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EVALUATION OF YIELDS OF OFFALS AND SLAUGHTER BY-PRODUCTS IN YOUNG FATTENING BULLS OF DIFFERENT GENOTYPE

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SUMMARY

In a series of experiment Hungarian Red Spotted /HRS/, Holstein-Friesian /HF/, Hungarian Grey /HG/, an Hereford /HE/ young fattening bulls were slaughtered at 200, 350 and 500 days of age. Preslaughter weights the genotypes given were 180, 354 and 513; 255, 377 and 504; 160, 266 and 402, as well as 108, 264 and 395 kg, respectively.

Yield of offals, weight of organs, fat around the digestive system and perinephric fat was recorded. Findings were evaluated by analysis of variance according to a 4 x 3 factorial design. Tendencies for the development of internal organs, i.e. offals and slaughter by-products during the growing-finishing period could be established.

Mean values for head with brain, tongue, lung,liver, spleen, heart, kidney, paunch, small intestine and large one were in HRS, HF, HG, and HE 2.8, 2.6, 2.9 and 2.5; 0.48, 0.52, 0.42 and 0.62; 1.24, 1.51, 1.44 and 1.30; 1.03, 1.09, 1.16 and 1.00; 0.21, 0.16,0.18 and 0.16; 0.39, 0.39, 0.38 and 0.34; 0.19,0.22, 0.21 and 0.18; 1.7, 1.8, 1.6 and 1.8; 1.0, 1.9, 1.1 and 1.0; 0.7, 0.8, 0.6 and 0.8, per cent at 500 days of age, respectively. Thus, relative values for the percentage of preslaughter weights seemed to decrese with advancing age in almost all offal categories /internal organs/ but skin.

At slaughter highest ratio of total fat was recorded in HF young bulls in the age categories determined /50.8, 47.0 and 48.8 per cent/ and the lowest one in their HE counterparts /30.7, 30.8 and 37.3 per cent, respectively/.

Intermediate yields of fat were found in HRS and HG young bulls, first of all at the final phase of fattening. This phenomenon may be attributed to the dairy, beef or dual purpose character of breeds investigated.

INTRODUCTION

More effective use of offals and slaughter by-products as acceptable food for human consumption than it is the case at present was suggested by Hannan /1978/ some ten years ago. The "fifth quarter" of slaughter cattle ought not to be classified into categories of body parts of low or limited value, the author emphasized.Significance and usefulness of slaughter by-products in human and animal nutrition seems to be obvious. An information material elaborated by Hungarian and Soviet research workers of OHKI, KÉKI AND VNIIMP within the framework of bilateral scientific and technical cooperation /1979/ underlines the nutritive value of by-products which nearly equals to that of lean meat. The protein content of high biological value in liver, kidney, heart and spleen may attain even 13-17 per cent. Thus, the organs mentioned above might be considered as valuable sources of protein. Supplemental protein sources may be the lung, paunch, ear, larynx, etc. Among the body parts, only the paunch has to be mentioned, which contains high amount of connective tissue, a character that enables it for wide use in production of a series of meat products. Effective use of slaughter by-products in direct human consumption and in meat processing industry has to be recommended. When following this practice, profitability of slaughter houses and packing plants can be improved rapidly and anticipated.

Keeping in mind the significance of offals and slaughter by-products a survey was made in international cooperation with participation of Finnish, Polish and Hungarian experts. The compilation covers the subject using meat industry by-products and offals which are rich in protein in producing foods and feeds /Tuominen and Honkavaara, 1982/. In their study data on quantity and quality of by-products were summarized from figures of total number of cattle slaughtered in Finland, Hungary and Poland in 1980.

Even if in handbooks or manuals /Lőrincz, 1961;Lőrincz and Lencsepeti,1973/ on meat production and meat technology standard values for yields of offals are commonly tabulated in detail, still there are gaps in our knowledge concerning the subject. The reason of this fact may be due to phenomena that often no differentiation has been made among weight categories, sexes, genotypes and rearing conditions of slaughter cattles.Available figures refer mainly to evaluations made on measurements that were taken generally under large-scale production conditions, where recordings can not fully cover all the necessary information. Mean values may overlap a wide range of effects which has not learned yet. In addition, former figures for yields and standard values for offals and slaughter by-prodcuts might have changed due to alterations in genotypes used and production technologies in fattening. Thus, the cause of changes may be the consequence of the appearence of new breeds, nutritional methods, etc. Therefore changes in standard values can be anticipated.

