optimal, but in reality it can vary greatly. In a sample of 205 carcasses chosen at random over a period of one year from an industrial abattoir situated in the most typical heavy pig production area, the average warm weight was equal to 135.2±14.5 with a minimum of 91 kg and a maximum of 176 kg, corresponding to about 110 and 215 kg live weight.

The most common weight categories were 120-130, 130-140 and 140-150, which accounted for 69.7% of the carcasses (**Table 2**). 40.5% of the carcasses were heavier than 140 kg and 13.7% lighter than 120 kg.

The weight of the single joints and the joint yield of the side, in the same sample group, are reported in **Table 3.** It shows that one heavy pig carcass provides 56.5% lean joints and 37.4% fat parts. The **ratio** between the former and the latter averages 1.5.

Other carcass characteristics concerning backfat and dorsal muscle thickness and lean meat percentage are reported in **Table 4** (Russo *et al.*, 1986). Backfat thickness in the lumbar and dorsal area averages between 36 and 41 mm but varies greatly from carcass to carcass.

Average muscle thickness is about 55-60 mm and less variable than backfat thickness. This is probably because, being older, the pigs reach a muscular development, which is close to that of the adult animal. Finally the same table shows that the average percentage of lean meat content of the heavy pig carcass, calculated on the basis of percentage of lean joints using an existing equation (CEC, 1979), is equal to 43.0 ± 3.9% and varies from a minimum of 33.7% and a maximum of 52.1%.

III - Carcass assessment

Italy has little experience to draw from regarding commercial carcass classification since the transactions between breeders and abattoirs are based on live weight and transactions between abattoirs and successive utilizers concern single cuts and not whole carcasses. Only a few co-operative factories buy pigs according to dead weight, based on subjectively assessed carcass quality.

Increased interest has recently been shown in this form of commercialization due to the effect of the new pig carcass classification table adopted by the EEC. This is based exclusively on the percentage of lean meat content, assessed objectively with automatic instruments which measure the thickness of backfat and of other parts of the carcass. Research has been carried out in order to acquire data on the lean meat content of Italian heavy pig carcasses and to find a valid estimation equation for the heavy pig carcasses which can be used in the Danish instrument, Fat-O-Meater (Russo *et al.*, 1986).

The percentage of carcasses which falls into the various classes of the new EEC classification table

is reported in **Table 5**. This shows that of the whole sample, no carcass falls into class E; the highest lean meat category, and that the majority, i.e. 47.3%, fall into class O. Of the rest, 6.8% fall into class U, 21.5% into class R, and 24.4% into P. The same table shows the negative effect of weight on the lean meat content of the carcasses. Below 120 kg, the most common classes are represented by U and R, while for the heavier carcasses, O and P classes predominate. In particular, 85.4% of the carcasses heavier than 135 kg fall into these two classes.

If these results referred to the light pig, they would be very poor, but they can be considered satisfactory for the heavy pig. This is made more obvious by considering that for heavy pig production, breeds or strains with exceptional muscular development, which generally present poorer meat, are not used. Instead the Large White and the Italian Landrace, with a tendency towards harmonious development of all muscles, are used.

In the same research simple correlations were calculated between lean meat percentage and some characteristics of the carcass, such as backfat thickness, *longissimus dorsi* muscle thickness, subjective assessment class and carcass weight. The residual standard deviation of the prediction equations of lean meat percentage were also calculated introducing each of the above-listed characteristics. Multiple equations of regression of the lean meat percentage on all combinations of the characteristics mentioned were also calculated in order to find the best. Backfat thickness presents the highest correlation with lean meat percentage. Of the various measurements, the highest coefficient of correlation was found for the measurement taken at the last rib at a distance of 6.5 cm from the dorsal mid-line. The carcass weight and subjective assessment class are found to be moderately correlated with lean meat content. However, no correlation was found between lean meat content and the thickness of the *m. longissimus dorsi*, taken between the 3rd - 4th last rib (**Table 6**) .

The best prediction of lean meat percentage of the heavy pig carcass can be obtained with the equation based on three measurements of backfat thickness (lateral at the last and between the 3rd - 4th last rib and central loins on mid-line over *gluteus medius*) and the subjective assessment.

