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FORMATION OF THE LEAN MEAT OF THE BELLY MEAT PART IN RELATION TO THE ACHIEVED LIVE WEIGHT OF PIGS.

STUPKA, R. - ŠPRYSL, M. – CÍTEK, J. – OKROUHLÁ, M.
Czech University of Agriculture, Department of Pig and Poultry Science, Prague, Kamycka, 165 21, Czech Republic

ABSTRACT:

The tests included 200 final pig hybrids currently produced in the Czech Republic in a balanced sex. Analysis was made of the formation of the lean meat of the belly meat part from the viewpoint of its total percentage in the carcass, the percentage of lean meat and formation of the belly in the monitored part in relation to the live weight.

The results have shown that the increase of the weight does not significantly influence the share of the belly in the carcass, the same trend has been observed also in the percentage of the EU belly in the total belly and in the carcass. The increase of the body weight results in a rapid increase of the total area of the belly which is accompanied by a slower increase of the meat area. Further, the increase of the weight also contributes to the increase of the meat weight but at the same time it decreases the percentage of meat in this part. There occurs a significant decrease of the share of the meat area in the belly approximately up to the live weight of 105 kg, subsequently this decrease slows down. In addition, different deposition of meat and fat in individual sections (1,2,3) has been found out in pigs with a low weight, i.e. a higher share of meat as compared to the animals with a higher weight, i.e. a lower share of meat.

Keywords: *pig, belly, weight, lean meat share*

INTRODUCTION

The age of pigs is very narrowly related to the live weight. With an increase of the slaughter weight of pigs representation of meaty parts and fatty parts change and thereby the slaughter / carcass value changes too (Hovorka,1989, Cisneros et al.,1996). The slaughter weight shall be considered the most significant factor influencing the carcass value / slaughter value William et al. (1990).

Gu et al. (1992) monitored composition of a carcass body of various hog genotypes in the interval from 59 to 127 kg of live weight. They found out that a growth of lean meat, back fat thickness, bones and skin almost copies the growing live weight on linear basis while in later growth phases fat growth becomes more intensive and meat share decreases in a carcass half (William et al.,1990).

Müller (1996) based upon analysis of 400 heads of slaughter hogs, developed a model of a slaughter weight influence on the lean meat share in a carcass and a share of the slaughter parts as belly, shoulder, head and joint.

According to Grácik et al. (1990) fat rate in a carcass parts in pig grows more than in other ones with an increasing slaughter weight 100 kg 16,28 kg = 21,14%, 110 kg 17,92kg = 21,25%, 120 kg 19,89kg = 21,40%, 130 kg 21,44kg = 21,83%, 140 kg 23,36kg = 22,02%, 150 kg 26,42kg = 23,13%.

MATERIAL AND METHODS

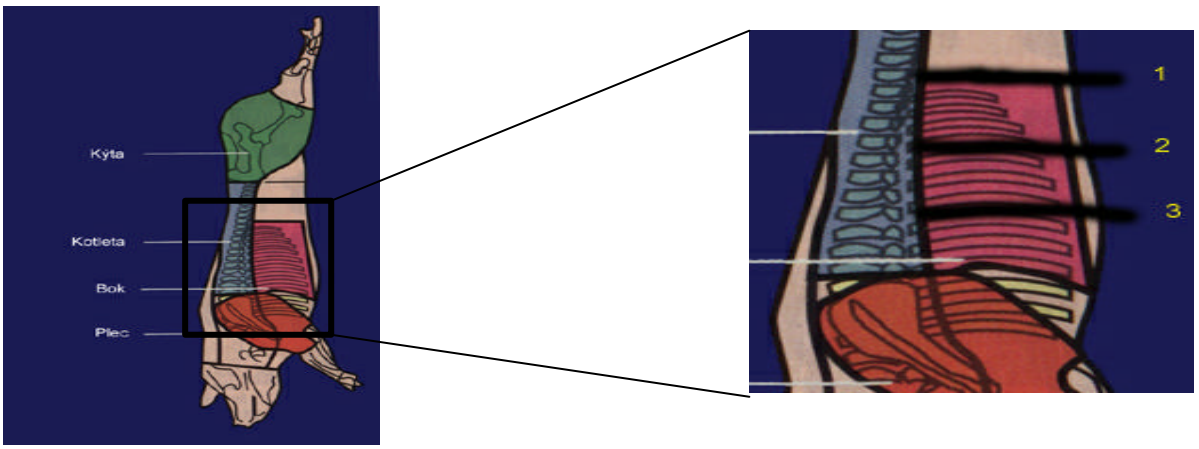
The analysis of the belly-meat part was carried out in 200 hybrid pigs slaughtered at the age of 166 – 175 days penned at the Test station according to the methodology for testing purebred/ hybrid pigs in couples (barrow+gilt).

