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Chapter

Negre Mallorquí (Majorcan Black) Pig

Joan Tibau, Neus Torrentó, Raquel Quintanilla Aguado, Joel González, Maria Angels Oliver, Marta Gil, Jaume Jaume and Nina Batorek-Lukač

Abstract

Negre Mallorquí pig is a native breed from Mallorca, characterized by its high rusticity and adaptation to the Mediterranean climatic conditions. The present chapter presents the history and current status of this breed, its phenotypic characteristics, the particularities of its production system and main products from this Mediterranean native pig breed. Data come from the scarce literature about Porc Negre Mallorquí breed, adding non-published data obtained during the TREASURE project. Reproductive performance was estimated by means of sow age at first parturition, litters per sow per year, piglets alive per litter, piglets birth and weaning weights, percentage of stillborn per litter, death rate percentage from birth to weaning, duration of lactation and farrowing interval. Growth performance was estimated by means of average daily gain and daily feed intake in several production periods. Carcass traits were evaluated by means of age and weight at slaughter, hot carcass weight, carcass yield and back fat thickness in several points. Meat quality traits were evaluated by means of pH at 45 min and 24 h after slaughter, objective colour, intramuscular fat content and fatty acid composition of intramuscular fat and back fat. The current chapter defines a first review about this local pig breed.

Keywords: untapped European breed, TREASURE, productive traits, phenotype, Spain

1. History and current status of the breed (census)

The Porc Negre Mallorquí, Cerdo Negro Mallorquín in Spanish and Majorcan Black Pig (MBP) in English, is a native breed from Mallorca, characterized by its high rusticity and adaptation to the Mediterranean climatic conditions [1]. The MBP is the only native pig breed in state of conservation in the Balearic Islands, declared as in danger of extinction. It is uncertain to assure the origin of this breed but the existence of pig livestock and pork consumption in Mallorca dates from the period of the first settlers, approximately 3500 BC [2]. The MBP reared nowadays is the sum of the genetic origins and the equilibrium between selection pressure by different civilisations, and the natural adaptation of the breed in the territory [3]. Very few studies exist about MBP genomics, but Clop et al. [4] found that this breed lacks for Asian haplotypes and halothane sensitivity gene,

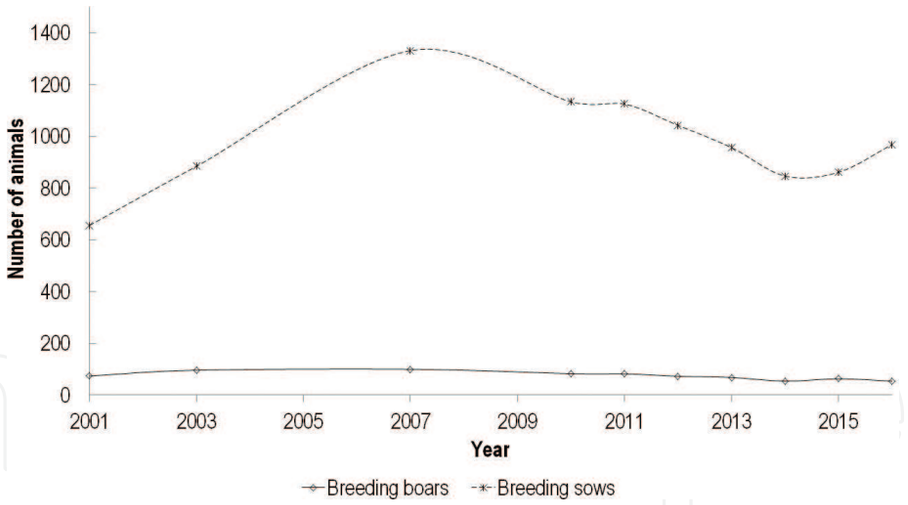


Figure 1.
Census of Porc Negre Mallorquí pig breed, presenting number of sows and boars per year, starting with the year of herd book establishment.

indicating a long-lasting geographical and genetic isolation. This breed had a great importance in the economy as well as in the Majorcan lifestyle until the middle twentieth century [3], contributing to the cultural heritage of the Island. Several circumstances promoted the reduction of pig numbers, such as the effect of diseases, and, more recently, the introduction of leaner pig breeds, the migration from farms to cities because of the tourism growth and the reduced generational renewal. Nevertheless, the MBP lived on as a source of protein and fat, because of its adaptation to the local environment and its ability to exploit the scarce natural resources of the Island [5].

