

ЕВРОПЕЙСКИЙ КОНГРЕСС РАБОТНИКОВ
И И МЯСНОЙ ПРОМЫШЛЕННОСТИ

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AS DEPENDENT ON THE PHYSIOLOGICAL
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THE USEFULNESS OF SLAUGHTER PRODUCTS AS DEPENDENT ON THE
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The influence of sexual hormones and above all of male sexual hormones upon the quality of raw meat is notorious. Their undesirable effect has been since long eliminated by means of castration with different technological results. It is well known that the effect of this procedure depends among other on the age of the castrated animal. Herefrom arises the question what is the most suitable moment for castration in order to obtain the highest and most diverse technological usefulness.

Zootechnical and veterinary publications answer this question differently and very often even opposedly. Some experimental works analyze the afore-mentioned problem under the aspect of the least post-castration losses due to the death of the animal and to reduce expenses connected with the nursing of the animal during the post-castration period /3/. Other works compare the effect of castration methods i.e. the bloodless and bloody castration of bullocks and boars with respect to fodder utilization, the rate of weight-increase, slaughter yield and meat quality, determined by its tenderness, colour and the amount of connective tissue inclusions /7,9/.

In the available literature, however, we did not find a satisfactory and detailed answer, to what degree the since long known changes in the structure and technological quality of the carcass depend on the age of the castrated animal. Thus we lack a satisfactory distinction whether the afore-said changes differ significantly in dependence on the age of the castrates and therefore- in the worst case-what difference in the quality of slaughter products will be found earlier and later castrates. Till now it has not been synonymously stated in what month of the animal's life boars should be castrated in order to obtain the best raw meat and the best economical effects of its use.

On the basis of the above the thesis of the present paper aimed at:

- in the changes
1. the investigation of the limits/in the castrates shape differences, in weight-increases and slaughter yield of fattened pigs cleared at the age of 6 weeks, 3 months and /six/ months
 2. evaluation of the technological usefulness of the fundamental cuts of boar carcasses castrated at various ages
 3. the ascertainemnt whether there are differences in the dynamics of development of individual tissues and organs of the carcass chiefly of meat, fat, bones and skin, which are at a high degree deciding as to the technological usefulness of slaughter products.

Experimental.

The experiment was carried out on 21 boars of the Zootnicka race. They were taken from 7 sows /3 from each/ and divided in three experimental groups in such a way that boars from each sow were placed in each of the three groups. The first /I/ group of boars was castrated at the age of 6 weeks, the second /II/ at 3 and the third /III/ at 6 months. All fattened pigs were equally fed. The weight-increase was controlled every 30 days by weighing of each boar separately. When they achieved a 120 kg.weight they were slaughtered. After slaughter the carcasses were prepared according to general adopted technology and weighed with the suet and kidneys with an accuracy by 100 kg. Twenty four hours after the slaughter the following measurements were performed on the cooled carcasses: the length in the middle of the carcass /from the atlas till the lap-joint/, the breadth of sides /at the fourth rib/, the thickness of the back fat above the shoulder, above the last rib and the middle buttocks muscle /the commencement, the middle and the end/ and besides the kidney, the suet as well as the previously cut out tenderloin were weighed. Then the right sides were dismembered into the following cuts: chine, loin /pork meat/, hip.meat, fillet, shoulder, knuckle /fore and hind/, dewlap, ribs, belly, hand and back fat. The fundamental cuts obtained by the disintegration were then skinned,

trimmed and boned. Only heads and feet have not been cut into anatomical and technological components. Besides the loin was cut beyond the 4 - th rib in order to determine the "eye" of the tenderloin according to Sieburg /6/. On the other hand the left side of the carcass served for the evaluation of the development degree of the individual muscles and for the laboratory evaluation of the quality of the fundamental slaughter products i.e. meat and raw fat. In order to evaluate the development degree of meat-forming, four most representative muscles were prepared from that side of the carcass namely: longissimus dorsi m., quadriceps femoris m., triceps brachii m., and gracilis m. Each muscle was weighed separately and analyzed as to the contents of water, water general nitrogen, nitrogen of the connective tissue and besides their water absorption and pH value determined. In the back fat the content of water and fat was investigated.