The pigs were fed ad-libitum in 3phases with a continuous transition by means of self-feeders Duräumat. Used complete feeding mixtures (CFM) were three-component mixtures (wheat, barley, soyameal, premix) and were mixed for each pen separately according to the designed scheme.

Feeding scheme

Nutrients in FCM		Feeding phase		
		up to 35 kg	35-65 kg	over 60 kg
Crude protein	(g/kg)	196,70	184,00	156,30
ME	(MJ/kg)	13,30	13,20	12,90
Crude fiber	(g/kg)	39,84	38,76	40,75
Lysine	(g/kg)	11,40	10,20	8,30
Threonine	(g/kg)	7,20	6,50	5,40
Methionine	(g/kg)	3,20	2,90	2,40
Ca	(g/kg)	7,20	6,80	6,10
P	(g/kg)	5,50	5,40	4,60

Dissection of the belly was made according to the EU methodology, separating the frontal part of the belly between 4th and 5th rib, the anterior part of the belly was separated by a section made 4 cm caudally behind the last rib first vertically and subsequently cranially close to the row of mammary glands ducts.



In order to evaluate the belly-formation with the subsequent determination of the estimate of the belly lean meat share, radiographs were made of the section of the carcass part of the EU belly at three points according to the methodology of Schwerdtfeger et al. (1993). The LUCIA programme (Laboratory Imaging Ltd.) was used to measure in sections 1,2,3 the area of the belly (mm^2), meat (mm^2) and the ratio of lean meat in the section area of the belly to the total area of the belly (%).

Lean meat and its share in the belly was calculated by Cítek (2002):

$y = 42{,}63841413 + 0{,}24603687*PLPODIL2 – 3{,}43803239*HMEU - 0{,}00098125*PLCELK3 + 0{,}00254507*PLMASO3 + 0{,}00088281 *PLMASO1$

$r^2 = 0{,}857$

PLPODIL2 = the ratio of the area of lean meat to the total area of the belly at the point of section 2 (%),
HMEU = weight of the part of the belly dissected according to EU (kg),
PLCELK3 = total area of the belly at the point of section 3 (mm^2),
PLMASO1 = the area of lean meat at the point of section 1 (mm^2),
PLMASO3 = the area of lean meat at the point of section 3 (mm^2).

For the purposes of implementation of an objective analysis of a belly part formation and assessment of its´ individual impacts the monitored set of slaughter pigs was divided according to the reached carcass weight into the following classes: 95kg and less, 95 – 99.9kg, 100 – 104.9kg, 105 – 109.9kg, 110 – 115kg, over 115kg.

RESULTS AND DISCUSSION

It is obvious out of the Table 1 that minimum differences were found out in weights of the tested animals. Contrary to that highly significant differences were calculated among the groups in the reached slaughter weight. At the same time in practically identical age, the starting values in the tests and significantly different reached slaughter weights the growth intensity of the animals was different. It means that the animals with a high slaughter weight had also high growth intensity and the other way round. The lightest group showed within the testing period average values of the daily gain equal to 722 ± 16,79g and the heaviest group had excellent values equal to 972 ± 15,21g.

