

## **COMPLEX PROCESSING OF MEAT LAMBS REARED SEPARATELY FOR INTENSIVE-SUCKING TECHNOLOGY FOR THE PRODUCTION OF NUMEROUS MEAT PRODUCTS RANGE**

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### *Annotation*

A comparative morphological, organoleptic, biochemical analysis of fat-tail lambs meat of 4 month age were grown by the separately-mammal method and then were slaughtered for study carcass and meat quality. Carcass dressing proportions and fatness of lambs showed better conformation of high meat productivity and higher nutritiousness property and prospects using mutton for providing palatability meat products.

**Key words:** separately mammal method, exterior productive, sign, exotropia chain, nutrient, technological adequacy, concept, risk analysis, critical points. introduction

The cheapest and ecologically pure meat can be got applying separately aspiration method in fat-tail lambs growing in the conditions of grassland keeping. The results of research testify that lambs used to self grazing and additional fertilizing intensively put on weight, grow well and develop and ewes grazing on grasslands very quietly and milking capacity increases from 1650 till 2074 gram per day. Intensive growth, complex estimation of fat- tail ram lambs5 meat production, lamb using (processing) and lamb meat, rational and perspective direction in the production of variety meat products.

Nowadays the level of meat production development both in our country and abroad makes new demands not only to control organization during technological process but to raw material control quality too. Changes inconsuming definition of "meat quality" and provision scheme are actively considered. Critical points of production process and measures of their prevention are defined according to standard conformity for quality products control. Such approach is based on the principles of risk analysis concept and critical control points in the framework HACCP (Hazard Analysis Critical Control Points).

Thus defining of increasing effectiveness ways of meat raw processing should be based on information analysis about content, biological, physical and chemical properties, biological and food value of slaughter products providing close interrelation of united exotrophic chain: effective lamb's industry processing - consuming and adoption of nutrients containing in meat production by people. Such approach will allow purposively

to fulfilling choice of dominant features of food and technological adequacy of meat raw material by which optimal variants can be defined their differentiation into different quality groups providing high effectiveness of processing and stability of quality finished products.

Definition "Quality" in international standards is defined as "totality of product's characteristics in aggregate with possibilities of matching its revealed and required parameters" where quality can be defined as direct as indirect parameters. For increasing production profitability meat industry should thoroughly and accurately arrange the system of raw quality which should concentrate on the important consumers' aspects. Nowadays the main task of meat science includes the following:

- investigation of ways and means for meat and meat products quality improvement;
- necessity of meat raw complex research for processing industry on the level of molecule, cell and the whole animal's organism for deepening the basic mechanism depending on fat lipopexia and level of livestock post.

Market analysis of foreign countries such as Australia, New Zealand, Syria, France, Yugoslavia, Bulgaria and others testifies increased growth of lamb meat consumer. According to Y.I. Imegeev's [1] data 2-3 ml. lambs of 100 days age are sent to slaughter yearly in Bulgaria which makes up

50% from all mutton production.

For example, the Talaverana breed is found throughout central-western Spain. Adult females weigh approximately 45 kg, and males about 60 kg[6]. Lambs are always sold after weaning, which generally takes place 30 to 40 days after birth, when the animals weigh between 10 to 13 kg. Lambs may be fattened to 25 to 30 kg by another enterprise, or slaughtered on weaning. The excellent quality of these sucking lambs assures good market prices, especially at certain times of the year.

Sucking lamb production is typical of Mediterranean countries. Carcass quality may be affected by diverse factors including gender and slaughter weight.

Slaughter weight influences body composition, thus affecting carcass parameters such as the degree of fatness (Falagan, 1980), proportions of different tissues (Solomon et al., 1980), conformation (Kempster et al, 1982) and muscle size (Cuthbertson, '82) [7]. The choice of slaughter weight has a major impact on the composition of the carcass and is therefore of great importance for the optimization of economic performance.

