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Summary of a Doctoral (Ph.D.) Thesis

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THE CARCASS AND MEAT QUALITY OF LAMBS FROM DIFFERENT GENOTYPES

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I. Introduction, purposes

In the national sheep breeding sector the greatest defaults are by the weaned lamb production per ewe and meat and bone performance. The 90 % of the Hungarian sheep population is Hungarian Merino, and the other purebred populations are few in number to play an important part in the sector in purebred form, but this headcount is enough to produce an F_1 maternal line.

The most promising crossing partners in maternal lines are: British Milksheep, Lacaune, Bábolna Tetra, Prolific Merino and Tsigai. Advisable terminal breeds can be the Suffolk, the Texel, the Charollais and the German Blackheaded breed.

The hold off of crossing can increase our handicap in competitiveness and our defaults in quality compared with the sheep-farms in the EU. At the same time the spontaneously made crossings can cause frustration in shepherds – as it happened previously – which can slow down development. That is why we need to evaluate the results of the different genotypes.

My aim is to:

- determine the meat production, the slaughter and meat quality of different genotypes,
- analyse the chemical composition and organoleptic features of the different meat parts as it is one of the interest of slaughter houses, and consumers
- the fatty acid composition of the different meat are in the forefront of attendance, that is why I analysed this important component as well, as I tried to give a complete picture of the examined genotypes

II. Material and methods

My examinations were a part of a great researching programme of the department. There are such new elements and analyses in it, which have not been made in Hungary before. I evaluated the slaughter value of genotypes. I made the chemical, organoleptic and fatty acid composition analyses of three different meat parts as: leg, loin and shoulder. I compared end-product crossing constructions. The maternal line was (Hungarian Merino x British Milksheep), and the terminal crossing partners were randomly: Ile de France, Texel, Suffolk, Charollais, German Blackheaded, German Mutton Merino, British Milksheep (table 1.).

Lambs were treated the same way during the examination. Intense mono-dietic, ad-libitum, small group fattening was used. The fattening recipe and the content of the compound feed was the same in every case. The slaughtering was made in different live weight. Before slaughtering the lambs were fasted for 24 hours, but water was provided ad libitum.

All lambs were measured individually before slaughtering. The carcass, the organs, the skin, the head were measured in warm than the cold carcass was weighed 24 hours after slaughtering. Cutting into parts was carried out by Australian method also 24 hours after slaughtering recommended by OMMI.

S/EUROP classification was also made on warm carcass on the day of slaughtering on the basis of regulation (16/1998 IV.3.) entitled “classification and grouping into trading classes of lambs after slaughtering by the Minister of Agriculture”. Carcasses were analysed on the basis of S/EUROP system with comparison tables by committees.

Meat samples were analysed in the Central Laboratory of the University of Debrecen, Centre of Agricultural Sciences.

Dry matter connective tissue and pigment content were analysed from homogenous samples. For the determination of crude protein and crude fat content the samples were dried at 60 ^{0}C and were minced again.

Dry-matter was determined in association with MSZ 5874/4-80. L-hidroxiprolin, crude fat, crude protein contents were determined in association with MSZ 5874/9-84, MSZ 5874/1985 and MSZ 5874-8/1978, respectively.

To determine the fatty acid composition total lipid was extracted from adipose tissue samples by the method of FOCH et al. (1957). The resultant fatty acid methyl esters were separated and analysed by gas liquid chromatography according to Husveth et al. (1982). The analyses were made in the Laboratory of the University of Veszprém, Faculty of Georgikon Agricultural Sciences. The leader of the analyses was Professor Ferenc Húsvéth.

Total pigment and organoleptic features were determined by methods recommended in the articles of National Meat Industry Research Centre (VADÁNÉ KOVÁCS, 1975)

Judgement of tenderness, taste and flavour was carried out with the oven loss determination (VADÁNÉ KOVÁCS, 1996). The taste of heat-treated meat was estimated without any spices. The taste flavour, tenderness, number of chewing and oven loss were measured from slices fried for 6 minutes. In order to determine the number of chewing samples were chew in such a number at which the bit becomes convenient to swallow.

I compared the results of the CT analyses, what was made at the University of Kaposvár, Faculty of Animal Sciences, with the results of the chemical analyses. Series of images were taken to all the animals with 10 mm slice thickness and 20 mm slice gap. The results were processed with the help of the CTPC post –processing program, developed in the Faculty.

Results were analysed by GLM, and PEARSON correlation with Excel 2000 and SPSS 8.0 statistical programmes.

III. Results

The examined lambs were at the same age, that is the reason why the live weight of the animals showed such a big deviation.