Table 1. Evaluation of the carcass belly according to carcass weight

Indicator	n	less 95kg $\bar{x}$	± $s_{\bar{x}}$	s	n	95kg – 99.9kg $\bar{x}$	± $s_{\bar{x}}$	s
Initial live weight (kg)	9	22.8	± 1.19	3.57	13	24.3	± 1.20	4.34
Finishing live weight (kg)	9	91.3 ABCDE	± 0.87	2.60	13	97.1 AFGHI	± 0.40	1.43
Total daily weight gain in test (g)	9	722 ABCD	± 16.79	50.37	13	765 EFGH	± 16.29	58.74
Indicator	n	100kg – 104.9kg $\bar{x}$	± $s_{\bar{x}}$	s	n	105kg – 109.9kg $\bar{x}$	± $s_{\bar{x}}$	s
Initial live weight (kg)	44	23.9 a	± 0.59	3.90	59	24.2	± 0.51	3.91
Finishing live weight (kg)	44	102.4 BFJKL	± 0.22	1.46	59	107.1 CGJMN	± 0.17	1.30
Total daily weight gain in test (g)	44	845 AEIJa	± 9.59	63.64	59	873 BFKLa	± 9.23	70.87
Indicator	n	110kg - 115kg $\bar{x}$	± $s_{\bar{x}}$	s	n	over 115kg $\bar{x}$	± $s_{\bar{x}}$	s
Initial live weight (kg)	46	25.6 a	± 0.61	4.12	22	24.9	± 0.89	4.18
Finishing live weight (kg)	46	111.7 DHKMO	± 0.23	1.53	22	117.8 EILNO	± 0.57	2.68
Total daily weight gain in test (g)	46	931 CGIKb	± 11.22	76.10	22	972 DHJLb	± 15.21	71.33

P <= 0,01 A,B,C,D,E,F,G,H,I,J,K,L,M,A,O, P <= 0,05 a,b,

Table 2 Evaluation of the belly part in pig carcasses with relation to carcass weight

Indicator	less 95kg				95kg - 99.9kg			
	n	$\bar{x}$	± $s_{\bar{x}}$	s	n	$\bar{x}$	± $s_{\bar{x}}$	s
Total belly weight (kg)	9	6.74 ABCDa	± 0.10	0.30	13	7.30 EFGa	± 0.16	0.58
Total belly share in the right half (%)	9	17.67	± 0.32	0.95	13	18.23	± 0.37	1.35
EU-belly weight (kg)	9	3.68 ABCD	± 0.10	0.30	13	3.92 EFGa	± 0.14	0.50
EU-belly share in the right half (%)	9	9.66	± 0.31	0.94	13	9.78	± 0.32	1.17
EU-belly share in the total belly (%)	9	54.63	± 1.37	4.10	13	53.58	± 1.23	4.45
Lean meat in EU-belly (kg)	9	2.05 ABab	± 0.05	0.16	13	2.16 cd	± 0.08	0.30
Lean meat share in EU-belly (%)	9	55.68 ab	± 1.12	3.35	13	55.27 cd	± 0.94	3.37
Lean meat share in pig carcasse (%)	9	57.03	± 1.19	3.56	13	57.30	± 0.91	3.27
Indicator	100kg - 104.9kg				105kg - 109.9kg			
	n	$\bar{x}$	± $s_{\bar{x}}$	s	n	$\bar{x}$	± $s_{\bar{x}}$	s
Total belly weight (kg)	44	7.60 AHI	± 0.08	0.50	59	7.74 BEJb	± 0.06	0.43
Total belly share in the right half (%)	44	18.14	± 0.15	1.03	59	17.76	± 0.12	0.92
EU-belly weight (kg)	44	4.17 AHIa	± 0.05	0.33	59	4.22 BEJb	± 0.05	0.37
EU-belly share in the right half (%)	44	9.96	± 0.12	0.77	59	9.68	± 0.10	0.80
EU-belly share in the total belly (%)	44	54.90	± 0.44	2.89	59	54.48	± 0.41	3.17
Lean meat in EU-belly (kg)	44	2.25 a	± 0.03	0.19	59	2.23 b	± 0.03	0.22
Lean meat share in EU-belly (%)	44	54.00	± 0.62	4.13	59	53.04	± 0.51	3.95
Lean meat share in pig carcasse (%)	44	55.74	± 0.54	3.55	59	56.72	± 0.58	4.48
Indicator	110kg - 115kg				over 115kg			
	n	$\bar{x}$	± $s_{\bar{x}}$	s	n	$\bar{x}$	± $s_{\bar{x}}$	s
Total belly weight (kg)	46	7.97 CFHKb	± 0.09	0.61	22	8.34 DGIJK	± 0.14	0.66
Total belly share in the right half (%)	46	17.69	± 0.17	1.12	22	17.85	± 0.30	1.39
EU-belly weight (kg)	46	4.39 CFHb	± 0.05	0.37	22	4.49 DGIJ	± 0.09	0.43
EU-belly share in the right half (%)	46	9.75	± 0.12	0.78	22	9.61	± 0.18	0.85
EU-belly share in the total belly (%)	46	55.09	± 0.43	2.91	22	53.93	± 0.80	3.74
Lean meat in EU-belly (kg)	46	2.30 Ac	± 0.03	0.23	22	2.33 Bd	± 0.04	0.19
Lean meat share in EU-belly (%)	46	52.56 ac	± 0.66	4.45	22	52.00 bd	± 0.91	4.27
Lean meat share in pig carcasse (%)	46	55.31	± 0.57	3.87	22	55.02	± 0.92	4.33

