CUTTING, DEBONING AND SELECTION OF GAME MEAT FOR TRADITIONAL SPECIALTIES

Marius Mihai CIOBANU[1], Diana Remina MANOLIU[1], Mugur MUNTEANU[1], Daniel Dumitrel TÎRZIU[1], Paul Corneliu BOIȘTEANU[1]

e-mail: paulb@uaiasi.ro

Abstract

The low consumption of game meat is directly related to the insufficient exploration of data on game meat processing and handling. Taking into account these considerations as well as the fact that in the practice of the meat processing industry methods and assessing game meat for processing have not yet been developed, the main aim of the paper is to highlight how this is done from a practical and applied point of view in the main game meat processing operations in terms of cutting, deboning, and selection of game meat for processing, associated with the determination of the carcass yields of the main sliced anatomical regions of the higher quality classes used to obtain traditional specialty products. To this end, following the primary processing of the game carcasses, the weighting of each anatomical portion will be assessed, both at the level of the region and of the carcass as a whole. The reasoning behind the processing of game meat into traditional specialties encompasses the complex features of the anatomical regions intended for the production of these products as well as the species of origin. For these reasons, the present study will concentrate on the cutting and deboning capacity of wild boar meat in accordance with the methods of processing the anatomical regions of the higher quality classes of their carcasses.

Key words: game meat, wild boar, anatomical regions, specialties

Depending on the animal species, hunting and harvesting of game requires the appropriate behaviour in order to maintain the animal's welfare and ultimately to obtain a carcass with valuable attributes (Branciari R. *et al*, 2020).

For most big game species, hunting by shooting requires a specific projectile, in which case shooting with a bullet is required. This criterion can be explained in terms of avoiding possible animal suffering, deterioration of meat quality, and lower carcass yields because an unsuitable projectile can cause the formation of an excessively large gunshot wound, which must be removed (Cotta V. *et al*, 2004). In the same context, literature sources also mention the risk of dissemination of certain parts of the projectile into animal tissues and their contamination, as well as the fact that most game animals killed by shooting may be exposed to potential sources of lead contamination. Although the general belief is that exposure to lead contamination of game meat would be low as particles can be easily removed from the projectile mass and the meat around the gunshot wound is removed, recent studies have shown that small bullet fragments can be dispersed in the vicinity of the gunshot wound (Meltzer H.M. *et al*, 2013; Costa H. *et al*, 2016; Bănucu I., 2019).

From an anatomical perspective, wild animals have similar bone structure and muscle tissue structure to domestic animals, with anatomical regions grouped into similar categories. Overall, the anatomical structuring of the different regions of the animal body is based on the muscle and bone structure of the carcass and on the purpose for which each part of the body is processed (Postolache N., 2011; Dannenberger D. *et al*, 2013). Due to the superior properties of game meat, most of the time the cutting, deboning, and processing of carcasses follows a strict set of specifications relating to the manner of sectioning and anatomical structuring, with all operations being described in detail according to the anatomical features of the animal (Bodnar K. *et al*, 2014).

In the game meat processing industry, due to the complexity of the execution of the cutting and deboning of game carcasses, the raw meat is often received in direct portioned form, depending on the specific products to be obtained. The performance of cutting, deboning, and sorting game meat by specialists is beneficial primarily in terms of the

[1] Iasi University of Life Sciences, Romania

yield of the carcasses, as the technique is sensitive and requires a high capacity for optimal separation of the various types of tissue (fat, bone, and connective tissue) (Hoffman L.C., Cawthorn D., 2014; Tomasevic I. *et al*, 2018; Niewiadomska K. *et al*, 2020).

The most sensitive anatomical region to cutting and deboning in the whole body of the animal is the dorsal part, which contains its most important and valuable muscles: the dorsal longitudinal muscles and the intercostal muscles. In practice, for the cutting and processing of the dorsal muscles, a cut is made along each side of the spine, from the croup to the neck, with the particularity that the separation is made before the separation of the thigh muscles (Sales J., Kotrba R., 2013; Young S., 2021).

The main aim of this paper is to highlight the main game meat processing operations from a practical and applied standpoint, with an emphasis on cutting, deboning, and selecting wild boar meat for processing. Furthermore, these operations were linked to determining the carcass yields of the main sliced anatomical regions of the higher quality classes used to produce traditional specialty products.

