MEAT PRODUCTION BY STEERS OF DIFFERENT GEOTYPES

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ABSTRACT

The objective of this study to investigate meat production by steers of different genotypes. In order to study the productivity of Simmental and black and white Simmental x Holstein cross bred, steers, six groups of bull-calves with 15 animals each, were formed. The first group consisted of Simmental steers, the second group (3/8) blooded, the third group (1/2) blooded, the fourth group (5/8) blooded, the fifth group (3/4) blooded and the sixth group (7/8) blooded Holstein steers respectively. Under the same conditions of feeding and maintenance purebred Simmental animals grow more intensively. At 18-months of age they exceed (3/8) Holstein blooded bull calves by 6.2 kg, half blooded by 16.5 kg, (5/8) blooded by 18.4 kg, (3/4) blooded by 25 kg and (7/8) blooded by 35.2 kg (P <0,001). The slaughter weight of Simmental bulls surpass their counterparts by 7.4-24.8 kg. Significant differences were observed (p < 0.001) between Simmental and crossed bull-calves having in their genotype 75.0-87.5% of Holsteins blood were observed. The same level of reliability (P <0.01) was indicated in the mass of internal fat and slaughtered yield. The specific gravity of flesh in bull calves carcass of all studied groups varied within the limits of 78.7-80.6%.The mass of the flesh of Simmental bulls was higher than hybrid animals by 4.0-12.0 kg.The fat content in meat of Simmental bull calves is 9.10%, that is 1,86-2,31% more than hybrid steers. Concerning to the protein content, the crossed bulls exceeded the Simmental ones by 0.10-0.39%.

Key words: crossing, growth, calves, meat productivity, fat, protein, average daily gain, slaughter yield.

انتاج اللحوم من قبل تراكيب وراثية مختلفة من العجول

فالماتوفاناتولي بافلوفيتج فلماتوفاناتولي فيتج العيساوي علي عبدالامير تيشكيناتتيانا نيكولايفنا نياسكين نيكولاي نيكولايفيتج[1]

أستاذ باحث باحث مدرس اقدم استاذ مساعد

المستخلص

يهدف البحث للكشف عن تأثير تراكيب وراثية من العجول على انتاج اللحوم. اظهرت نتائج الدراسة الحالية بتفوق عال المعنوية (P<0,01) لصالح مجموعة سلالة السمينتال النقي على باقي هجئن الهولشتاين عند عمر 18 شهرا وتحت نفس ظروف التغذية والرعاية متفوقا على مجموعة 3\8 دم هولشتاين ومجموعة نصف دم هولشتاين وعلى مجموعة5\8 دم هولشتاين وعلى مجموعة 3\4 هولشتاين بفارق 6,2 و16,5 و 18,4 كغم على التوالي، وتفوقت (p>0.001) على مجموعة 7\8 دم هولشتاين بفارق 35,2 كغم. كما تفوقت مجموعة المسمنتال وبفارق 7,4–24,8 كغم على باقي المجاميع المدروسة في صفة وزن الذبيحة الحار تفوقا معنويا عن باقي العجول المضربة والحاوي تركيبها الوراثي على 75–87,5% لدم الهولشتاين (p>0.001) و على مستوى عال المعنوية بالنسبة للدهن الداخلي ومحصول الذبيحة. محتوي الدهن في لحم عجول السمينتال سجل فرقا عال المعنوية بنسبة 9,10% عن بقية المجاميع الاخرى وبفارق 1,86–2,31%. تغاير الوزن النوعي للذبيحة في كافة المجاميع المدروسة بحدود 87,7–8,6% ،كما تفوق وزن الذبيحة لعجول السمينتال على باقي هجن الهولشتاين وبمدى 4,0–12,0 كغم (p>0.01, 0,001). كذلك في محتوى البروتين متفوقا على باقي هجائن الهولشتاين بفارق 0,1–0,39 كغم.