The statistical significance of the effect of castration as performed in various periods of the animal's live, was determined by means of the analysis of variance.

Discussion

Breeding observations have shown that the castration period influences the growth rate of young hogs. This was confirmed by the fact that animals castrated at the age of 3 months attained the planned slaughter maturity after 250 days whereas earlier castrates - 10 days later and animals castrated at the age of 6 months by 266 days.

The shape of animals castrated at various ages, was also different at the time of slaughter. From data in Tab.I it is distinctly seen that late castrates became like boars. This is expressed even if it be only by the more distinctly marked disproportion of development between the fore and hind part of the trunk.

In the preliminary post-slaughter evaluation of the breeding effects of boars, which have been castrated at various ages, the following facts drew our attention:

- I. Almost similar slaughter yield of carcasses of all of the three experimental groups with a marked tendency to ri-

sing in the second group of castrates i.e. animals, castrated after 3 months of life and for decreasing in the III group i.e. the group of late castrates /Tab.2/. The differences between the individual groups are, however, in this regard of poor significance

2. Relatively considerable prolongation of the carcass of the II group castrates. Carcasses of this group are on an average 4 cm. longer than carcasses of later castrates /Tab.2/. This fact postulates the potentially best technological evaluation of boar's carcasses, which have been castrated not too early and not too late i.e. in the initial period of sexual maturity
3. The relatively best growth of the back fat on carcasses of early castrates and the worst on carcasses of late ones. The increase of general content of back fat is parallel to the unequality of the thickness of its layer on various parts of the back. The thinner back fat of late castrates is therefore more equally spread than with early castrates. The weaker development of the thickness of the back fat layer with later castrates is first of all determined by the thin subcutaneous layer, because the thickness of the muscle layer beneath it is almost identical both with the early and late castrates. This fact indicates that very weak development of the back fat in the early life-period of late castrates and the supplement of the development's deficiencies during the very fattening time, what takes place after the late castration. With regard to the intensity of the development of the back fat layer the second group of castrates takes a middle place between the remainder two /Tab.3/.
4. A distinct variety as to the contents of meat, fat, bones and skin in the individual group of castrates. The principal quantitative component of cuts in all of the three groups is, of course, the meat /53%-56%/ of the carcass weight /then fat, bones and skin. The differences in the meat content of carcasses from young boars castrated 6 weeks resp. 3 months after their birth, are relatively high. The same difference is found when comparing the

amount of meat on castrates at the age of 6 weeks and 3 months. These differences amount to 3% and are statistically significant in both cases. Comparing the fat content of the afore-mentioned carcasses we observe a quite different picture /Tab.4/. The later the castration was carried out the less is the relative content of fat on the carcasses. The differences in the bone and skin content between the particular groups of animals are relatively great, particularly between the early and late castrates /Tab.4/. Late castrates are characterized by a marked and from the technological point of view undesirable increase of the bones and skin weight.

Basing on the afore-said data one may consider that the castration of young boars in the 3-rd month of their life results in the best breeding and technological effects. Their carcasses are characterized by an increased share of such a desirable component as meat and simultaneously a decreased content of elements which diminish the technological usefulness of the carcass. Because of the statistical significance of the described changes in the developing proportions it may be said that the castration in the appropriate period of the physiological development proves to be an important factor in overcoming the fat-excess of the castrates' carcass. The various rates of attaining the sexual maturity of swines of individual races and utility types demands, of course, a various age as the most appropriate for castration. There is, however, undoubtedly that the castration of suckling pigs should be discontinued, because the effects do not correspond with the postulates of the modern meat industry and consumer preference.

The demonstrated differences in the development of the meat tissue of young hogs, which have been castrated at various periods of live give rise to the question what are the components of these differences.

The technological dismemberment of carcasses has in this connection shown that:
I. the development of ham/fillet did not show any essential differences on the carcasses of the particular castrates'

groups. Only some tendency to reducing its relative weight in carcasses of late castrates was found. However the meat content of hams is different although the difference between the groups are statistically not significant in this regard. Hams /fillets/ of fattened pigs, castrated in the 3rd month of life are characterized by the highest content of meat and lowest of fat. As to the bones and skin content these hams /fillets/ occupy a middle place. The weight-increase of bones when the castration is retarded is connected with the progressive thickening of the layer of the compact substance /Tab.I,2/ and following this with the rise of the proper weight. As to shank-bone the proper weight being 1,297 g/ml. with 1,5-3 months castrates rises to 1,314 g/ml. in the third experimental group. It may be confirmed that the increase of the general content of bones in the carcass is due not only to the general development of the bones but also to the change of the structure of the bones themselves.