Nowadays, the MBP Producers Association promotes its production and controls the herd book. Census of Negre Mallorquí pig breed is presented in **Figure 1**. Presently, there are 59 registered farms of Negre Mallorquí pigs with about 969 breeding sows and 54 boars in the latest available status (August, 2016 [6]).

The main meat product obtained from these pigs is the "sobrassada de Porc Negre Mallorquí", a specialty fat-rich cured sausage granted with a PGI certification. Another appreciated product is Mallorcan suckling pig "Porcella", the three-month purebred MBP piglet eaten mainly roasted for Christmas. It is estimated that around 2000 piglets are sold yearly as "porcella" [7], which is approximately 15% of piglets produced per year. The revenues obtained from "porcella" are a key factor for the durability of the reproductive farms, and therefore, the breed itself, contributing to its sustainability. It is especially worth mention the particularities of this production system regarding its main product, the "sobrassada", since almost the whole carcass is used to elaborate them, by mincing the ham, shoulder, loin, belly and back fat.

2. Exterior phenotypic characteristics

The MBP breed morphology information is summarized in **Table 1**. It is a rustic, medium-sized breed with high percentage of fat tissue (as in other Mediterranean pig breeds: Iberian, Nero Siciliano and Nero Casertano). This breed presents black or grey skin colour, and tassels in the neck (seen on **Figure 2**), pendulous ears and a concave nose profile (**Figures 2** and **3**).

Measurement (average)	Adult male	Adult female
Body weight (kg)	115	120
Tail length (cm)	40	40
Ear length	Large	Large
Height at withers (cm)	70	69
Number of l functional teats	9	9

Table 1.
Summary of morphology information on Negre Mallorquí pig breed.



Figure 2.
Negre Mallorquí sow with piglets.



Figure 3.
Negre Mallorquí boar.

3. Geographical location and production system

The farms rearing MBP (n = 61; **Figure 4**) are located all over Mallorca Island. Although the traditional production areas are near the sea because of specific vegetation, more than 60% of animals are located in the southeast of the island, corresponding with the zone of major production of cereals, and most of them have complementary farming and agricultural activities. The farms are classified according to their functioning as: (a) farrowing units (49.4%) focused in producing reproductive sows and selling piglets as "porcellas" or to the fattening units; (b)