P <= 0,01 A,B,C,D,E,F,G,H,I,J,K, P <= 0,05 a,b,c,d,

Evaluation of a meaty belly part representation in the carcass can be found in the Table 2. In evaluation of the total belly part from the carcass it is logically obvious that there was a statistically significant growth of these part as well as the live weight of pigs. Compared to that as regards the carcass percentage of the belly no significant differences were discovered among the evaluated groups. Therefore, it may be stated that with increasing weight within the evaluated set of pigs no higher rate of the belly part can be seen in the carcass. Grácik et al. (1986) found out that meaty parts share decline with growing weight but however there is a percentage growth in a meaty part "belly". The reached values fluctuated over 20%. The cited conclusions were not confirmed within the work.

The same trend was discovered in a EU belly weight and a percentage of the EU belly from the total carcass. While comparing these differences there was an identical percentage growth in both evaluated indicators (Graph 1).

As regards the belly meat share a trend of its growth with a growing weight of pigs is preserved here. Statistically significant differences especially between the lightest and the heaviest group were calculated. Therefore, it is obvious that there is a significantly lower meat increase in the belly in relation to the growing weight of pigs.

As regards the percentage of meat in the belly a dropping share of meat in the one may be seen with a growing weight of the animals. Therefore, we may say that with an increasing weight the belly share in the carcass does not change significantly, there is an absolute increase of lean meat value, but at the same time the belly lean meat share drops. This is caused by a higher rate of fat deposition in heavier hogs / hogs with a higher weight.

The same declining trend can be monitored even in the lean meat share in carcass. Again it is obvious that the meat percentage in the carcass as well as belly meat share do not reach the same values and that there is an increase of this difference in relation to increasing weight.