2. Differences in muscles of shoulders between the groups are not significant. Data in Tab.5 show, however, that the most suitable raw product are shoulders from castrates in the second group. Dismembered shoulders from the carcasses of young pigs, castrated in the 3-rd month of life, offer most meat, not too much fat and skin and less bones than shoulders of the same weight from the remainign two groups of castrates.
3. The analysis of the loin weight and its meat and bones content did not show any essential differences between early and late castrates. Distinct differences, however, were found in the cross-section of long.dorsi muscle. The area of the loin "eye" rises from 33,86 cm² to 37,14 cm² and 38,14 cm² for the various castrative ages from 6 weeks to 6 months respectively. Differences between the I and II castrates' group and between the I and III group are statistically significant in this regard. The same statistical dependence was also found when the meat content on the carcass was analyzed. Thus the dependence between the muscles' content of the carcass and the loin "eye" was confir-

med once more. Besides the above said will indicate that the technological usefulness of the loin increases with the retardation of the castration period. Young boars castrated in the 3rd month of their life give the heaviest loin with a big cross-section area.

4. The heaviest belly comes from late castrates, but the thickest ~~at~~ one from young boars castrated in the 6th week of their life. Bellies with the greatest amount of meat layers and simultaneously with the lowest fat content characterizes the II group of castrates. However quantitative differences of meat in the belly of the particular castrates'group are statistically not significant.
5. No considerable differences were found when comparing the relative weights of the four largest muscles in carcasses from the particular castrates'group /Tab.6/.

The above discussed results pertaining to the technological cuts of carcasses from animals, which have been castrated in various periods of their male sexual hormones activity do not show a more pronounced influence of their intervention upon the development of the particular parts of the carcass. It only may be confirmed that the most priceworthy bellies and loins were obtained from carcasses of animals, which have been castrated in the initial stage of their sexual activity.

The lack of considerable differences between cuts of carcasses in the castrates'groups was also confirmed by the physical and chemical analysis of the back fat and boned meat /Tab.6/.

The analysis shows namely bigger fluctuation of the typed characteristics performed in different muscles with the individual groups of animals than in identical muscles in different groups of castrates. It may be said that the meat of animals, castrated in their 3rd or 6th month of life, contains a little more protein comprising also the protein of the connective tissue and less water and fat. Parallely the chemical composition of back fat is varying at some degree even more distinctly. The back fat of early castrates contains above 1% more fat than that of the late ones.

Investigations on the age-influence of the castrated

male animals upon the technological usefulness of slaughter products have thus shown that the castration in the 3rd month of life first of all assures a larger meat-content of the carcass, what, of course, must be regarded as very advantageous. In comparison with the muscling degree in early and late castrates these differences are statistically significant. This improvement pertains to the muscling degree as well of the individual cuts as of the carcass as a whole. It must, however, be underlined that desirable effects of the castration in the 3rd month of life, observed during the experimental work refer to one type of swine i.e. the meat-fatty type. It would render some difficulties to answer the question whether an analogous influence will be observed with fattened pigs of the bacon-type. The question is also still open how to evaluate the zootechnical effects of the castration carried out in various periods of life/the food utilization, weight gains etc/. The problem must therefore be regarded as open and requires further studies both from the zootechnical and technological point of view.