MATERIAL AND METHOD

The present study aimed at collecting the biological material necessary to carry out the proposed technological operations. The biological material of the present study was represented by seven wild boar carcasses harvested from the hunting area 24 Frasin, Suceava, during two hunting seasons (2021 and 2022) by hunters specialized in hunting practice.

Hunting was applied by the technique of shooting the animals, without the use of hunting dogs, allowing a selection of hunted animals in terms of body constitution. The procedure was carried out using a hunting gun, and none of the specimens constituting the biological material of the present study were shot more than once; all animals were killed in a single shot.

Once the wild boars were shot and recovered, they were subjected to a bleeding operation that was performed directly in the field. After bleeding, the carcasses were transferred to a specially equipped area for the primary processing of the hunted animals, i.e., the removal of the abdominal viscera, facilitated by the use of a pulley and hooks for lifting the carcasses. Prior to all these operations, carcasses were weighed to obtain their weight before and after primary processing.

In evaluating the yields of different types of wild boar carcass tissues, a hunting centralizer was first developed to collect data from the field at the time of harvesting the biological material in question in order to associate them with the various practical aspects to be reported during the study.

The biological material was transported to the meat processing section of the University of Life Sciences, where the animals were received. Each wild boar carcass was weighed in the form in which it was received and also after skinning and removal of the head and extremities, respectively, before storage for processing.

During the actual cutting, deboning, and sorting of game meat, data on the masses of the sliced anatomical parts will be proactively collated. On the basis of these data, the weight of each anatomical portion and each type of tissue will be evaluated on the basis of percentage calculations, and the results obtained will be reported both at the level of the anatomical region and at the level of the carcass as a whole.

The carcass cutting procedures were carried out in the following order: (I) removal of the knuckle by cutting around the knee joint in the area between the patella and tibia; (II) separation of the leg by cutting before the dorsal region and before the belly, continuing towards the fat pad area and separation of the shoulder by delimiting the muscles in the scapulohumeral area; (III) removal of fat from the back, by delimiting along the dorsal region up to the limit of the actual muscle tissue; (IV) removal of intercostal muscles by cutting the muscles in the sublumbar region; (V) cutting of the loin and neck by first making a longitudinal section along the length of the vertebral column to remove muscles from the cervical and dorsal vertebrae; (VI) demarcation and separation of the lower dorsal loin region.

The data obtained from the above-mentioned steps were processed specifically, using classical percentage calculation programs and formulas, and the results were interpreted in terms of the proportion of high-quality anatomical regions used to make traditional game meat specialties.

RESULTS AND DISCUSSIONS

Game harvest data

Four of the wild boars (M2, M3, M5, and M6) were harvested early in the morning, while only three (M1, M4, and M7) were harvested late in the evening, according to the hunting centralizer. All subjects constituting the biological material of the present study were shot using a smoothbore gun with non-lead ammunition. In terms of anatomical region, three of the wild boars (M1, M5, and M6) were shot in the abdominal area, while the others were shot in the neck (M2), shoulder (M3), head (M4), or lower leg (M7).

Data obtained from the primary processing of game

In the primary processing of freshly harvested game, the weight parameters of the animals after the two main operations, bleeding and evisceration, are taken into account. The average weight of the 7 wild boars taken in the study was 68.65 kg (between 62 and 88 kg). In each case, the time between shooting and performing the individual primary operations was optimal, with subjects always recovering within 30 minutes of shooting, bleeding within 10 minutes of harvesting, and being eviscerated within 60–90 minutes.

Data obtained from primary storage and transport to the processing unit

The primary storage of the game carcasses harvested during each of the periods was carried out in a space set up for this purpose, located in the area of the hunting ground where all the actions mentioned were carried out. According to the hunting centralizer, the carcasses were kept at a temperature of 4-6°C in the primary storage facilities, as stipulated in the legislative limits, with an average storage time of 2–3 days. In terms of the game transport conditions, the transport time for the six wild boar carcasses was approximately similar, i.e., approximately 2.5–3 h, with a chilling temperature of up to 4°C provided during transport, which meets the criteria, both from a safety and legislative standpoint.