Taking into account of the considerations mentioned above the aim of this study was the evaluation of yield of offals and slaughter by-products in different cattle breeds used in Hungary at various ages representing the initial, medial and final phase of the fattening period.

MATERIALS AND METHODS

In a series of experiment Hungarian Red Spotted /HRS/, Holstein-Friesian /HF/, Hungarian Grey /HG/ and Hereford /HE/ young fattening bulls were slaughtered at 200, 350 and 500 days of age according to the experimental design given in Table 1. Concerning age and live weight recorded prior to slaughter actual figures are summarized.We succeed in obtaining characteristic values which well represent the adequate phases of fattening. To the animals maize silage based diets were fed with moderate compound feed and hay supplementation. Prior to slaughter fasting of young fattening bulls lasted for 24 hours. Preslaughter live weight, weight of offals and organs as well as fat around the alimentary tract, deposited in pelvis and around the scortum was recorded at evisceration. Overall amount of fat produced was calculated by adding fat recorded at evisceration and that of separated from carcasses at dissection. Weight and length of intestines was recorded as well. Findings were evaluated by means of analysis of variance according to a 4 x 3 factorial design /4 breeds and 3 age categories within each breed group/. In such a way tendencies for the development of internal organs during growth could be established.

RESULTS AND DISCUSSION

Weight of organs and body parts as well as yields as percentage in preslaughter live weight are summarized in Table 2. Additive effects for breeds and age categories on mean values were significant in all cases at $P < 0.01$ per cent level of probability. In general weight of organs and body parts increased with advancing age with moderate interbreed differences which might be related to the degree of development and type of purpose of production of cattle. Yield of skin did not seem to increase with advancing age in either breeds. Small differences were found, however, among breeds. The HF showed relatively low yield for skin in all age categories. The relative weight of testicles increased owing to the sexual maturation which was recorded by the medial and final phase of fattening. Increase was present for the relative means of penis and large intestines as well. In contrary, decrease was observed for averages of the following organs and slaughter by-products: feet, head with brain, lung, liver, heart, kidney, omasum and abomasum. Slight decreasing tendencies were recorded for paunch and small intestine. The results of this study are in accordance with the findings of several authors. In Czech Pied young bulls Kahoun and Zemánek /1967/ found 4, 2, 11.1, 4, 0.31, 0.38, 1.04, 1.21, 0.20 and 0.21 per cent means for the yields for head, feet, skin, digestive system, tongue, heart, lung, liver, spleen and kidney, respectively. In Slowak Spotted young bulls Pelech /1971/ recorded yields for skin, head, feet and empty digestive system 10.74, 2.85, 1,78 and 5.17 per cent, respectively. Botto and Durecko /1973/ slaughtered 212 Slowak Pied young bulls with 502.3 kg average live weight. In their study yield of tongue, spleen, liver, lung, heart, kidney, paunch and intestines were 0.48, 0.19, 1.08, 1.05, 0.39, 0.21, 2.89 and 1.78 per cent, respectively.

Length of small as well as large intestine are shown in Table 3. With advancing age longer measurements were made. At the same time clear differences could be established among genotypes with the longest values in HRS and HF, with intermediate and shortest ones in HG and HE breeds.

Figures for fat recorded at the time of evisceration and separated at dissection are summarized in Table 4. In addition to the actual amounts of fat produced and deposited attantion has to be paid to the percentages related to preslaughter weight. At evisceration ratio of fat showed the highest values recorded in HF young bulls at the age categories determined /200, 350 and 500 days of age with means of 50.8; 47.0 and 48.8 per cent/. The lowest values were found in their HE counterparts /30.7; 30.8 and 37.3 per cent, respectively/. Intermediate yields of fat were recorded at evisceration in HRS and HG young bulls, first of all at the end of fattening, a phenomenon, which may be related to the dairy, beef or dual purpose character of breeds investigated. In contrary, the order of breeds concerning the ratio of dissected fat from carcasses was reverse: HE > HRS > HG > HF. Overall fat production, however, expressed as percentage of live weight prior to slaughter, showed rapid increase among the age categories lasting from 200 to 500 days of age with clear interbreed differences. At 500 days of age the age at which in general the desired final weights are attained under commercial conditions in this country, relative values of overall fat production were equal in HF, HG and HE young fattening bulls. Their HRS counterparts deposited the smallest amount of fat.