In any case basing on the obtained results it may be stated that in case of finishing swine to the pre-slaughter weight of 120 kg:

1. The conformance of carcasses of young boars castrated in the 6th month of life resembles that of typical boar carcasses what cannot be found in early castrates or such, which have been castrated in the 3rd month of life. The fundamental element of this resemblance is the increase in weight of the skin and bones.
2. The slaughter yield of all castrates is more or less the same. But with late castrates particularly with the ones castrated in the 3rd month of life there appears a tendency to rise this yield.
3. The thickest back fat covers carcasses of animals castrated in the sixth week of life and the thinnest one the carcasses of those castrated in the age of 6 months. Boars castrated in the 3rd month of life had the thickest superficial layer of back fat. Relatively uniformly spread back fat on the whole length of the back characterizes early

- castrates of animals, castrated at the age of three months.
4. The quantitative changes of meat, fat, bones and skin are the most distinct among changes resulting from the various age of castrates. The differences of meat, fat and bones in standard sides of young pigs, castrated in the 3rd month are big compared with the remaining top groups and statistically significant. Carcasses from this group give 3% more meat than early castrates.
 5. With the prolongation of the pre-castration period follows an increase of the skin and bones content of the carcasses. The increase of the content of these less valuable carcass components is responsible for the diminished usefulness of late castrates.
 6. The technological usefulness of ham/fillet/, shoulder, loin and belly in all three groups of animals is the same. The difference of meat and fat contents in these cuts are of no statistical significance.
 7. The physical and chemical characteristic of the meat of young pigs, castrated in three various periods of sexual maturity, shows no considerable differences. The most fat content will be found in the meat of early castrates and of protein in the meat of later and very late castrates. No significant differences of the amount of connective tissue in all investigated groups were found. However, there exists some tendency to rise its content parallel with the increase of general protein. The water content in the back fat augmented also with the retardation of the castration age.
 8. The main argument recommending the castration of boars in the 3rd month of their age is the increase of muscling in the carcass when the animal is slaughtered after reaching a 120 kg. weight.

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Tab.1

Pre-slaughter measurements of fattened pigs (in cm)

	Fattened pigs castrated after:		
	6 weeks:	3 months:	6 months:
the height of withers	66,14	67,28	67,71
the breadth of chest	31,00	30,43	33,43
the depth " "	39,64	39,57	40,14
the slant length of trunk	94,28	95,43	95,43
the circle of chest	117,57	116,57	118,57
the horizontal length	127,00	130,14	131,86
the circle over the fore fetlock	17,14	16,63	17,78
and over the hind one	16,78	16,71	17,43

Tab.2.

Length and breadth of sides /in cm/ and post-slaughter
yield

	Fattened pigs castrated after:		
	6 weeks:	3 months:	6 months:
Yield immediately after slaughter	80,50%	80,65%	79,79%
" the carcass has been cooled	79,54%	79,71%	78,76%
Length from the pubic symphysis to the atlas	100,00	102,00	98,00
" to the 1-st rib	82,00	84,00	81,00
Breadth of chest /above the 4th rib/	41,00	42,00	40,00

Tab.4. Contents of meat, fat, bones and skin in the right side /in % of the side weight/

	cuts weight in % of the weight of standard sides			Com ponents of the technological cuts											
				meat			fat			bones			skin		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
1.neck-meat	6,59	6,89	6,57	4,80	5,13	5,16	0,66	0,61	0,29	1,13	1,15	1,12	-	-	-
2.loin	9,08	9,94	9,96	7,78	8,20	8,21	-	-	-	1,30	1,74	1,75	-	-	-
3.hip, meat	2,37	2,28	2,54	1,92	1,82	2,07	-	-	-	0,45	0,46	0,47	-	-	-
4.ham/fillet/	21,24	21,02	20,76	13,26	13,43	12,92	5,73	5,15	5,15	1,33	1,46	1,54	0,92	0,98	1,15
5.shoulder	13,39	14,30	14,27	9,29	10,15	10,08	2,52	2,31	0,97	1,00	1,10	1,10	0,61	0,70	0,78
6.fore-knuckle	2,44	2,44	2,59	1,18	1,16	1,22	0,25	0,25	0,21	0,72	0,76	0,82	0,29	0,27	0,34
7.hind knuckle	2,57	2,74	2,81	1,39	1,50	1,50	0,43	0,45	0,46	0,50	0,53	0,57	0,25	0,26	0,28
8.dewlap	3,99	3,55	3,73	1,23	1,09	1,23	2,30	2,03	1,99	-	-	-	0,46	0,43	0,51
9.ribs	4,68	5,11	4,94	3,37	3,57	3,48	0,51	0,63	0,40	0,80	0,91	1,06	-	-	-
10.belly	11,06	11,06	12,35	5,14	6,11	6,38	4,82	3,94	4,46	-	-	-	1,10	1,01	1,51
11.groin	3,96	3,54	3,77	0,86	0,91	1,07	1,75	1,38	1,31	-	-	-	1,35	1,35	1,39
12.a cut of back fat	18,18	16,34	15,52	2,21	1,96	1,97	14,15	12,51	11,68	-	-	-	1,82	1,87	1,87
13.tenderloin	1,01	1,11	1,04	1,01	1,11	1,04	-	-	-	-	-	-	-	-	-
T o t a l				53,34	56,19	56,34	33,14	29,30	28,42	7,51	8,04	8,45	5,73	5,88	6,46