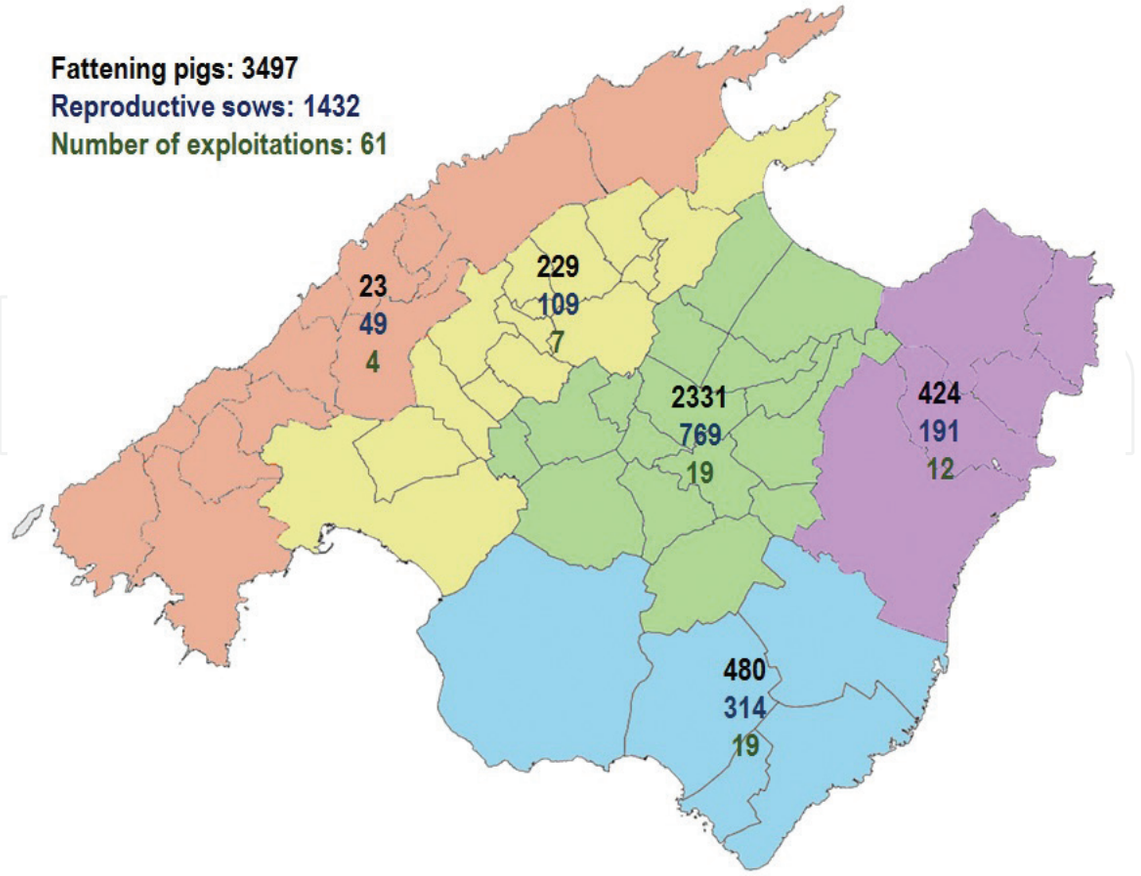


Figure 4.
*Distribution of MBP production farms by municipalities (excluding farms that have been exclusively engaged in fattening). * The maximum number of farms in one municipality is 12 (Manacor).*

fattening units (13.9%) focused in rearing piglets until slaughter weight; (c) mixed units (36.7) which produce piglets some sold as "porcella" and some fattened until slaughter at heavy weights (150 kg body weight and average 12 months of age). A characteristic of MBP farrowing farms is seasonality of production, piglets farrowed in October to November are consumed as "porcella" during Christmas time (with a live weight lower than 10 kg), whereas piglets farrowed in May are either consumed as "porcella" from June to July or fattened for 12–18 month to produce "sobrassada". The MBP is always managed in an extensive way, characterised by low-level breeding and feeding conditions [5]. Feeding regime is traditionally based on pasture (**Figure 2**), cereals (barley), legume seeds, figs, almonds, acorns and several Mediterranean shrubs. Aside of natural feeding resources, sows are fed with commercial diets during lactation and pregnancy and growing pigs are supplemented with barley and green peas. Growth figures are related to the natural resources availability (land quality and rain) and the supplementation in the previous weeks before slaughtering.