الكلمات المفتاحية: التضريب، النمو، انتاج اللحم، الدهون، اللحم، معدل المحصول اليومي.

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INTRODUCTION

One of the most important tasks, which is to be solved in the coming years by the Russian agro-industrial complex, is to increase production of high-quality beef. Now and during the long term, over 85% of the beef will be got from dairy cattle. In this connection, great attention should be paid to meat production during animals' selecting. When creating new types of dairy cattle by crossing Simmental cows with Holstein sires there was a need to study meat qualities of crossbreeds obtained from such crossing. Meat production analysis of steers with different Holstein breed relation degree shows that the animals with high Holstein breed relation degree have a high potential of meat production. They can be used to obtain high quality heavy carcasses of lean beef, (1,2,3,4,5,6,7,8,10,11). Meat production of animals is due to their genotypic and phenotypic characteristics. These features are formed and developed under the influence of environmental conditions during animals development and fattening. The aim of this study is to discover the meat quantities and qualities of Simmental and Simmental x Holstein hybrids of black and white breed obtained from the absorbed crossing

MATERIALS AND METHODS

This experiment was carried out in Bogdanovsky LLC in Staroshaygovsky district of Mordovia Republic during 1/04/2016 to 1/10/2017. Six groups of steers were formed with 15 animals each to assess growth and carcass traits of Simmental steers and their Holstein hybrids of black and white breed. The first group consisted of steers of Simmental breed. The second group consisted of 3/8 blood Holstein steers. The third group consisted of half blood Holstein, bull calves. The fourth group consisted of 5/8 blood Holstein steers. The fifth group consisted of three-quarter blood Holstein bull calves. The sixth group consisted of 7/8 blood Holstein steers. The animals were selected according to the principle of analog pairs, taking into account genotype, the age of mothers, live weight and physiological state. Control over the growth of young animals was carried out by individual weighing .Meat production of steers was investigated by control slaughter 5 heads from each group at 18 months of age, according to the methods of VASHNIL (V.I. Lenin All-Union Academy of Agricultural Sciences), VIJ (Federal Research Center of Animal Husbandry) VNIIMP (Federal Scientific Center of Food Systems), and VNIIMS (All-Russian Research Institute of Metrological Service). The following indicators were taken into account: the live weight (after feeding stop and pre slaughter), the weight of carcass, the fat mass, the slaughter yield of carcass and fat (kg, %), the weight of internal organs, the weight of fresh skin. The chemical composition of the meat was determined according to a conventional method. The protein content was determined according to Kjeldahl method, the fat content was determined by the Soxhlet method, the amount of bound water by Grau and Gamma method (1956) with VNIIP modification (1960). The results of the experimental studies were processed by the method of biometric statistics (E.K.Merkur'eva, 1970).«Microsoft Excel» was used one way analysis of variance was performed and means were compared using LSD test. In this study, during the entire period of rearing, the steers had the same rations. The basis of the rations in the stall period was: cereal, legumes hay; corn silage; cereal-leguminous hay, barley, oats and wheat grains, sunflower meal, barley straw, salt and chalk. According to the technology used in the farm, up to 6-month-old the steers were kept loosely in group of five animals. Later, up to 18 months of age, they were kept loosely in group of 15 animals. The peculiarity of growing young animals was that from 30 days of age all youngsters were fed with whole milk substitute. The number of feeds eaten during the growing period from the birth to 18 months of age is shows in Table 1