Nevertheless, from an applied point of view, it may be better to use another equation based only on the two lateral measurements of backfat and on carcass weight, even though with this equation there is a minimal loss of estimation accuracy. However, by eliminating one fat thickness measurement, classification efficiency is considerably increased in terms of speed and cost. Furthermore by substituting subjective assessment with carcass weight, which in any case must be recorded for payment, disagreements between breeder and abattoir can be avoided.

For the utilizer of heavy pig carcass, meat quality is very important, not only as regards nutritive and **organoleptic** aspects, but also from a technological point of view.

Technological, qualitative characteristics are of particular importance, because they determine the aptitude of the meat for the production of high quality salami. Only meat of a uniform light red colour and which is not watery, can be used to produce typical seasoned, salted and raw hams, like Parma and St. Daniel ham.

It is for this reason that the percentage of carcass with PSE or DFD meat is very low. In a recent survey carried out on about a thousand pigs, the former alteration was found in only 4.1% and the latter in only 0.5% of the carcasses (Bosi *et al.*, 1986; Russo *et al.*, 1985). But PSE and DFD represent extreme manifestations of poor meat quality. Even in meat considered normal, important differences in qualitative characteristics can be found, which can influence yields and commercial and **organoleptic** characteristics of Italian salami.

In subjective assessments of meat quality, these differences do not show up to an acceptable degree of precision. In the last few years, there has consequently been a growing demand for objective methods of assessing meats along the slaughtering-chain. Recent research (Russo *et al.*, 1985) showed that the pH, which can be found easily and rapidly, and water holding capacity, measured both by the Filter Paper Press and the Kapillar Volumeter method, are no better than subjective assessments at forecasting from the slaughtering phase what the final characteristics of the meat will be from single carcasses. These parameters, however, can be used effectively in comparative assessment of whole lots of pigs.

Colour measured with the L, a, b, system (Santoro, 1978) appears to be more interesting. Indeed in another study (Russo *et al.*, 1985), the parameters L and b of the above-mentioned system, which thanks to be availability of portable instruments can be measured on the slaughtering chain, have shown a higher degree of association than the pH_1. This represents an important index of technological quality of meat, because such parameters are translated into direct economic losses for the slaughtering and processing industries.

Nevertheless, the problem of objective assessment of meat quality remains unsolved and requires considerable research effort.

Research over the next few years should pursue the objective of linking carcass assessment, based on lean meat content, with objective assessment of meat quality, to find a system of classification which is better suited to the heavy pig, used for production of high quality Italian salami.

References

Bosi P., Russo V., Casini L. and Nanni Costa L., 1986. Indagine sul pH_1 di alcuni muscoli di suino pesante. Zoot. Nutr. Anim., 12:81.

C.E.C., 1979. Development of uniform methods for pig carcass classification in the EC. "Information on Agriculture N° 70 - Report Study P.201". Office for Official Publications of the EC - Luxembourg.

Russo V., Bosi P. and Nanni Costa L., 1985. Evaluation of meat quality characteristics in the Italian heavy pig. In "Evaluation and Control of Meat Quality in Pigs". EC Seminar Dublin, 21 and 22 November.

Russo V., Nanni Costa L., Lo Fiego D.P. and Santoro P., 1985. Ricerche sulle perdite di sgocciolamento della carne del suino pesante. Atti VI° Conv. Naz. Assoc. Scient. Prod. Anim., Perugia 28 Maggio-1 Giugno.

Russo V., Nanni Costa L., Lo Fiego D.P., Bosi P., 1986. Determinazione del contenuto in carne magra delle carcasse del suino pesante con l'apparecchiatura danese Fat-O-Meater (FOM) ai fini della nuova classi ficazione della CEE. Zoot. Nutr. Anim., 12.

Santoro P., Rizzi L. and Mantovani C., 1978, Colore e contenuto di mioglobina in carni di tacchini macellati a diverse età. Zoot. Nutr. Anim., 4:147.