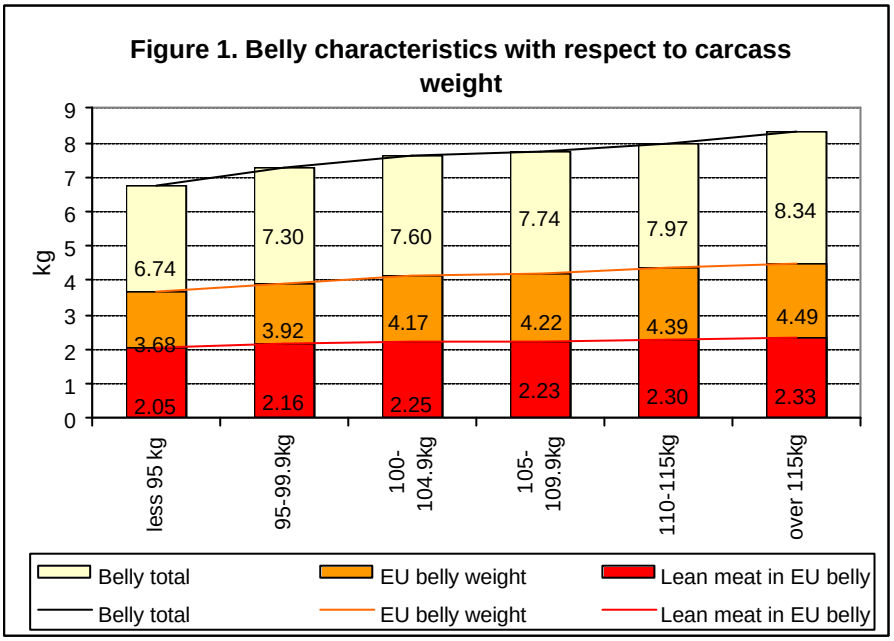


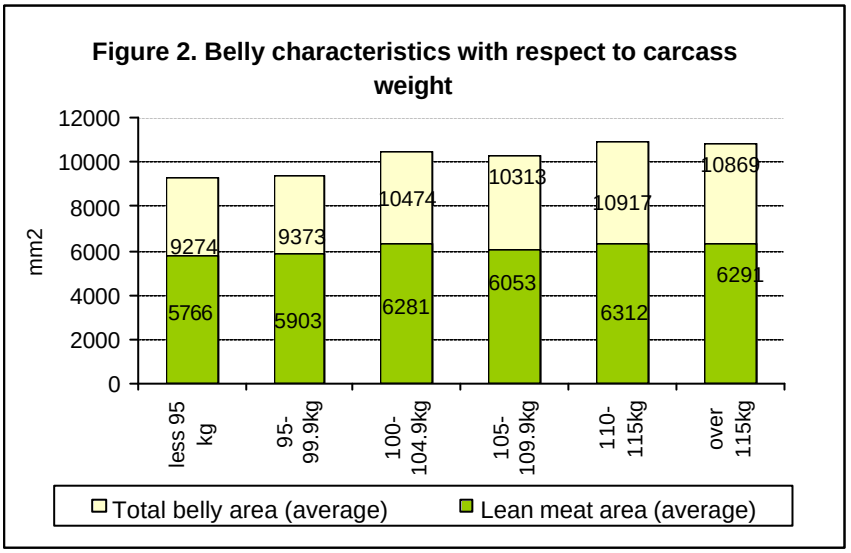
Table 3 Evaluation of the area belly section in pig carcasses with relation to carcass weight