Table 1. Actual feed consumption for the period of youngsters' rearing

Index	Quantity of feed, kg	EFU (energy feed unit)	DP (digestible protein)
From birth to 6 months age			
Whole milk and its substitute, kg	**580**	**1322**	**19140**
Concentrates, kg	**215**	**2257**	**18275**
Senage, kg	**650**	**2723**	**39650**
Hay, kg	**220**	**1496**	**12980**
Digestible protein			**90045**
Energy feed unit		**779,8**	
Digestible protein per 1 energy feed unit			**115,4**
From 6 months to 12 months age			
Concentrates, kg	**456**	**4788**	**38760**
Corn silage, kg	**900**	**2070**	**12600**
Senage, kg	**900**	**3771**	**54900**
Sunflower meal, kg	**54**	**561**	**17496**
Hay, kg	**220**	**1496**	**12980**
Straw,kg	**150**	**856**	**1950**
Digestible protein			**138696**
Energy feed unit		**1358,2**	
Digestible protein per 1 energy feed unit			**102,1**
From 12 months to 18 months age			
Concentrates, kg	**540**	**5670**	**45900**
Corn silage, kg	**1260**	**2898**	**17640**
Senage, kg	**1080**	**4545**	**65880**
Sunflower meal, kg	**90**	**936**	**29160**
Hay, kg	**90**	**612**	**5310**
Straw,kg	**90**	**514**	**1170**
Digestible protein			**165060**
Energy feed unitf		**1515,5**	
Digestible protein per 1 energy feed unit			**108,9**
From birth to 18 months age			
Whole milk and its substitute, kg	**580**	**1322**	**19140**
Concentrates, kg	**1211**	**12715**	**102935**
Corn silage, kg	**2160**	**4968**	**30240**
Senage, kg	**2630**	**11019**	**160430**
Sunflower meal, kg	**144**	**1497**	**46656**
Hay, kg	**530**	**3604**	**31270**
Straw,kg	**240**	**1370**	**3120**
Digestible protein			**393791**
Energy feed unit		**3649,5**	
Digestible protein per 1 energy feed unit			**107,9**

The total nutritional (energy) value of fodder, eaten by steers from the birth to 18 months of age, was 3649.5 EFU and 393 kg of digestible protein. 1 EFU is equal to 107.9 g of digestible protein. Feed consumption per 1 kg increment for a group of Simmental bull calves, for the period from birth to 18 months of age, amounted to 7.66 EFU, which is 0.1-0.61 EFU less than that of hybrid bull-calves.

RESULTS AND DISCUSSION

The growth rates of youngster animals indicate that under the same conditions of feeding and maintenance, pure bred Simmental animals grow more intensively and surpass their counterparts. At 18 months of age they exceed 3/8 Holstein blooded bull calves by 6.2 kg, half blooded by 16.5 kg,5/8-blooded by 18.4 kg, 3/4 blooded by 25 kg., ($P < 0,01$), and 7/8-blooded by 35.2 kg ($P < 0,001$). Over the entire period of growing, from birth to 18 months, Simmental bulls were characterized by larger daily average increase. This indicator was higher by 10-64 g ($P < 0.001$). It is necessary to note that significant differences in average daily gain are noted between Simmental bulls and crossed animal shaving in their genotype 75.0-87.5% of Holsteins blood. This is due to the fact that the Simmental bull calves have a