4. Organisations for breeding, monitoring and conservation

Recovery and promotion of the breed started thanks to the interest of a group of local producers and meat processors to obtain "sobrassada" (a dried and fermented sausage, highly seasoned with paprika, pepper and salt) maintaining the characteristics of the pure breed production system. In 1994, MBP products obtained the recognition of "Protected Geographical Indication" (P.G.I.) for the "sobrassada", and in 1997, the Producers Association of Majorcan Black Pig (ARPNMS) started

Name of organisation	Address	Web address
The Majorcan Black Pig Breeders Association	Agua 4, 07510 Sineu (Palma de Mallorca), Spain	/
Serveis de Millora Agrària i Pesquera (SEMILLA), Government of the Balearic Islands	Eusebi Estada, 145. 07009 (Palma de Malorca), Spain	http://www.caib.es/sites/semilla/ca/gerencia-77038/?campa=yes
IRTA—Animal Breeding & Genetics	Torre Marimon, 08140 Caldes de Montbui (Barcelona), Spain	http://www.irta.cat/en/grup/animal-breeding-genetics/

Table 2.
Contact details of breeding organisation for Porc Negre Mallorquí pig breed.

the herd book of the breed with close to 400 reproductive sows. Semilla, a service of the Balearic Government, gives technical support to preserve and promote the breed. Individual identification of animals is mandatory, and pedigree information is used to limit the incidence of inbreeding (**Table 2**). During years, only the morphological traits were the criteria to select the best boars. At present, there is a specific conservation programme to reduce inbreeding based on continuous exchange of genetic material across herds, with a replacement rate around 33%. In addition, auction sales and reproducer exhibitions are celebrated to promote genetic exchanges across farms.

5. Productive performance

5.1 Reproductive traits

Basic data obtained on reproductive traits in this review are presented in **Table 3**. The management of reproduction is very simple. In extensive production system, females and males there are kept together, except during the lactation period; thus, there is no controlled mating, and paternity of young piglets is uncertain, especially as free piglet adoption is not uncommon between sows [1, 5]. The reported age of sows at first parturition is 12 months [9]. On average, sows of MBP breed have 2.0 litters per year [1, 8, 9] with 6.8–7.5 piglets [1, 5, 9] of average 0.9 kg live body weight [9]. Stillborn percentage of piglets is 5.1% [1], whereas piglet mortality rate until weaning in the considered studies was 20.0% [1, 9], which is expected for an extensive production system. The farrowing interval is 180 days [9], whereas duration of lactation is over 4 weeks (46 days; [8]), and in some cases, especially in winter, young piglets (close to 8 kg live weight) are removed from the litter and consumed as "porcellas" [1].

5.2 Growth performance

Basic data on growth performance obtained in this review are presented in **Tables 4** and **5**. Due to big differences between studies with regard to the live weight range covered, we defined the stages for growth performance as lactation (regardless of how long it was), growing stage (from weaning to approximately

References	Sow age at first parturition (mth)	Litters per sow per year	No. of piglets alive per litter	Piglet live weight (kg)	Stillborn per litter (%)	Mortality at weaning (%)	Piglet weaning weight (kg)	Duration of lactation (d)	Farrowing interval (d)
[1]	.	2.0	7.5	.	5.1	20.0	.	.	.
[8]	.	2.0	.	.	.	.	11.4	64	.
[9]	12	2.0	7.0	0.9	.	20.0	.	.	180
[5]	.	.	6.8	.	.	.	.	.	.

mth = month, d = days.

Table 3.
Summary of collected literature data on traits of reproduction in Negre Mallorquí pig breed.

References	Feeding	No. of animals	ADG lactation[1]	ADG growing[2]	ADG fattening[3]			ADG birth-slaughter[4]
					Early	Late	Overall	
[1]	Rest		.	405	613	.	.	.
[8]	Rest	1022	.	.	.	.	410	.
		250	200	.	.	.	.	.
[10]	Rest	66	.	.	.	.	.	377
[11]	.	18	.	.	.	.	.	371
	.	39	.	.	.	.	.	360
[12]	.	.	.	.	.	543	.	.
	.	.	.	.	.	471	.	.