At the same age the Charollais crossings had the biggest live weight (31,50 kg), and the lambs from Texel shires had the second biggest live weight (31,05kg). The Suffolk crossed genotype showed a good picture as well (28,63 kg). Then the order was the following: British Milksheep, Ile de France, German Blackheaded and finally the German Mutton Merino had the worst result (Table 2).

Slaughter traits

In the case of cooling loss we can separate 2 different groups, in the first group the loss is between 2-3% (British Milksheep, Ile de France, Suffolk, Texel crossed genotypes), while in the second group this value was between 5-6% (German Mutton Merino, German Blackheaded, Charollais). This big difference was significant, that is why we need to estimate this trait as well (table 2).

I examined the rate of meat and bone in the carcass. From the analysed genotypes the labs from British Milksheep, Ile de France, Charollais and Texel rams had the same value as the international tendency (4:1). In the case of German Mutton Merino and German Blackheaded crossed genotype this rate was lower (31% bone) (table 2).

The S/EUROP conformation results suited professional acceptance. None of the genotypes gave an excellent value, but all of them had better results than the Hungarian commercial stock which was determined by MOLNÁR (1999). She said that 10,2% of the stock was in R, 74% in O and 15,8% in P categories.

In fatness classification the German Blackheaded had the worst qualification (60% was in class 1), while the lambs from Texel and Charollais rams had the best result (78% in class 2). The results are in table 3.

In the analyses of the weight of valuable meat parts the two extreme examples are the following: there are 40% relative difference between Suffolk and German Mutton Merino crosses. The relative difference was 34,5% in the shoulder ratio between the lambs from German Mutton Merino (22,1%) and British Milksheep (26,87%) rams. The difference is significant at the level of $P<0,01$.

On the basis of the ratio of valuable meat parts there are two groups. In one group there are the Ile de France, Suffolk, British Milksheep, here the values are between 69-71%, while in the other group these results are in the range of 62-64% (Texel, Charollais, Germen Blackheaded, German Mutton Merino crosses). The results are in table 4.

The results of the chemical analyses

In the literature there are relatively few value for the quality of the different meat parts of sheep. We can generally say that in the case of the dry-matter-, crude protein- and crude fat content there are differences between the meat parts. The dry matter content of young lambs is optimal over 25%. The highest dry matter content was by the loin (26,53%), what was significantly higher than in case of the leg (26,1%, P<0,05) and the shoulder (25,78%, P<0,001).

The average absolute crud protein content of the meat is around 20%. The highest protein content was in the loin (21,45%), while the less crude protein was in the shoulder (20,44%). The difference is significant at the level of P<0,05.

In the case of lamb meat the crude fat content of lean meat is between 3-30 %, as it is written in the different scientific literature. Naturally it is around the first value in case of young lambs.

The crude fat content was the same by the leg and loin meat (3,4%), in the shoulder meat it is higher (84%). The absolute difference is 17 relative %, which is significant at P<0,001 level.

The shoulder had the lowest hemin content (22,4%), which is significantly lower than in the leg and lion meat of the lambs. The low hemin content means lighter meat, which is preferred by the consumers.

There was only a minimal difference between leg meat (1,48%) and shoulder samples (1,47%) in case of the connective tissue content. These results were significantly lower than in loin meat (1,25%, P<0,01). The results are in table 5.

Among the genotypes the meat of the German Mutton Merino crossed lambs had the highest dry-matter content (26,96%). Afterward the rank is the following: Texel – (26,30%), Charollais – (26,28%), German Blackheaded – (26,19%), Ile de France – (25,88%), British Milksheep – (25,36%) and Suffolk crosses (25,31%). The difference is significant between the two extreme values at the level of P<0,001.

The increasing order of the crude protein content of the meat of different lamb genotypes is the following:

German Blackheaded- (20,60%), German Mutton Merino- (20,99%), Charollais– (21,33%), Suffolk– (21,36%), Ile de France– (21,37), Texel– (21,42%), British Milksheep crosses (21,60%). The difference is significant between the two extreme values at the level of P<0,05.

In the case of crude fat content of the meat the quality rank among the genotypes is the following:
British Milksheep- (2,41%), Suffolk- (2,57%), Texel– (3,45%), Charollais- (3,51%), German Blackheaded- (4,42%), German Mutton Merino (4,89%) crossed lambs. The difference between the extreme values is 102 relative %. The distinctions is significant at the level of P<0,001.