higher genetic potential for meat production. The closer relationship with Holstein breed the less live weight in hybrid bull calves. Control bulls were slaughtered at 18 months of age. Five bulls from each experimental group were slaughtered. Their live weight corresponded to the average weight within the group. As can be seen from the data in Table 2, the live weight after feeding stop of Simmental bulls was 478.4 kg. They exceed their counterparts by 7.6-33.8 kg. The difference increases the closer relationship with Holstein breed. After 24 hours pre slaughter starvation of bull calves, the loss of their live weight amounted to 11.2 - 15.9 kg. By live weight Simmental bulls surpass their counterparts by 7.4-24.8 kg. Significant differences between Simmental and crossed bull calves having in their genotype 75.0-87.5% of Holsteins blood (P <0.001)were observed. The same level of reliability (P <0.01) was indicated in the mass of internal fat and slaughtered yield. It should be noted that all bull calves were adopted for high fatness, and carcasses were accounted for the first category. The cutting of chilled half-carcasses of the experimental bull-calves made it possible to establish the yield of meat cuts, bones and tendons, as well as the meat ratio. The specific gravity of flesh in bull-calves' carcass of all studied groups varied within the limits of 78.7-80.6%. The mass of the flesh of Simmental bulls was higher than in hybrid animals by 4.0-12.0 kg, (P <0.01, 0.001) , (Table 3).Significant differences between Simmental and Holstein crossed bull calves were observed. The weight of bones was within the limits of 18.36 - 19.52 kg, ten dons within 3.74 - 4.70 kg. The meat ratio for bull-calves was 4.15-3.71%. As for the morphological composition of carcasses in the context of genotypes, the best were the carcasses of Simmental bull calves were the best. Morphological composition of hybrid steers carcass changed according to the degree of relation with Holstein breed. Apparently, this was influenced by inbreeding. The main criterion for assessing the quality of meat is the chemical composition. Meat nutrition researches can identify genotypic features, as well as processes that occur under the influence of conditions of animals feeding and keeping. Analysis of chemical composition of average sample revealed a relatively higher dry matter content in Simmental steers (Tab. 4) .Their advantage in this indicator in comparison with other genotypes was 1.4 - 2.17% .Significant differences (P <0.01) were obtained by comparing purebred Simmentals with animals having more than 62.5% of Holstein blood in the genotype. These differences in the first case can be explained by the fact that meat of Simmental bull calves contains 1.86 - 2.31% (P <0.01) more fat than hybrid bull calves. According to the protein content, the crossed steers exceeded the Simmental bulls by 0.10- 0.39%. It denotes that in animals of new genotypes the process of protein deposition in carcasses occurs more intensively. The ratio of protein and fat shows it is possible to obtain not fatty beef of high quality from hybrid animals.These data are confirmed by the indices given in Table 5.The size of meat energy value in our studies is more envy of the fat content in flesh of carcass. This indicator per 1 kg of fleshin Simmental bull calves was 282-758 kJ more compared to hybrid animals. As a result, the flesh of Simmental steers contains 104-339 MJ energy more than in hybrid bull-calves. This difference increases with the increase of blood relation to Holstein breed. Based on the results obtained from this experiment, It is possible to conclude that with the increase of relation degree from 3/8 to 7/8 in Holstein hybrids, a decrease in live weight is indicated. The results of control slaughter showed that Simmental bull-calves were the best in fatness, development of muscle tissue, fat deposit, weight of carcass without fat, and slaughter yield. The slaughter indicators of the steers declined with the increase of blood relation to Holstein breed.

Table 2. Live weight and results of control slaughter of bull-calves of 18-months old

Index	Genotype of steers					
	Simmental steers	3/8 Holstein steers	1/2 Holstein steers	5/8 Holstein steers	3/4 Holstein steers	7/8 Holstein steers
	M	M	M	M	M	M
Number of animals in the group	15	15	15	15	15	15
Live weight at birth, kg	37,9±0,99	37,1±0,87	36,9±0,74	35,3±0,72	36,2±0,69	37,3±0,67
Live weight of steers at the age of 18 months	476,3±6,81	470,1±5,92	459,8±6,90	457,9±7,50	451,3±5,20	441,1±6,61
Average daily gain, g	812±10,3	802±9,5	783±10,1	782±12,1	769±10,3	748±11,2
Slaughtered steers, number of animals	5	5	5	5	5	5
Live weight after feeding stop, kg	478,4±2,84	470,8±3,60	463,4±5,82	455, 8 ± 3,65	450,8 ± 4,52	444,6 ± 4,41
Preslaughter live weight, kg	465,2±6,07	456,8±3,03	447,5±4,35	443,0 ± 3,67	438,2 ± 5,04	433,4 ± 4,64
Weight of slaughtered carcass, kg	243,2±4,39	235,8±1,08	233,2±4,02	229,2 ± 3,63*	222,1 ± 3,83	218,4 ± 2,77
Weight of slaughtered carcass without fat, %	52,46±0,49	51,58±0,22	52,10±0,52	51,72 ± 0,45	51,16 ± 0,82	50,40 ± 0,39
Weight of internal fat, kg	10,36±0,80	8,62±0,34	8,56±0,50	9,62 ± 0,37*	8,24 ± 1,05	7,74 ± 0,64
Slaughter yield, %	54,44±0,53	53,50±0,19	54,02±0,48	53,88 ± 0,50*	52,57 ± 0,62	52,14 ± 0,41