REFERENCES

BOTTO,V.-DURECKO,J.: Hodnotenie vnutornych organov a menejhodnotnych casti tela jatocného dobytka. Acta Zootechnica-Zbornik Agronomickej Fakulty VSP Nitra, 1973:26, 141-147.

HANNAN,R.:Developments in Animal By-Product Utilisation. Meat, 1978:10, 34-41. p.

KAHOUN, J.-ZEMÁNEK, F.:Vyroba hoveziho a teleciho masa. SZN, Praha, 1967.

LŐRINCZ,F.: A húsipari gyakorlat kézikönyve. I-II.köt. Müszaki Könyvkiadó, Budapest, 1961.

LŐRINCZ,F.-LENCSEPETI, J.: Húsipari kézikönyv, Mezőgazdasági Kiadó, Budapest, 1973.

PELECH, O.: Hodnotenie mäsovej uzitkovosti hosp. zvierat z knihy SIDOR, V. a koll. Hodnotenie mäsovej uzitkovosti hosp. zvierat. Priroda, 1971.

TUOMINEN, R.-HONKAVAARA, M.:Using meat industry by-products and offals which are rich in protein in producing foods and feeds. Mimeo. 1982.

:Информация о результатах исследований по совместно выполняемой научно-исследовательской работе ВНИИМП /СССР/, ГИИМП и ЦНИИПП /ВНР/ по теме: "Разработка новых видов мясопродуктов повышенной стойкости и вкусовых достоинств с использованием субпродуктов и пищевых добавок", СССР, Москва, 1979.

Table 1. Experimental design, number of animals, age and weight prior to slaughter

Item	Age categories /days/	Genotypes 1/ HRS	HF	HG	HE
Number of animals	200	30	11	10	10
	350	29	9	9	12
	500	29	10	11	10
Actual age in days	200	233	198	202	200
	350	370	361	349	355
	500	502	490	505	496
Weight prior to slaughter /kg/	200	180	255	160	108
	350	354	377	266	264
	500	513	504	402	395

1/ HRS = Hungarian Red Spotted
HF = Holstein-Friesian
HG = Hungarian Grey
HE = Hereford

Table 2. Body parts and organs separated at slaughter in kg and in percentage of live weight of animals prior to slaughter

Item	Age categories /days/	Genotypes HRS		HF		HG		HE	
		kg	%	kg	%	kg	%	kg	%
1	2	3	4	5	6	7	8	9	10
Hide prior to treatment	200	18.5	10.3	21.6	8.5	16.0	10.0	10.5	9.7
	350	39.6	11.2	33.6	8.9	28.7	10.8	28.7	10.9
	500	58.3	11.4	43.2	8.6	45.2	11.2	41.3	10.5
4 feet	200	4.62	2.6	5.6	2.2	4.68	2.9	2.79	2.6
	350	7.49	2.1	7.53	2.0	5.73	2.2	4.95	1.9
	500	9.78	1.9	9.17	1.8	7.65	1.9	6.87	1.7
Head with brain	200	6.3	3.5	7.4	2.9	6.0	3.8	4.2	3.9
	350	10.9	3.1	9.9	2.6	9.0	3.4	7.7	2.9
	500	14.3	2.8	13.0	2.6	11.4	2.9	10.0	2.5
Tongue with larynx	200	1.28	0.71	1.38	0.54	0.71	0.44	0.65	0.61
	350	2.10	0.59	2.06	0.54	1.99	0.76	1.28	0.49
	500	2.46	0.48	2.62	0.52	1.69	0.42	2.45	0.62
Lung with trachea	200	2.81	1.58	4.29	1.69	2.23	1.42	1.69	1.57
	350	4.75	1.35	5.26	1.40	3.52	1.33	2.94	1.14
	500	6.36	1.24	7.63	1.51	5.72	1.44	5.13	1.30
Liver	200	2.50	1.39	4.20	1.65	1.78	1.12	1.35	1.25
	350	4.26	1.21	4.77	1.26	3.58	1.35	2.88	1.09
	500	5.29	1.03	5.45	1.09	4.61	1.16	3.95	1.00
Spleen	200	0.38	0.21	0.62	0.24	0.25	0.16	0.19	0.17
	350	0.70	0.20	0.79	0.21	0.55	0.21	0.37	0.14
	500	1.10	0.21	0.82	0.16	0.72	0.18	0.63	0.16
Heart	200	0.75	0.42	1.26	0.49	0.67	0.42	0.51	0.48
	350	1.31	0.38	1.60	0.43	1.08	0.41	0.83	0.31
	500	2.02	0.39	1.97	0.39	1.54	0.38	1.34	0.34
Kidney	200	0.50	0.28	0.85	0.33	0.39	0.25	0.31	0.29
	350	0.70	0.20	0.90	0.24	0.73	0.28	0.48	0.18
	500	0.99	0.19	1.09	0.22	0.83	0.21	0.72	0.18