No. = number; ADG = average daily gain in g; Rest = restrictive feeding regime.
[1]ADG in a period of lactation regardless of how long it was.
[2]ADG in the growing period estimated from weaning to approximately 30 kg live body weight.
[3]ADG in the fattening period is reported for early and late fattening stages estimated between approximately 30 and 60 kg live body weight and above 100 kg live body weight, respectively. Sometimes, the source provided only the overall growth rate for the whole studied period (in that case defined as overall).
[4]Calculated from the data given on live weight and age of pigs.

Table 4.
Summary of collected literature data on growth performance in Negre Mallorquí pig breed.

References	Feeding	No. of animals	ADFI fattening[1]	
			Late	Overall
[8]	Rest	1022	.	2.95
[12]	.	.	2.76	.
	.	.	2.55	.

No. = number, ADFI = average daily feed intake in kg/day; Rest = restrictive feeding regime.
[1]ADFI in a period of fattening is reported for late fattening stage estimated above 100 kg live body weight and as the overall daily feed intake for the whole studied period (from approximately 30 kg body weight until slaughter).

Table 5.
Summary of collected literature data on average daily feed intake (in kg/day) in Negre Mallorquí pig breed.

30 kg live body weight), early fattening stage (estimated between approximately 30 and 60 kg live body weight) and late fattening stage which corresponds to finishing period in MBP breed (estimated above 100 kg live body weight). Sometimes, the source provided only the overall growth rate for the whole fattening stage (defined as overall) or even from birth to slaughter (defined as birth-slaughter, which is often calculated from the data given on live weight and age of pigs). It should also be noted that the collected studies simulated practical conditions of the extensive production systems used not aiming at evaluation of the breed potential for growth. Traditional growing period is longer than 12 months and the minimum live weight accepted to produce "sobrassada" is 120 kg [1]. Males to be slaughtered are castrated at a young age [1]. Daily gain in the period of lactation was 200 g/day [8] and increased to 405 g/day in growing [1], 613 g/day in the early fattening stage [1] and 507 g/day in the late fattening stage, which corresponds to the finishing period [12]. In overall, a fattening stage gain of 410 g/day was observed [8], whereas the average daily gain in the period from birth to slaughter was 369 g/day [10, 11] within the considered studies of MBP breed observed in the extensive system of production.

In considered studies, the information on feed intake and feed nutritional value was scarce. Production of MBP is extensive and is characterized by the use of endogenous resources in their diet: grass, Mediterranean shrubs, legumes, seeds, figs, almonds and acorns. In sows, natural feeding resources are supplemented during lactation and pregnancy with commercial diets, and in growing pigs with barley and peas. Cereals are usually subjected to a grinding treatment to be transformed into flour. Jaume et al. reported that the average daily feed intake of finishing MBP (105–152 kg body weight, feed mixture of 80% barley and 20% peas) was 2.8 kg/day [12], whereas in the overall fattening period, an average 3.0 kg/day of granulated grains was distributed to MBP according to the results of Tibau [8]).

5.3 Body composition and carcass traits

Basic data obtained in this review with some of the most commonly encountered carcass traits that could be compared are presented in **Table 6**. In considered studies, pigs of Negre Mallorquí breed were slaughtered at approximately 374 days of age [8, 10, 11], at an average 136 kg live body weight (100–158 kg; [8, 10, 11, 13, 17]) and reached an average carcass weight of 106 kg [8, 10, 11, 13–17] and a dressing yield of 77% [8, 10, 11, 13, 17]. The carcasses presented an average of 84.2 cm (data not shown; [10, 11, 17]). The fat thicknesses varied from 42 to 75 mm over *Gluteus medius* [8, 10, 11, 14, 15], 62 to 90 mm at the position of the first rib [8, 10, 11, 14], and 42 to 74 mm at the position of last rib [8, 10, 11, 13–16], indicating large quantity of back fat tissue produced. Within the considered studies, muscle depth measured at the cranial edge of *Gluteus medius* muscle ranged from 42 to 75 mm (59 mm in average; [10, 11, 13, 15, 17], whereas other measurements evaluating muscularity were not found, due to the fact that carcasses are not split in common