Table 3. Morphological composition of carcass

Index	Genotype of steers					
	Simmental steers M	3/8 blood Holstein steers M	1/2 blood Holstein steers M	5/8 blood Holstein steers M	3/4 blood Holstein steers M	7/8 blood Holstein steers M
Number of animals	5	5	5	5	5	5
Weight of cooled carcass, kg	121,6 ± 2,20	117,7 ± 1,42	116,6 ± 2,01	114, 4 ± 1,82	112,4 ± 1,82	109,2 ± 1,39
Weight of flesh, kg	98,0 ± 1,89	94,4 ± 1,35	93,82 ± 1,63	92,0 ± 1,90	89,4 ± 1,92	86,0 ± 1,77
Specific gravity, %	80,6	80,2	80,5	80,4	79,5	78,7
Weight of bones, kg	19,52 ± 0,41	18,84 ± 0,47	18,78 ± 0,32	18,66 ± 0,24	18,36 ± 0,40	18,5 ± 0,3
Specific gravity,%	16,0	16,0	16,1	16,3	16,3	16,9
Mass of cartilage and tendons, kg	4,08 ± 0,47	4,26 ± 0,27	4,00 ± 0,36	3,74 ± 0,74	4,44 ± 0,49	4,70 ± 0,52
Specific gravity, %	3,35	3,62	3,43	3,27	3,49	4,3
Meat ratio	4,15 ± 0,08	4,09 ± 0,10	4,11 ± 0,04	4,11 ± 0,51	3,93 ± 0,17	3,71 ± 0,14

Table 4. Chemical composition of bull-calves' meat, % (total sample)

Index	Genotype of steers					
	Simmental steers M	3/8 blood Holstein steers M	1/2 blood Holstein steers M	5/8 blood Holstein steers M	3/4 blood Holstein steers M	7/8 blood Holstein steers M
Number of animals	5	5	5	5	5	5
Humidity, %	69,60 ± 0,57	71,00 ± 0,50	71,12± 0,39	71, 12 ± 0,19	71,48 ± 0,24	71,77 ± 0,38
Dry matter,%	30,40±0,57	29,00±0,50	28,88±0,39	28,89±0,19	28,52±0,24	28,23±0,38
Fat, %	9,10 ± 0,37	7,24 ± 0,19	7,28 ±0,42	7,18 ± 0,19	7,14 ± 0,22	6,79 ± 0,21
Protein, %	20,35 ± 0,57	20,50 ± 0,38	20,61 ± 0,26	20,74 ± 0,31	20,43 ± 0,38	20,45 ± 0,42
Ash	0,95 ± 0,02	1,10 ± 0,15	1,01 ± 0,02	0,95 ± 0,01	0,96 ± 0,01	0,95 ± 0,02
Fat and protein ratio	2,44 ± 0,13	2,83 ± 0,06	3,01 ± 0,15	2,90 ± 0,11	2,87 ± 0,14	3,01 ± 0,15

Table 5. Nutrient release and energy value of flesh part of carcass

Group No	Content per 1 kg of flesh, g		Energy content per 1 kg of flesh, kJ	Including fat energy, kJ		Total energy in flesh of carcass, MJ
	protein	fat		protein	Fat	
1	208,5	86,0	8320	4941	3379	1631
2	205,0	72,4	7703	4858	2845	1454
3	206,1	82,8	8138	4884	3254	1527
4	207,4	71,8	7737	4915	2822	1423
5	204,3	71,4	7648	4842	2806	1367
6	204,5	67,9	7514	4846	2668	1292

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