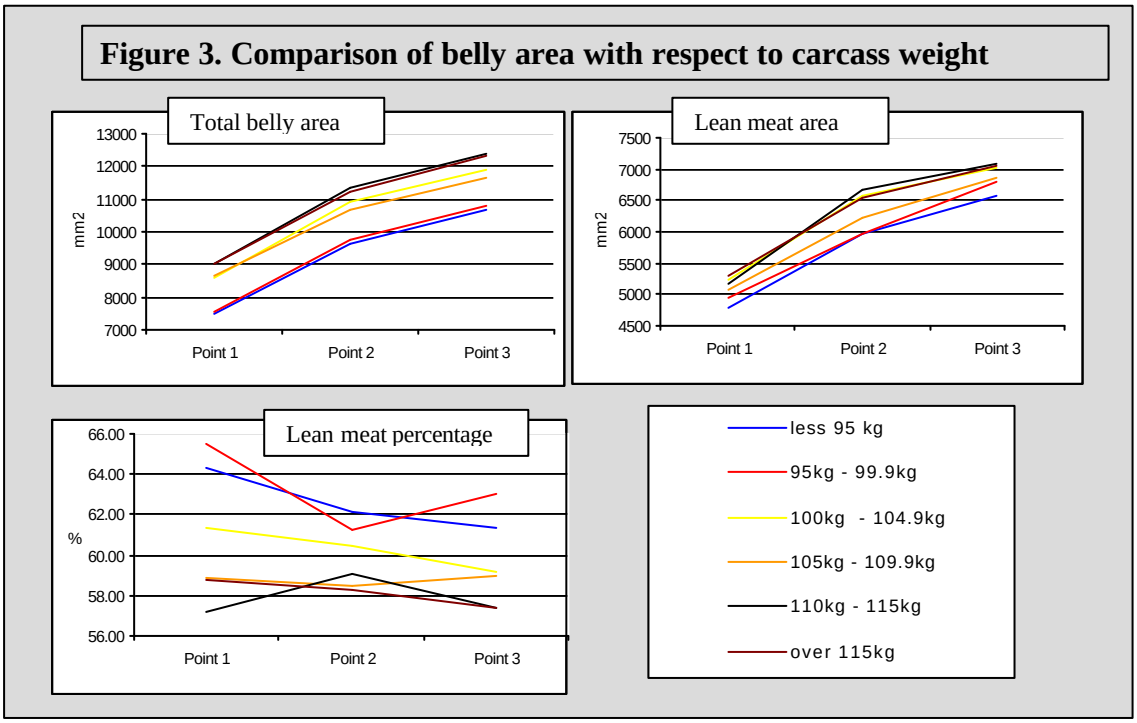
Indicator	less 95kg					95kg - 99.9kg				
	n	$\bar{x}$		± $s_{\bar{x}}$	s	n	$\bar{x}$		± $s_{\bar{x}}$	s
Total area of belly on section 1 [mm2]	9	7477	ABCD	± 174	522	13	7575	EFGH	± 247	892
Total area of belly on section 2 [mm2]	9	9641	ABa	± 453	1358	13	9735	CDEb	± 431	1555
Total area of belly on section 3 [mm2]	9	10703	ABa	± 361	1083	13	10808	CDb	± 415	1497
Total belly area (points 1-3 average) [mm2]	9	9274	ABCa	± 281	843	13	9373	DEFG	± 327	1179
Lean meat area on section 1 [mm2]	9	4778		± 139	418	13	4937		± 171	616
Lean meat area on section 2 [mm2]	9	5958		± 243	728	13	5983	a	± 344	1241
Lean meat area on section 3 [mm2]	9	6562		± 270	811	13	6789		± 303	1094
Lean meat area (points 1-3 average) [mm2]	9	5766		± 207	621	13	5903		± 239	863
Share of meat area in the total area on section 1 [%]	9	64.28	Aab	± 2.79	8.38	13	65.49	BCDc	± 1.84	6.62
Share of meat area in the total area on section 2 [%]	9	62.14		± 2.00	6.00	13	61.23		± 1.82	6.56
Share of meat area in the total area on section 3 [%]	9	61.37		± 1.86	5.58	13	63.00	Aab	± 1.98	7.14
Share of meat area in the total area (points 1-3 average) [%]	9	62.27	a	± 1.81	5.43	13	63.06	Ab	± 1.60	5.76
Indicator	100kg - 104.9kg					105kg - 109.9kg				
	n	$\bar{x}$		± $s_{\bar{x}}$	s	n	$\bar{x}$		± $s_{\bar{x}}$	s
Total area of belly on section 1 [mm2]	44	8608	AE	± 174	1153	59	8632	BFa	± 133	1024
Total area of belly on section 2 [mm2]	44	10915	Ca	± 210	1393	59	10647	Cb	± 168	1289
Total area of belly on section 3 [mm2]	44	11900	ab	± 207	1370	59	11659	c	± 196	1504
Total belly area (points 1-3 average) [mm2]	44	10474	AD	± 158	1048	59	10313	EIab	± 138	1062
Lean meat area on section 1 [mm2]	44	5249		± 118	784	59	5063		± 83	641
Lean meat area on section 2 [mm2]	44	6572		± 149	988	59	6228	b	± 162	1244
Lean meat area on section 3 [mm2]	44	7021		± 148	979	59	6868		± 139	1067
Lean meat area (points 1-3 average) [mm2]	44	6281		± 115	765	59	6053		± 111	852
Share of meat area in the total area on section 1 [%]	44	61.35	Ec	± 1.13	7.52	59	58.86	Ba	± 0.74	5.66
Share of meat area in the total area on section 2 [%]	44	60.46		± 1.11	7.38	59	58.49		± 1.15	8.87
Share of meat area in the total area on section 3 [%]	44	59.12		± 0.95	6.32	59	58.95	a	± 0.75	5.79
Share of meat area in the total area (points 1-3 average) [%]	44	60.13		± 0.92	6.10	59	58.70		± 0.74	5.66
Indicator	110kg - 115kg					over 115kg				
	n	$\bar{x}$		± $s_{\bar{x}}$	s	n	$\bar{x}$		± $s_{\bar{x}}$	s
Total area of belly on section 1 [mm2]	46	9048	CGa	± 164	1112	22	9005	DH	± 242	1135
Total area of belly on section 2 [mm2]	46	11335	ADC	± 216	1462	22	11253	BE	± 360	1691
Total area of belly on section 3 [mm2]	46	12369	ACc	± 207	1401	22	12348	BD	± 350	1640
Total belly area (points 1-3 average) [mm2]	46	10917	BFI	± 173	1174	22	10869	CGb	± 294	1379
Lean meat area on section 1 [mm2]	46	5175		± 132	893	22	5297		± 180	844
Lean meat area on section 2 [mm2]	46	6677	ab	± 151	1025	22	6535		± 225	1054
Lean meat area on section 3 [mm2]	46	7085		± 160	1087	22	7041		± 201	942
Lean meat area (points 1-3 average) [mm2]	46	6312		± 131	887	22	6291		± 181	848
Share of meat area in the total area on section 1 [%]	46	57.20	ACE	± 1.03	6.99	22	58.81	Db	± 1.20	5.63
Share of meat area in the total area on section 2 [%]	46	59.06		± 1.02	6.91	22	58.28		± 1.34	6.29
Share of meat area in the total area on section 3 [%]	46	57.42	A	± 1.08	7.34	22	57.35	b	± 1.41	6.59
Share of meat area in the total area (points 1-3 average) [%]	46	57.91	Aa	± 0.93	6.29	22	58.06	b	± 1.21	5.66