Statistically significant differences
Explanation of I,II,III see tab.5 and 6

Tab.3.

Measuring results of the back fat thickness

Thickness of the back fat /in cm/	6 weeks castrates:			3 month cas.		6 months cast.			
	total:	layer:		total:	layer:	total:	layer:		
		ext.	int.				ext.	int.	ext.
-above the shoulder	5,5	1,7	3,9	5,2	1,8	3,5	5,1	1,4	3,7
- "the last rib	3,5	1,1	2,3	3,2	1,1	2,00	3,4	1,0	2,4
-buttocks muscle /the beginning/	4,1	1,8	2,3	4,0	2,0	2,00	3,7	1,6	2,1
buttocks muscle /the middle/	3,2	1,8	1,4	3,3	1,9	1,5	3,2	1,7	1,4
-buttocks muscle /the end/	4,5	-	-	4,5	-	-	4,2	-	-

Tab.5

Technological characteristic of cuts: ham, shoulder, loin and belly.

Denomination of the cut	cuts weight in %: % weight of the right side			% weight of meat: the % weight of the right side			% weight of fat: the weight of the right side			% weight of bones: the weight % of the right side			% weight of bones /skin?/: to the right side		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
H a m	18,85	18,71	18,28	62,15	63,54	61,98	26,89	24,41	22,74	6,25	6,90	7,39	4,33	4,67	5,52
Shoulder	11,90	12,84	12,57	69,38	71,0	70,36	27,48	23,77	23,97	10,47	9,73	10,90	6,66	6,82	7,83
L o i n	8,32	8,82	8,75	82,82	82,30	82,30	-	-	-	17,06	17,53	17,55	-	-	-
Belly	9,73	9,91	10,52	46,79	54,85	53,38	43,67	35,45	37,03	-	-	-	9,23	9,09	9,32

I= boars castrated in the 6th week of life
 II= " " " " 3rd month of life
 III= " " " " 6th " " "

Tab. 6.

Physico-chemical evaluation of back fat and muscles: /N/-long.dorsi, /4/-quadri-
ceps femoris, /3/ triceps brachii and /Sm/ -gracilis, expressed in %.

	N			/4/			/3/			/Sm/			Back fat		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
1. water holding capacity	8,95	10,77	10,81	8,49	9,95	10,44	10,77	10,80	9,96	8,42	8,88	8,91	-	-	-
2. pH	5,43	5,53	5,50	5,86	5,92	5,73	5,69	5,70	5,70	5,88	5,70	5,73	-	-	-
3. moisture	73,58	72,91	72,73	74,59	74,15	74,45	74,14	73,59	74,61	74,79	74,21	73,71	4,14	4,22	4,34
4. fat in %	4,35	4,10	4,05	4,77	4,41	4,63	4,88	4,72	4,29	3,85	3,45	3,69	94,40	93,95	93,19
5. total nitrogen %	18,55	19,70	18,95	17,99	19,13	18,37	18,16	19,41	18,68	18,26	18,86	18,99	-	-	-
6. nitrogen in connective tissue %	1,74	1,93	1,89	2,98	2,44	2,44	1,98	2,04	2,07	2,05	2,00	2,00	-	-	-
7. muscle weight % of the side weight	3,75	4,12	3,99	1,65	1,96	1,98	1,39	1,37	1,37	0,37	0,40	0,38	-	-	-

I= young boars castrated in the 6th week of life

II= " " " " " 3rd month of life

III= " " " " " 6th month of life