Table 2. continued

1	2	3	4	5	6	7	8	9	10
Penis	200	0.37	0.21	0.50	0.20	0.27	0.17	0.17	0.16
	350	0.58	0.16	0.73	0.19	0.38	0.14	0.56	0.21
	500	1.18	0.23	0.98	0.19	1.03	0.26	0.93	0.23
Testicles	200	0.18	0.10	0.25	0.10	0.09	0.06	0.08	0.07
	350	0.46	0.13	0.58	0.15	0.43	0.16	0.38	0.14
	500	0.75	0.15	0.79	0.16	0.44	0.11	0.47	0.12
Omasum and abomasum	200	3.19	1.80	5.55	2.20	4.43	2.80	2.36	2.20
	350	6.34	1.80	6.82	1.80	5.25	2.00	5.65	2.10
	500	7.95	1.50	10.23	2.00	6.65	1.70	5.98	1.50
Paunch	200	3.40	1.90	4.86	1.90	3.28	2.10	1.77	1.60
	350	6.70	1.90	7.20	1.90	5.50	2.10	4.56	1.70
	500	8.58	1.70	9.26	1.80	6.56	1.60	7.12	1.80
Small intestine	200	3.71	2.10	4.94	1.90	3.06	1.90	2.14	2.00
	350	4.29	1.20	4.70	1.20	-	-	3.64	1.40
	500	5.13	1.00	5.49	1.90	4.42	1.10	3.85	1.00
Large intestine	200	1.23	0.70	1.62	0.60	0.68	0.40	0.67	0.60
	350	2.25	0.60	2.62	0.70	0.90	0.30	1.70	0.60
	500	3.42	0.70	4.18	0.80	2.44	0.60	3.02	0.80

Table 3. Length of small and large intestine

Item	Age categories /days/	Genotypes HRS	HF	HG	HE
Small intestine	200	32.9	36.1	29.3	24.2
	350	43.2	40.2	37.1	29.6
	500	42.1	39.5	35.7	32.2
Large intestine	200	5.2	5.6	5.3	4.4
	350	6.9	6.9	6.0	5.8
	500	7.5	7.4	6.6	6.8

Table 4. Amount and ratio of fat recorded at slaughter and dissection

Item	Age categories /days/	Genotypes HRS	HF	HG	HE
Total fat deposited /kg/	200	6.63	13.76	3.27	6.47
	350	22.01	24.23	15.93	30.42
	500	36.43	52.70	41.68	39.11
Ratio of fat recorded at slaughter /%/	200	41.2	50.8	51.7	30.7
	350	44.5	47.0	47.6	30.8
	500	43.7	48.8	44.6	37.3
Ratio of fat dissected at tissue separation /%/	200	58.8	49.2	48.3	69.3
	350	55.5	53.0	52.4	69.2
	500	56.3	51.2	55.4	62.7
Total fat in percentage of live weight recorded prior to slaugter	200	3.7	5.4	2.0	6.0
	350	6.2	6.4	6.0	11.5
	500	7.1	10.5	10.4	9.9