There are big differences in the connective tissue of the meat among the genotypes. The meat of lambs from German Blackheaded rams had the worst result as the average connective tissue content was 1,83% in this case, the meat of the German Mutton Merino crossed lambs was not the best in this analyses as the average value was 1,67%. The Suffolk crossed lambs had the best result (0,92%). It is remarkable, that the absolute difference between the extreme results was 98,9 relative %. The distinctions is significant at the level of P<0,001. The data are in table 6.

In table 7 the total saturated fatty acid rate can be found. The meat of German Mutton Merino had the highest saturated fatty acid content (48,88%), then the meat of the German Blackheaded (47,97%), British Milksheep (47,27%), Ile de France (47,09%), Suffolk (45,7%) crossed lambs is in the row. The oleic -, linoleic -, linolenic acid are essential fatty acids. The highest oleic acid content was in the meat of the Suffolk crosses (39,94%, while the meat of German Mutton Merino crossed lambs had the lowest C18:1 content (37,44%). The relative % of the difference is 6,46%. The distinctions is significant at the level of P<0,05.

There were not any significant differences in the case of the linoleic acid content of the intramuscular fat of the genotypes. In the case of the linolenic acid the intramuscular fat of British Milksheep R1 lambs had the highest content (1,15%), while the meat of Suffolk crosses had the lowest rate from this fattyacid (0,67%).

The greatest proportion of unsaturated fatty acids was in the meat of Suffolk crossed lambs (54,05%) while the worst rate was in the case of the lambs from German Blackheaded crossing (51,21%).

The difference between the two values is 5,5 relative %. The distinctions is significant at the level of P<0,001.

The fatty acid composition of the meat parts is the following: the meat of the shoulder had the highest saturated fatty acid content (48,05%), which is much higher than in case of the loin (46,88%). It confirms that the loin is healthier than the meat of the shoulder. The data are in table 8.

<u>The results of the organoleptic analyses</u>

In the evaluation of the odour of the meat the German Blackheaded crossed lambs had the best results, while the meat of the lambs from Ile de France rams got the worst qualification. The difference was 11,14 relative %.

In the case of the taste the meat of the lambs from German Blackheaded rams had the best quality, the German Mutton Merino crosses and the labs from Charollais rams had the second best result. Afterwards the order is the folloowing: the lambs from British Milksheep, Texel, Suffolk, Ile de France rams. The difference between the extreme values is 26,8 relative %. The distinctions is significant at the level of P<0,05.

The worst average toughness value was in the case of the meat of German Mutton Merino crossed lambs (3,19), the best average date was by the British Milksheep crosses (2,23). The difference is 35,42 relative %. The distinctions is significant at the level of P<0,001.

The ovenloss can be interesting especially to housewives. The best result was by the meat of German Blackheaded (19,36%) crossed lambs while the highest loss rate was in the case of the lambs from Suffolk rams (24,03). The difference is significant at the level of P<0,05.

The organoleptic parameters of the genotypes are shown in table 9.

The results of the different meat parts independently from the genotype are in table 10. The meat of the shoulder had the best taste, had the best value of tenderness, lowest chewing number, and lowest ovenloss rate. In the case of the odour the meat of the leg and the loin were the same, while the results of the shoulder were better. These differences were not significant.

The results of the correlation analyses

In the inspection of the correlation between the CT examination and the chemical analyses I got the following results:

There is a weak positive connection between CT examination of the fatness and the fat content analysed by chemical methods (r= 0,289). There is a weak negative relationship between the CTIF index (muscle / fat ratio measured by CT) and the chemically analysed fat content of the meat (r= -0,387). There is a medium negative connection between the bone ratio of the carcass and the fat content (r= -0,419)

There is only a slight connection between the chemical parameters of loin meat and leg and shoulder meat (r= 0,081 – 0,358). In this way the chemical parameters of the meat parts cannot be estimated from the chemical parameters of the loin.

IV. Conclusion

For the (Hungarian Merino x British Milksheep) maternal line the following shires can be recommended: Suffolk, Texel, Charollais. Cross to this the German Mutton Merino is the least advisable.

On the basis of the examination it is proved that a higher merino genetic percentage does not ensure better meat quality, and organoleptic features.

There is a big difference between the quality of the fatty acid content of the meat of the different genotypes. The unsaturated/saturated fatty acid ratio was unfavourable in the case of the meat from the lambs of the German Mutton Merino crossed genotype. The best result were by the lambs from Suffolk rams.

There are only weak correlations between the chemical parameters of the meat and the parameters measured with CT.

The chemical parameters of the meat parts cannot be estimated reliably from the chemical parameters of the loin.