P <= 0,01 A,B,C,D,E,F,G,H,I, P <= 0,05 a,b,c,

It is obvious out of the Table 3 that there is a statistically significant growth of the overall belly area with increasing weight of pigs and only a moderate (insignificant) increase of meat area (Graph 2). We confirm an overall belly area growth from cut 1 to cut 3. Identical trend was recorded in all weight categories. The same conclusion shall be made also for the indicator of the belly meat area. It is obvious that there is a higher increase of the belly area in relation to increasing weight of body but at the same time there is a slower growth of the belly meat area.

As regards the indicator "the percentage of the meat area in the belly" it was confirmed that there is a drop of the meat share in relation to the weight increase, especially then up to the live weight approximately 105 kg (Graph 3). After reaching this value there is no significant decrease of the meat share and the belly meat part preserves the same percentage of meat and fat within the evaluated weight category. A different rate of meat and fat deposition on the individual cuts 1 – 3 (Graph 3) in animals with a low weight may also be seen, i.e. with a higher rate of meat in comparison to the animals with a higher weight and a lower percentage of meat.





CONCLUSION

- No significant changes in percentage of the carcass belly part can be observed in respect of the weight growth, the same trend was found out in the EU belly part share out of the total belly part as well as carcass.
- In relation to the body weight growth there can be seen a fast growth of the total belly area, which is accompanies by a lower growth of the meat area.
- In relation to the increasing weight there is an increase of the meat weight but at the same time there is a drop of the lean meat share in this part. There is a significant drop of the meat area share in the belly up to the live weight of approximately 105 kg, and subsequently the drop slows down.
- Existence of different deposition of meat and fat in the individual cuts (1,2,3) was proved in pigs with a lower weight, respectively with a higher rate of meat in comparison to the animals with a higher, respectively lower lean meat share.

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CONTACT ADDRESS

Doc.Ing.Roman Stupka, CSc.,
Czech University of Agriculture, Department of Pig and Poultry Science,
Prague, Kamycka, 165 21,
Czech Republic
Tel. +420 220 922 251, +420 224 383 062;
e-mail: stupka@af.czu.cz,

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