Results on the anatomical regions obtained after cutting, deboning and sorting in terms of quantity

The quantitative results obtained for the main anatomical regions of the wild boar have been structured in table 1, starting from the moment of reception of the carcasses in the processing microsection to the final stages of meat selection. At reception, carcass weights averaged around 60 kg, with the heaviest being the M5 carcass at 75 kg and the lightest of those received being the M6 carcass at approximately 52.5 kg.

Table 1

Results of the cutting, deboning, and selection of wild boar meat in terms of quantity

Species: Boar			*kg*									
			M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	$\bar{x}_M$	**Min.**	**Max.**
Carcass weight at reception			59.2	53.2	67.28	58.5	75.04	52.4	55	60.08	52.4	75.04
Primary processing on reception	Carcass weight after skinning		55.6	49.7	64.25	55.08	69.33	49.95	51.9	56.54	49.7	69.33
	Skin weight		3.6	3.5	3.03	3.42	5.71	2.45	3.1	3.54	2.45	5.71
	Carcass weight after removal of the head		50.8	44.7	60.1	49.9	62.4	44.05	46.1	51.15	44.05	62.4
	Head weight		4.8	5	4.15	5.18	6.93	5.9	5.8	5.39	4.15	6.93
	Carcass weight after removal of extremities		50	44	59.5	48.8	60.5	43.2	44.9	50.12	43.2	60.5
	Weight of extremities		0.8	0.7	0.6	1.1	1.9	0.85	1.2	1.02	0.6	1.9
Gunshot wound removal	Weight after gunshot wound removal		46.15	38.88	53.25	40.6	54.32	38.3	38.9	44.34	38.3	54.32
	Shot wound weight		3.85	5.12	6.25	8.2	6.18	4.9	6	5.78	3.85	8.2
Cutting - Deboning	Weight of anatomical regions before selection	***S***	***18.25***	***15.72***	***24.64***	***15.37***	***19.43***	***14.15***	***15.02***	***17.51***	***14.15***	***24.64***
		C_I, C_{II}	17.4	14.66	19.72	15.33	24.34	16.35	15.88	17.66	14.66	24.34
	Bone weight		7.5	8.5	7.89	9.9	10.1	7.8	8	8.52	7.5	10.1
Selection	Weight of selected anatomical regions	**S**	**17.5**	**14**	**23**	**12.53**	**17.15**	**11.85**	**12.25**	**15.46**	**11.85**	**23**
		C_I, C_{II}	16	12.3	18	12.7	20.9	13.35	13.65	15.27	12.3	20.9
	Scrap weight		2.15	4.08	4.36	5.47	5.72	5.3	5	4.58	2.15	5.72

$\bar{x}_M$ - mean values; **S** – specialties; **C_I, C_{II}** – quality I and II.

After reception, primary processing of the game revealed different quantitative parameters for by-products such as skin, heads, or limb extremities. The average weight identified for wild boar skin was about 3.5 kg, with variations between 2.45 kg in younger and smaller boars and 5.71 kg in boars over 2 years of age, so that the average carcass weight after skinning was 56–57 kg. After removal of the head, the weight decreased on average by 5.5 kg, with the head weighing between 4.15 and 6.93 kg. Following the removal of the extremities of the limbs, the initial processing was completed, leaving ready-to-process carcasses with a mean weight of 50 kg.

For the majority of wild boars, the shot wound represented a significant quantitative part of the carcass ready for processing, with five of the animals having shot wound weights greater than 5–6 kg. Relative to the average, the shot wounds weighed about 6 kg, being the lowest in M1 boar (3.85 kg) and the highest in M4 boar (8.2 kg).

The cutting and deboning operation allowed separation of the main muscle regions and bones. Prior to selection, the specialties were separated by cutting, with an average quantitative value of 17.51 kg, a minimum of 14.15 kg (M6), and a maximum of 24.64 kg (M3). Besides specialty cuts, quality I and quality II meat cuts were obtained, with average weights of 17.66 kg, the minimum being identified in carcass M2 and the maximum being reached in M5. The average weights of bones separated by deboning reached values of 8.5 kg, with close limits of 10.1 kg for the maximum reached and 7.5 kg for the lowest quantities obtained.