Table 1: Utilization of the various joints of the heavy pig carcass

Joints	Utilization
Lean joints	
Ham	- salted and seasoned for Parma, S.Daniele and other hams - cooked
Shoulder	- typical seasoned and cooked meats (*insaccati*) - cooked
Loin	- fresh consumption (chops)
Neck (*coppa*)	- salted and seasoned
Fat joints	
Belly	- salted and seasoned - defatted for typical seasoned salami (*Felino salame*)
Backfat	- outside layer minced or cubed in the sausages - processed for lard
Collar fat	- cubed in the *mortadella*
Flare fat	- processed for lard
Other joints	
Ham, shoulder, loin, coppa, and belly trimmings	- for fresh, seasoned or cooked sausages
Head	- stripped for cooked sausages (*zampone* and *cotechino*)
Feet	- boned and defatted (wrapper for *zampone*)
Skin	- minced in the *cotechino* and *zampone*

Table 2: Overall distribution of hot carcass weights in a random sample of carcasses

Weight class (kg)	% Carcasses
90-100	0.5
100-110	3.9
110-120	9.3
120-130	21.9
130-140	23.9
140-150	23.9
150-160	13.2
160-170	2.4
170-180	1.0

Table 3: Hot weight of the various untrimmed joints and joint yield of the halfcarcass (mean ± s.d.)

Joints	kg	%
Half carcass	67.1±7.2	-
Ham	15.2±1.6	22.7±1.2
Loin	8.9±1.0	13.3±1.2
Neck	5.7±0.6	8.6±0.7
Shoulder	7.9±0.9	11.9±0.9
Total lean cuts	37.7±3.8	56.5±3.1
Backfat	9.9±2.1	14.6±2.2
Belly	8.2±1.2	12.3±0.9
Collar fat	4.9±0.8	7.3±0.8
Flare fat	2.2±0.6	3.2±0.7
Total fat cuts	25.2±4.2	37.4±3.5

Table 4: Mean values and measures of variation for the characteristics determined on the carcasses

	Number of carcasses	Mean±s.d.	C.V. %	Min Value	Max value
Cold carcass weight (kg)	205	132.5±14.2	10.7	90	173
Central backfat thickness:					
- Loin (mm)	205	36.7±7.6	20.7	13	62
- Last rib (mm)	205	38.0±7.2	18.9	18	55
Lateral backfat thickness:					
- 8cm 3/4 last loin vertebra (mm)	200	40.7±9.1	22.4	22	71
- 8cm 3/4 last rib (mm)	200	35.8±7.7	21.5	18	60
- 6.5cm last rib (mm)	205	37.0±7.2	19.5	16	55
M. longissimus dorsi **thickness:**					
- 8cm 3/4 last rib (mm)	200	57.0±7.1	12.5	37	85
- Lean meat (%)	205	43.0±3.9	9.1	33.7	52.1

Table 5: Percentage of carcasses comprised in the classes of the new EEC pig carcass classification scheme according to weight

Lean content (class) %		All	Carcass weight (kg)			
			<105	105-120	120-135	>135
≥55	(E)	-	-	-	-	-
≥50 but <55	(U)	6.8	50.0	7.4	8.1	2.1
≥45 but <50	(R)	21.5	12.5	44.5	25.7	12.5
≥40 but <45	(O)	47.3	25.0	40.7	50.0	48.9
<40	(P)	24.4	12.5	7.4	16.2	36.5
		100.0	100.0	100.0	100.0	100.0

Table 6: Prediction of carcass lean percentage from different single measurements (s.d. of lean percentage = 3.87)

	r	r^2	residual standard deviation
Carcass weight	-0.400	0.160	3.56
Backfat thickness measurements:			
- central loin	-0.753	0.567	2.55
- central last rib	-0.694	0.482	2.80
- lateral 8cm 3/4 last loin vertebra	-0.573	0.328	3.12
- lateral 8cm 3/4 last rib	-0.784	0.615	2.36
- lateral 6.5cm last rib	-0.844	0.712	2.08
M. Longissimus dorsi m. **thickness:**			
- lateral 8cm 3/4 last rib	+0.019	0.0004	3.81
Type class score	-	0.160	3.57

All coefficients were statistically significant ($P<0.01$) except the one concerning *longissimus dorsi* muscle thickness ($P>0.05$).