In the near future because of the decreasing live animal transport the slaughtered and processed meat marketing will come to the front. The composition and utilization of sheep breeds in Hungary can be changed by this tendency in a large measure. On the basis of my analyses for the different processing levels different genotypes can be recommended. Because of the different conformity, fatness, loin ratio, leg and shoulder weight the Texel, Suffolk, Charollais and Ile de France breeds can be recommended in different cases.

V. New scientific results

1. I provided new data to the evaluation of meat production, slaughter value and meat quality of the genotypes in Hungary. In the case of (Hungarian Merino x British Milksheep) genotype, which has very favourable maternal features the recommended shire breeds are the following: Charollais, Texel, Ile de France de France, Suffolk. These breeds are appropriate to produce high quality lambs. In the proportion of the valuable meat parts the Suffolk proved to be the most advantageous crossing partner, while in the case of the S/EUROP quality the Texel and the Charollais breeds are the most favourable.

2. I analysed the differences between the genotypes regarding the proportion of the different valuable meat parts, and the quantitative and qualitative differences in the leg, loin and shoulder. In the carcass of the given genotypes the proportion, the weight and the quality of the leg, loin and shoulder are differing. In the case of the weight of the loin the Suffolk crosses had the best result, while by the proportion of the leg and shoulder the lambs from Texel and Charollais rams had the best result.

3. I analysed the fatty acid content of the different valuable meat parts, so I contributed to the better estimation of the meat quality of the genotypes. The meat of the Suffolk crosses had the best fatty acid content; while in the case of the meat parts the loin gave the best results.

4. With the correlation analyses I contributed to the comparison of the chemical analyses of the sheep meat, and the CT examination of the animals. On the basis of my results the applied, currently processed system in which (because of the low determinating coefficient) the fat content determined by CT is

not suitable to estimate the intramuscular fat content defined by chemical analyses. I got similar result for the muscle amount of the carcass defined by CT, and the dry matter content of the meat.

5. By the correlation from the chemical parameters of loin meat the chemical parameters of the leg and the shoulder cannot be estimated. The relationship is different in the case of each genotype, but it is never stronger than a medium level, moreover sometimes it has negative values.

Table 1: The structure of the examination: the number of the analysed animals by genotypes and parameters

Parameter	(HMx BM)[1]x British Milksheep	(HMx BM)[1]x Ile de France	(HMx BM)[1]x Suffolk	(HMx BM)[1]x German Blackheaded	(HMx BM)[1]x German Mutton Merino	(HMx BM)[1]x Charollais	(HMx BM)[1]x Texel	Total
Live weight	6	12	12	15	15	15	15	90
Warm weight	6	12	12	15	15	15	15	90
Killing-out percentage	6	12	12	15	15	15	15	90
EU-conformation	6	12	12	15	15	15	15	90
EU-fat coverage	6	12	12	15	15	15	15	90
Cold weight	6	12	12	15	15	15	15	90
Cooling loss	6	12	12	15	15	15	15	90
Australian cutting	6	12	12	15	15	15	15	90
Chemical analyses	6	12	12	15	15	15	15	90
Fatty-acid composition	6	12	12	15	15	-	-	60
CT analyses	6	12	12	-	-	15	15	60
Organoleptic examinations	6	12	12	15	15	15	15	90

1. (HM x BM): Hungarian Merino x British Milksheep

Table 2. : The slaughter traits of lambs of the examined genotypes

Genotype	N		Live weight (kg)	Slaughter weight (kg)	Dressing percentage (%)	Cold weight (kg)	Cooling loss (kg)	Bone ratio (%)	Meat ratio (%)
1. (HM x BM) x BM	6	Average	25,50	11,15	43,76	10,97	0,22	30,00	70,00
		CV%	*8,50*	*8,75*	*5,02*	*8,43*	*18,84*	*4,20*	*5,30*
2. (HM x BM) x ILE	12	Average	24,96	11,28	45,14	11,17	0,20	27,85	72,15
		CV%	*9,61*	*12,04*	*5,01*	*12,08*	*30,15*	*8,61*	*3,41*
3. (HM x BM) x S	12	Average	28,63	12,80	44,85	12,72	0,22	28,23	71,77
		CV%	*12,24*	*11,99*	*7,03*	*13,05*	*26,65*	*7,54*	*3,64*
4. (HM x BM) x GMM	15	Average	24,16	10,99	45,38	10,45	0,54	32,26	67,76
		CV%	*16,23*	*17,55*	*3,13*	*17,84*	*23,00*	*9,61*	*5,50*
5. (HM x BM) x GBH	15	Average	24,83	11,30	45,19	10,72	0,58	34,15	65,85
		CV%	*12,33*	*23,39*	*4,73*	*22,83*	*33,12*	*8,49*	*6,48*
6. (HM x BM) x CH	15	Average	31,50	14,37	45,53	13,63	0,69	27,23	72,77
		CV%	*12,07*	*14,35*	*4,64*	*19,33*	*26,16*	*5,80*	*4,32*
7. (HM x BM) x T	15	Average	31,05	14,36	46,11	14,14	0,22	27,56	72,44
		CV%	*13,48*	*18,14*	*2,92*	*18,64*	*29,94*	*12,22*	*2,33*