The final selection of boar meat involved the removal of connective tissues, cartilage, and other fragments, all of which amounted to approximately 4.5 kg, ranging from 2.15 kg in younger animals to 5.72 kg in older boars. The average weight of the specialties obtained from the seven wild boars was 15.5 kg, with the average weight of the game meat of quality I and II also being around the same value, i.e., 15.3 kg.

The average weights of the main categories of wild boar muscle tissue for specialties and meat of quality I and II were similar, slightly higher in the case of specialties at 15.46 kg and 15.27 kg for quality I and II meat. Comparing specimens, in the case of M1, M2, and M3 boars, the quantities of specialties obtained were larger than the quantities of quality I and II meat, whereas in the case of M4, M5, M6, and M7 boars, higher quantities of quality I and II meat were obtained after cutting, deboning, and sorting of the meat (*figure 1*).

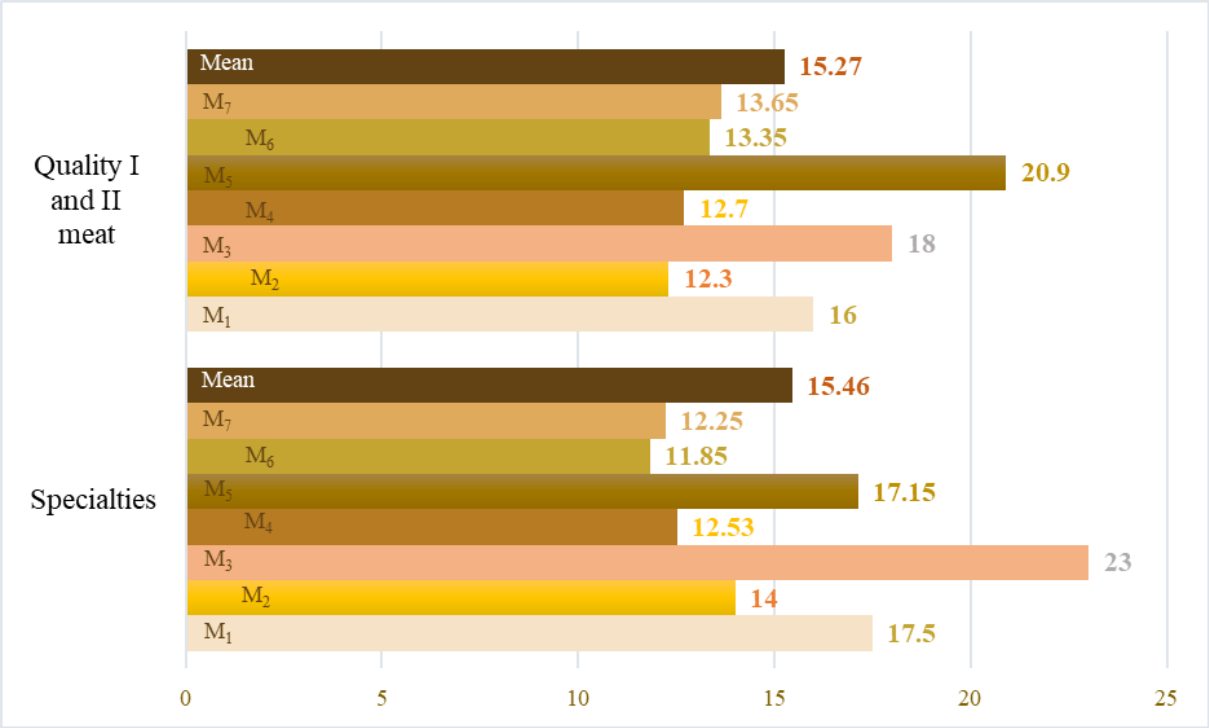

Figure 1 **Comparative weight of specialties and quality I and II wild boar meat after cutting, deboning and sorting**

Results on proportions of anatomical regions of game meat by quality classes

The quantities identified for each anatomical region cut, deboned, and sorted were related to the total carcass weight identified at reception after primary processing and the total weight of the whole body of the animals, according to the game centralizer. Table 2 shows the weight of the

anatomical regions of the carcass and of the whole body of the animals, with individual values for each specimen studied but also with mean values.