References	No. of animals	Final age (d)	Final BW (kg)	Hot CW (kg)	Dressing yield (%)	Back fat thickness[1] (mm)			M[2] (mm)
						S	First rib	Last rib	
[8]	66	366	158	117	80.4	66	89	72	.
[10]	66	427	158	117	80.4	66	89	72	66
[11]	18	275	100	73	72.4	42	62	42	42
	39	427	152	115	80.1	67	90	74	67
[13]	18	.	100	73	72.6	.	.	42	42
	10	.	152	122	80.2	.	.	69	61
[14]	39	.	152	115	80.1	67	90	74	.
	18	.	100	73	72.4	42	62	42	.
[15]	32	.	.	104	.	65	.	56	75
	34	.	.	128	.	75	.	50	65
[16]	67	.	.	115	.	.	.	.	.
[17]	69	.	153	124	74.9	.	.	.	54

No. = number, BW = body weight; CW = carcass weight.
[1]Back fat thickness (mm) measured according to ZP method (above Gluteus medius muscle (S)), at the position of first (first rib) and last rib (last rib).
[2]M muscle thickness measured according to ZP method (at the cranial edge of Gluteus medius muscle (mm)).

Table 6.
Summary of collected literature data on body composition and carcass traits in Negre Mallorquí pig breed.

References	No. of animals	pH 45	pH 24	CIE[1]			IMF (%)	IMF fatty acid composition[2] (%)			BFT fatty acid composition[3] (%)			
				L*	a*	b*		SFA	MUFA	PUFA	SFA	MUFA	PUFA	n6/n3
[8]	66	6.19	5.87	44	9.8	1.4	8.9	38.8	50.4	10.8	38.2	58.1	3.7	.
[10]	66	6.19	5.87	44	9.8	1.4	8.9	.	.	.	.	.	.	.
[11]	18	.	5.39	52	10.8	2.4	7.0	.	.	.	.	.	.	.
	39	.	5.78	44	10.2	1.8	9.1	.	.	.	.	.	.	.
[13]	18	5.68	5.39	52	.	.	7.0	.	.	.	37.7	51.8	10.5	10.30
	10	5.88	5.97	43	.	.	9.0	.	.	.	39.3	49.7	11	8.80
[14]	39	.	5.78	44	10.2	1.8	9.1	.	.	.	.	.	.	.
	18	.	5.39	52	10.8	2.4	7.0	.	.	.	.	.	.	.
[15]	32	6.41	.	44	10.7	2.2	7.8	.	.	.	.	.	.	.
	34	6.33	.	44	10.9	2.1	9.7	.	.	.	.	.	.	.
[16]	67	6.37	.	44	.	.	.	.	.	.	.	.	.	.
[17]	69	6.27	5.60	44	11.2	1.2	6.0	.	.	.	41.0	51.3	6.9	15.2

No. = number, pH 45 = pH measured approximately 45 min post-mortem; pH 24 = pH measured approximately 24 h post-mortem; IMF = intramuscular fat; SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids.

[1]CIE = objective colour defined by the Commission Internationale de l'Eclairage; L greater value indicates a lighter colour; a* greater value indicates a redder colour; b* greater value indicates a more yellow colour.*

[2]For fatty acid composition of intramuscular fat tissue in Longissimus muscle, only pigs on control diet were considered, and when fatty acid composition was reported separately for neutral and polar lipids, values reported for neutral lipids were considered. Control diets differed among studies, to see diet composition address to the corresponding source.

[3]For fatty acid composition of back fat tissue, only pigs on control diet were considered, and when fatty acid composition was reported separately for outer and inner layers, values reported for outer layer of back fat tissue were considered. Control diets differed among studies, to see diet composition address to the corresponding source.

Table 7.
Summary of collected literature data on meat quality in Negre Mallorquí pig breed.

slaughterhouse practices. For measurements of fat thickness, fat tissue is cut from the skin following the midline for about 15 cm, allowing the measurement with a ruler.