(HM x BM): Hungarian Merino x British Milksheep, ILE: Ile de France, S: Suffolk, GMM: German Mutton Merino, GBH: German Black Headed, CH: Charollais, T: texel

Table 3. : Percentile distribution of S/EUROP conformation and fat coverage by genotypes

Genotype	N	Average	E (%)	U (%)	R (%)	O (%)	P (%)	Average	$1^0,1^+$ (%)	2 (%)	3^- (%)	$3^0,3^+$ (%)
1. (HM x BM) x BM	6	R-	0	0	75	25	0	2-	0	100	0	0
2. (HM x BM) x ILE	12	R^0	0	8	75	16	0	2+	0	100	0	0
3. (HM x BM) x S	12	O^0	0	0	34	66	0	2^0	33	66	0	0
4. (HM x BM) x GMM	15	R-	0	0	61	38	0	2-	60	40	0	0
5. (HM x BM) x GBH	15	R-	0	0	60	33	7	1+	60	40	0	0
6. (HM x BM) x CH	15	R+	0	8	92	0	0	2^0	7	78	14	0
7. (HM x BM) x T	15	R+	0	25	75	0	0	2^0	6	88	6	0

(HM x BM): Hungarian Merino x British Milksheep, ILE: Ile de France, S: Suffolk, GMM: German Mutton Merino, GBH: German Black Headed, CH: Charollais, T: texel

Table 4. : The weight of the different meat parts by genotypes (g)

Genotype	N		Short loin	Long loin	Leg	Shoulder	Rate of valuable meat parts (%)	Goin	Rib	Neck	Shank
1. (HM x BM) x BM	6	Average	545,00	436,67	1333,33	1406,67	68,80	610,00	698,33	166,67	196,67
		CV%	22,53	12,60	6,25	9,73	3,43	11,87	18,55	15,01	10,50
2. (HM x BM) x ILE	12	Average	616,67	485,00	1336,67	1450,00	69,11	674,17	678,33	150,00	180,83
		CV%	19,39	13,94	10,75	13,70	1,93	15,07	13,38	15,31	11,42
3. (HM x BM) x S	12	Average	686,67	544,17	1605,00	1649,17	70,50	693,33	878,33	188,33	214,58
		CV%	18,67	12,33	12,77	22,08	5,93	8,64	15,81	18,23	11,73
4. (HM x BM) x GMM	15	Average	493,33	413,33	1285,33	980,00	62,38	541,33	953,33	191,00	194,00
		CV%	28,12	30,15	16,54	18,17	7,69	20,38	23,08	8,17	9,70
5. (HM x BM) x GBH	15	Average	540,00	500,00	1335,93	1066,67	63,26	584,07	1040,00	156,67	226,00
		CV%	33,43	50,70	19,80	21,16	6,16	29,86	35,20	21,26	15,76
6. (HM x BM) x CH	15	Average	519,86	560,14	1644,00	1819,71	62,97	753,29	1424,71	267,14	236,57
		CV%	14,36	17,08	16,80	16,18	4,06	21,40	17,81	15,65	10,79
7. (HM x BM) x T	15	Average	527,75	585,13	1717,63	1831,38	64,33	745,75	1384,88	861,88	234,50
		CV%	19,50	23,53	15,32	19,70	3,09	25,03	23,18	288,50	15,16

(HM x BM): Hungarian Merino x British Milksheep, ILE: Ile de France, S: Suffolk, GMM: German Mutton Merino, GBH: German Black Headed, CH: Charollais, T: texel

Table 5.: The chemical parameters of the examined meat parts

Type	N		Dry matter (%)	Protein (%)	Fat (%)	Hemin (mg/g)	Connective tissue (%)
Leg	90	Average	26,10	21,35	3,45	2,56	1,48
		CV%	*4,35*	*6,01*	*35,33*	*20,21*	*1,20*
Shoulde	90	Average	25,78	20,44	4,05	2,24	1,47
		CV%	*5,01*	*3,85*	*37,66*	*17,61*	*38,78*
Loin	90	Average	26,53	21,75	3,44	2,49	1,25
		CV%	*4,77*	*5,21*	*27,96*	*20,01*	*38,05*