Table 2

Proportions of anatomical regions of wild boar obtained after cutting, boning, and selection

Species: Boar		***M₁***	***M₂***	***M₃***	***M₄***	***M₅***	***M₆***	***M₇***	$\bar{x}_M$
Animal weight (kg)		68.0	62.0	74.75	66.3	88.0	59.5	62.0	
Carcass weight (kg)		50.0	44.0	59.5	48.8	60.5	43.2	44.9	
Specialties	*kg*	17.5	14.0	23.0	12.53	17.15	11.85	12.25	
	% of C	35.0	31.81	38.65	25.67	28.34	27.43	27.28	30.60
	% of T	25.73	22.58	30.76	18.89	19.48	19.91	19.75	22.44
Quality I and II	*kg*	16.0	12.3	18.0	12.7	20.9	13.35	13.65	
	% of C	32.0	27.95	30.25	26.02	34.54	30.9	30.4	30.29
	% of T	23.52	19.83	24.08	19.15	23.75	22.43	22.01	22.11
Bones	*kg*	7.5	8.5	7.89	9.9	10.1	7.8	8.0	-
	% of C	15.0	19.31	13.26	20.28	16.69	18.05	17.81	17.2
	% of T	11.02	13.7	10.55	14.93	11.47	13.1	12.9	12.53
Offcuts	*kg*	2.15	4.08	4.36	5.47	5.72	5.3	5.0	-
	% of C	4.3	9.27	7.32	11.2	9.45	12.26	11.13	9.25
	% of T	3.16	6.58	5.83	8.25	6.5	8.9	8.06	6.74
Gunshot wound	*kg*	3.85	5.12	6.25	8.2	6.18	4.9	6.0	-
	% of C	7.7	11.63	10.5	16.8	10.21	11.34	13.36	11.65
	% of T	5.66	8.25	8.36	12.36[b]	7.02	8.23	9.67	8.51
Head	*kg*	4.8	5.0	4.15	5.18	6.93	5.9	5.8	-
	% of T	7.05	8.06	5.55	7.81	7.87	9.91	9.35	7.94
Extremities	*kg*	0.8	0.7	0.6	1.1	1.9	0.85	1.2	-
	% of T	1.17	1.12	0.8	1.65	2.15	1.42	1.93	1.47
Skin	*kg*	3.6	3.5	3.03	3.42	5.71	2.45	3.1	-
	% of T	5.29	5.64	4.05	5.15	6.48	4.11	5.0	5.1
Organs and viscera	*kg*	4.6	5.1	3.37	3.85	6.8	3.9	4.1	-
	% of T	6.76	8.22	4.5	5.8	7.72	6.55	6.61	6.6

C – carcass; T – total weight of the animal; a – minimum value; b – maximum value; $\bar{x}_M$ – mean value.

On a carcass basis, the mean values identified for each anatomical region, in order of proportion, were 30.60% specialties, 30.29% meat quality I and II, 17.2% bone, 11.65% shot wound, and 9.25% trimmings. In terms of the share of anatomical regions in relation to the whole animal body, specialties and meat quality I and II were the main ones, with shares of 22.44% and 22.11%, respectively, followed by 12.53% bones, 8.51% shot, 7.94% head, 6.74% scraps, 6.6% organs and viscera, 5.1% skin, and 1.47% limb extremities.

CONCLUSIONS

Data obtained from harvesting and processing wild boar meat by cutting, deboning, and sorting the meat facilitated the overall characterization of the technological processing characteristics of game meat. The parameters obtained after the processing operations were correlated with the hunting method, hunting conditions, initial processing, storage, and transport.

Following the hunting session, it was concluded that all specimens were harvested under optimal conditions in terms of general physical condition and during the optimal hunting periods for this species. The execution of the primary processing operations in the field was carried out every time within the stability time limit, with the game being bled, eviscerated, and later stored until its transport to the processing section.

After cutting and deboning, the anatomical regions with muscle tissue had average weights of about 31 kg, accounting for approximately 61% of the total carcass weight and 44.5% of the total animal weight.

In addition, the muscle tissue of interest for the present study obtained from the cutting, deboning, and trimming operations, i.e., the specialty category, accounted for 23% of the whole animal body and 31% of the carcass weight.

Comparing the values obtained in terms of the proportion of specialties and the proportion of quality I and II meat in wild boar, the proportions of the two anatomical regions are approximately equal, with no particular differences.

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