5.4 Meat quality

Basic data obtained in this review with some of the most commonly encountered meat and fat quality traits measured in *Longissimus* muscle that could be compared are presented in **Table** 7. In the studies reporting meat quality of MBP, pH measured in *Longissimus* muscle at 45 min and 24 h *post-mortem* were around 6.17 [8, 10, 13, 15–17] and 5.67 [8, 10, 11, 13, 14, 17], respectively. The electrical conductivity in this muscle was 6.78 mS (data not shown; [17]). The average pH 45 min post-mortem at *Semimembranosus* was 6.42 (data not shown; [16, 17]), but no data are available at 24 h because the whole ham is warm deboned and minced for "sobrassada" production. Intramuscular fat content in *Longissimus* muscle reported within the considered studies was high and ranged from 6.0 to 9.7% (8.1% on average; [8, 10, 11, 13–15, 17]). Colour measured in CIE Lab colour space and using the Japanese Colour Scale indicates reddish pink colour of the meat (L^* = 46 [8, 10, 11, 14, 15, 17] and score = 3.4; data not shown; [10]). Drip loss in a *Longissimus* duplicate sample showed an average value of 1.65% (data not shown; [16, 17]). Instrumental texture was evaluated within the TREASURE project [17], being the unique data available, and the mean value for shear force was 3.49 kg. Regarding the fatty acid profile, an average value obtained for SFA, MUFA, and PUFA content of intramuscular fat in *Longissimus* muscle, reported for the control group of animals in the only available study, were 38.8, 50.4 and 10.8%, respectively [8], whereas SFA, MUFA, and PUFA content of back fat tissue were 39.1, 52.7 and 8.0% respectively [8, 13, 17].

6. Use of breed and main products

The main MBP product is spicy meat paste sausage made with paprika known as the "Sobrassada de Mallorca de Porc Negre". It is spreadable dry-cured sausage made only with meat (30–60%) and fat (40–70%) of purebred animals grounded and seasoned with paprika (mix of different varieties of *Capsicum annuum*, 4–7%), salt (1.8–2.8%), spices or natural aromas (pepper, spicy paprika, rosemary, thyme, and oregano). This meat mass is grinded to 3–5 mm in diameter stuffed into natural gut and left in natural or industrial dryer chambers (temperature 8–15°C, humidity 60–85%) [18]. The duration of drying depends on sausage size. The product is qualified as Protected Geographical Indication since 1994. The "Sobrassada de Mallorca" protected geographical indication covers two types of "sobrassada": "Majorcan Sobrassada" made from selected pork meats and "Black pig Majorcan Sobrassada": made exclusively from Majorcan black pig meat and stuffed into natural casings. In this case, pigs are reared and fed on the island of Mallorca in accordance with traditional practices. There are several varieties of Majorcan "sobrassada", the most common one is "Rizada", which weighs around 800 g and the curing process lasts from 6 to 12 weeks. In addition, the consumption of MBP "porcella" is very important from a gastronomic, cultural and sustainability perspective. "Porcella" tender meat is prepared mainly during Christmas, when local Majorcans eat "porcella rostida", cooked with herbs and wine to create a juicy festive dish. Thus, producer's sale piglets in winter, depending on the demands and present or expected feeding seasonal possibilities (the stock of barley and green peas, the intensity of vegetation due to weather condition), increasing the efficiency and flexibility of the production system and improving the sustainability. Mallorca's "porcella" is distinguished

by the "porcella mallorquina" label, which indicates that the animal has been born, raised and slaughtered on the island. Flare fat is traditionally used in "ensaimadas", a typical sweet cake. Some alternative products have been developed to increase the presence of MBP products in the market, as fresh meat, especially the loin, or as processed products, such as a loin carpaccio or ready-to-eat ribs, and cured or cooked shoulder and ham.

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