Table 6.: Chemical parameters of the meat of the different genotypes

Genotype	N		Dry matter (%)	Protein (%)	Fat (%)	Hemin (mg/g)	Connective tissue (%)
1. (HM x BM) x BM	18	Average	25,36	21,60	2,41	2,37	1,12
		CV%	*4,79*	*5,44*	*27,82*	*17,06*	*43,90*
2. (HM x BM) x ILE	36	Average	25,88	21,37	3,24	2,44	1,33
		CV%	*5,06*	*6,78*	*25,46*	*13,64*	*34,69*
3. (HM x BM) x S	36	Average	25,31	21,36	2,57	2,37	0,92
		CV%	*4,30*	*5,01*	*24,84*	*18,49*	*34,99*
4. (HM x BM) x GMM	45	Average	26,96	20,99	4,89	2,25	1,67
		CV%	*4,06*	*6,43*	*26,97*	*15,95*	*35,61*
5. (HM x BM) x GBH	45	Average	26,19	20,60	4,42	2,19	1,83
		CV%	*5,21*	*6,67*	*29,35*	*16,04*	*51,10*
6. (HM x BM) x CH	45	Average	26,28	21,33	3,51	2,85	1,26
		CV%	*1,07*	*0,92*	*0,89*	*0,58*	*0,44*
7. (HM x BM) x T	45	Average	26,30	21,42	3,45	2,51	1,38
		CV%	*4,04*	*4,13*	*27,07*	*22,22*	*95,13*

(HM x BM): Hungarian Merino x British Milksheep, ILE: Ile de France, S: Suffolk, GMM: German Mutton Merino, GBH: German Black Headed, CH: Charollais, T: texel

Table 7.: Fatty acid composition of the meat of the different genotypes

Genotype	1. (HM x BM) x BM		2. (HM x BM) x ILE		3. (HM x BM) x S		4. (HM x BM) x GMM		5. (HM x BM) x GBH	
N	18		36		36		45		45	
	Average	*CV%*	Average	*CV%*	Average	*CV%*	Average	*CV%*	Average	*CV%*
c10:0	0,28	*32,34*	0,26	*25,65*	0,28	*35,93*	0,38	*47,00*	0,37	*54,04*
c12:0	0,58	*54,17*	0,47	*34,92*	0,59	*49,81*	1,04	*56,13*	0,92	*60,03*
c14:0	5,87	*23,02*	5,92	*21,56*	6,36	*28,25*	8,03	*23,77*	7,54	*32,85*
c14:1	0,98	*31,12*	1,03	*39,31*	1,13	*29,99*	1,22	*31,17*	1,10	*40,62*
c15:0	0,27	*21,10*	0,27	*81,04*	0,23	*27,01*	0,25	*24,69*	0,27	*28,48*
c16:0	20,17	*10,31*	20,66	*9,35*	20,62	*7,57*	19,61	*8,93*	19,00	*18,15*
c16:1	3,80	*19,44*	3,54	*16,76*	3,94	*12,76*	3,53	*21,24*	3,46	*19,53*
c17:0	2,16	*40,80*	2,56	*33,24*	2,35	*32,60*	2,66	*222,82*	1,77	*21,47*
c17 : 1	1,01	*28,25*	1,19	*30,31*	1,25	*25,84*	0,79	*19,66*	0,81	*20,04*
c18 : 0	17,84	*28,48*	16,89	*22,22*	15,19	*27,46*	16,76	*17,35*	17,95	*26,33*
c18 : 1	38,17	*10,65*	38,99	*6,10*	39,94	*7,39*	37,44	*7,10*	37,66	*6,92*
c18 : 2	5,83	*25,88*	6,44	*17,45*	6,35	*13,74*	6,44	*15,07*	6,17	*18,16*
c20 : 0	0,11	*65,63*	0,07	*57,09*	0,07	*55,68*	0,14	*71,40*	0,15	*46,02*
c18 : 3n3	1,15	*29,46*	0,74	*36,38*	0,67	*30,06*	0,86	*29,36*	0,84	*28,24*
c20 : 1	0,77	*44,04*	0,64	*28,54*	0,67	*19,91*	0,98	*34,15*	1,02	*15,40*
c20 : 2n-6	0,14	*49,09*	0,09	*179,72*	0,08	*87,31*	0,13	*111,88*	0,10	*88,67*
c20 : 4n-6	0,03	*166,53*	0,06	*164,83*	0,04	*163,19*	0,10	*164,70*	0,06	*129,35*
SFA	47,27	*11,65*	47,09	*6,34*	45,70	*7,44*	48,88	*12,77*	47,97	*8,92*
MUFA	44,72	*10,38*	45,39	*6,04*	46,92	*6,87*	43,95	*5,01*	44,05	*5,24*
PUFA	7,16	*23,87*	7,33	*15,38*	7,13	*13,40*	7,53	*15,35*	7,16	*17,61*
UFA	52,88	*10,23*	52,72	*5,70*	54,05	*6,29*	51,48	*4,96*	51,21	*5,59*
UFA/SFA	1,12	*17,05*	1,13	*10,71*	1,19	*12,26*	1,07	*12,03*	1,08	*17,24*
Total lipid	698,83	*16,62*	759,25	*13,72*	734,68	*9,60*	780,32	*10,28*	761,52	*15,36*

SFA: saturated fatty acid, MUFA: mono unsaturated fatty acid, PUFA: poly unsaturated fatty acid UFA: unsaturated fatty acid
(HM x BM): Hungarian Merino x British Milksheep, ILE: Ile de France, S: Suffolk, GMM: German Mutton Merino, GBH: German Black Headed,

Table 8.: Fatty acid composition of the meat of the examined meat parts (%)

Type	Leg		Shoulder		Loin	
N	60		60		60	
	Average	*CV%*	Average	*CV%*	Average	*CV%*
C10 : 0	0,36	*42,13*	0,33	*53,65*	0,29	*46,46*
C12 : 0	0,87	*50,73*	0,77	*70,87*	0,63	*72,36*
C14 : 0	7,61	*24,11*	6,9	*28,17*	6,29	*35,65*
C14 : 1	1,14	*31,95*	1,13	*34,27*	1,06	*40,24*
C15 : 0	0,25	*27,06*	0,25	*27,35*	0,27	*63,29*
C16 : 0	20,3	*9,16*	19,99	*8,72*	19,48	*16,7*
C16 : 1	3,78	*17,7*	3,61	*17,21*	3,47	*20,22*
C17 : 0	1,93	*33,35*	2,77	*185,14*	2,22	*35,96*
C17 : 1	0,94	*27,23*	0,99	*34,34*	1,05	*35,41*
C18 : 0	16,13	*22,01*	16,92	*23,46*	17,59	*26,99*
C18 : 1	38,13	*7,41*	38,25	*8,41*	38,75	*7,24*
C18 : 2	6,08	*18,5*	6,39	*17,21*	6,42	*16,04*
C20 : 0	0,11	*89,66*	0,11	*52,99*	0,11	*62,3*
C18 : 3n3	0,83	*33,58*	0,86	*31,58*	0,78	*38,14*
C20 : 1	0,85	*33,69*	0,86	*35,11*	0,8	*33,21*
c20 : 2n6	0,11	*104,26*	0,1	*89,16*	0,1	*142,12*
c20 : 4n6	0,05	*150,78*	0,08	*200,81*	0,06	*128,58*
SFA	47,56	*6,24*	48,05	*13*	46,88	*9,24*
MUFA	44,83	*6,25*	44,84	*7,39*	45,13	*6,8*
PUFA	7,07	*17,75*	7,42	*16,36*	7,36	*15,37*
UFA	51,89	*5,96*	52,25	*7,18*	52,49	*6,29*
UFA/SFA	1,1	*11,23*	1,1	*14,25*	1,14	*16,6*
Total lipid	748,94	*14,45*	761,55	*12,73*	751,89	*12,5*

SFA: saturated fatty acid, MUFA: mono unsaturated fatty acid, PUFA: poly unsaturated fatty acid UFA: unsaturated fatty acid

Table 9.: Organoleptic parameters of the meat of the different genotypes

Genotype	N		Tenderness	Taste	Odour	Ovenloss (%)	Chewing number
1. (HM x BM) x BM	18	Average	2,23	2,47	2,08	21,47	11,39
		CV%	*0,61*	*0,51*	*0,47*	*20,99*	*2,11*
2. (HM x BM) x ILE	36	Average	2,96	2,92	2,18	21,64	13,25
		CV%	*0,65*	*0,69*	*0,33*	*30,88*	*2,28*
3. (HM x BM) x S	36	Average	2,51	2,78	2,17	24,03	11,64
		CV%	*27,71*	*21,96*	*22,43*	*24,00*	*21,90*
4. (HM x BM) x GMM	45	Average	3,19	2,45	2,01	20,21	11,02
		CV%	*38,44*	*24,63*	*23,16*	*34,00*	*17,57*
5. (HM x BM) x GBH	45	Average	2,53	2,23	1,95	19,36	10,64
		CV%	*33,88*	*32,23*	*25,48*	*40,52*	*16,66*
6. (HM x BM) x CH	45	Average	2,61	2,45	2,01	19,94	11,26
		CV%	*27,30*	*21,46*	*16,98*	*5,07*	*11,28*
7. (HM x BM) x T	45	Average	2,47	2,51	2,11	21,12	11,58
		CV%	*37,29*	*20,58*	*15,03*	*30,78*	*13,89*

(HM x BM): Hungarian Merino x British Milksheep, ILE: Ile de France, S: Suffolk, GMM: German Mutton Merino, GBH: German Black Headed, CH: Charollais, T: texel

Table 10. : Organoleptic parameters of the examined meat parts

Genotype	N		Tenderness	Taste	Odour	Ovenloss (%)	Chewing number
Leg	90	Average	2,74	2,53	2,04	22,88	11,77
		CV%	*28,50*	*26,27*	*22,82*	*6,83*	*17,67*
Shoulder	90	Average	2,56	2,46	2,13	19,64	10,83
		CV%	*28,20*	*25,80*	*17,41*	*29,84*	*18,44*
Loin	90	Average	2,73	2,60	2,03	20,40	11,90
		CV%	*27,55*	*23,39*	*20,50*	*31,69*	*16,24*

Table 11.: Correlations between the slaughter parameters

	Slaughter weight	S/EUROP conformation	Fat coverage	Dressin percentage
S/EUROP	0,556			
Fat coverage	0,683	0,449		
Dressing percentage	0,644	0,387	0,461	
Bone ratio	-0,253	0,001	-0,518	-0,073

Table 12.: Correlations between the organoleptic parameters and the fatty acid composition of the meat

	MUFA	PUFA	UFA	SFA	UFA/SFA	Fat content	Taste
PUFA	0,092						
UFA	0,935	0,439					
SFA	-0,666	-0,290	-0,704				
UFA/SFA	0,888	0,379	0,936	-0,883			
Fat content	-0,234	0,112	-0,171	0,124	-0,196		
Taste	0,035	-0,023	0,023	-0,026	0,015	-0,249	
Smell	-0,036	-0,057	-0,053	0,001	-0,021	-0,053	0,416

Table 13.: Correlations between the S/EUROP quality and the fatty acid content of the meat

	MUFA	PUFA	UFA	SFA	UFA/SFA	S/EUROP
PUFA	0,092					
UFA	0,935	0,439				
SFA	-0,666	-0,290	-0,704			
UFA/SFA	0,888	0,379	0,936	-0,883		
S/EUROP	0,248	-0,100	0,186	-0,107	0,130	
Fat coverage	0,328	-0,111	0,283	-0,069	0,197	0,449

Table 14.: Correlation matrix of the connections between the CT examination, boning results and chemical parameters of the meat

	CT-fat	CT-muscle	CT fat / muscle	Meat ratio	Bone ratio	Dry matter content	Protein content
CT- muscle	0,660						
CT fat/muscle	-0,764	-0,158					
Meat ratio	0,145	-0,076	-0,235				
Bne ratio	-0,419	-0,269	0,372	0,082			
Dry matter content	0,212	-0,064	-0,229	-0,016	-0,080		
Protein content	-0,030	0,005	0,089	-0,115	-0,081	0,675	
Fat content	0,298	-0,109	-0,387	0,126	-0,068	0,623	-0,126

Table 15.: The connections between the chemical parameters of the meat of loin and the chemical parameters of the meat of the leg and shoulder

		meat of the loin				
		Dry matter	**Protein**	**Fat**	**Hemin**	**Connective tissue**
meat of the leg	**Dry matter content**	**0,358**	0,258	0,124	0,228	0,001
	Protein	0,083	**0,158**	-0,197	0,183	-0,327
	Fat	0,240	0,033	**0,362**	-0,012	0,317
	Hemin	0,221	0,262	-0,079	**0,606**	-0,165
	Connective tissue	0,084	-0,071	0,200	-0,111	**0,255**
meat of shoulder	**Dry matter content**	**0,144**	-0,087	0,344	0,132	0,276
	Protein	-0,015	**-0,003**	0,019	0,031	0,006
	Fat	0,127	-0,081	**0,300**	0,046	0,291
	Hemin	-0,044	0,000	-0,115	**0,342**	-0,163
	Connective tissue	0,100	-0,080	0,245	-0,044	**0,081**

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