Because they reach maturity earlier, female lambs display greater fatness than males at the same live weight (Butterfield, 1988). Furthermore, gender influences the quantity of fat stored in different depots (Jones et al., 1990). Mendizabal and Soret (1997) observed that Latxa breed female lambs displayed more omental, mesenteric and kidney knob and channel fat (KKCF) than males, and that the latter depot presented the greatest degree of adipocyte hypertrophy[8].

Few studies on carcass and meat quality of sucking lambs have been published, and those that exist generally refer to a single slaughter weight (Beriain et al, 1993; Sanudo et al, 1997)

Increased interest to the given kind of food product is connected with the quality of lambs' meat having high food value. By quantity and quality amino acid content it' close to "ideal" protein, has optimal correlation of proteins: fat, low calorie content and has delicate and succulent consistence. In addition lambs' meat differs with weak flavor and easily digests by the organism. Low content of cholesterol in fat is the main feature of lamb meat. Such diseases as atherosclerosis and caries of teeth system are found rarely among people consuming most of all mutton and lambs' meat.

#### **materials and methods**

The experimental part of the work was started on the livestock farm "May" May area of Pavlodar region in the period 1998-2009 and were continued in the breeding farms "Bastau" in the north of Kazakhstan and Farm "Shaushi" in the southern region of Kazakhstan in 2010-2016.

Geographical coordinates 51°47'07.8 "north latitude 68 ° 50'25.08" east longitude

The Breeding farm "Bastaw" is located approximately 45 km North East of Atbasar and 250 km North of Astana in agro-ecological zone IV classified as semi-arid (Kiriro 1994). The average rainfall is 350 mm per annum. Rainfall distribution is bimodal with a peak in April and November. The average minimum and maximum temperatures are -43°C and 43°C, respectively. The relative humidity varies from 40% to 65%. Soil and vegetation Akmola region represented by steppes and semi-deserts in part. Depending on the topography and the bedrock soil complexes

and plant associations are extremely diverse and varied. To the north of Ishim located forb-grass steppe on the southern black earth and with more saline land in depressions and skeletal soils on hills. The vegetation is drought resistant, presented feather grass, fescue.

Animals were grazed on natural pastures during the day. Selection of parents for the next generation was based on weight of the animals and their physical conformity to breed type. Sheep were artificially inseminated in season October and November to the lambs were in season April- May, respectively. Ewes were first joined to rams depending on their weight and the youngest age at first mating was 18 months. Lambs ran with the dams up to 4 months when they are weaned. Nursing dams were supplemented with concentrates and all animals were provided with mineral licks and water ad libitum. All animals are routinely weighed at birth, months 2, 4, 6 and

16. Disease and parasite management was mainly prophylactic through regular dipping, drenching and vaccinations against notifiable diseases. Sick animals were usually treated.

Research carried out at the Department of S.Seifullin Kazakh Agro Technical University on "Technology of meat, dairy and food products" department of Shakarim Semipalatinsk State University, Kazakhstan Laboratory (Research Institute of Structural meat and dairy industry) (Semey), nutritional and technological quality of meat fat sheep and studied in the laboratory of the All-Russian research Institute of meat industry VM Gorbатов).

The object of the research is Kazakh fat-tail rock rough wool sheep, which are grown on the breeding farms Partnership restrictions constant responsibility "Bastau" in northern Kazakhstan and Farm "Shaushi" in the southern region of Kazakhstan with a total of more than 37 000 heads. Live weight, exterior features, meat and fat productivity, reproduction ability and milk production are studied at adult head of livestock.

Homogeneous selection and 'Bock-matting with the aim of getting progeny being up to quality of the following types at the period of accidental company among rams and ewes was made. It means that rams of normal type were flocked- matting with ewes of the same type and progeny became the given normal type. Ram-lambs were selected as the object of research because they are considered as the main meat contingent in sheep- breeding. Growth of young animals was performed by adopted technology at the farm: lambing in April, from 20th day age growth is separately aspiration, weaning from dam at 4 month age. After weaning, thoroughbred and mongrel young animals were set for 2 month intensive fattening on natural grasslands adding 300 gram forage per head including in different proportions wheat, oats and barley. The age of animal essentially influences to meat quality characteristics. First of all it is necessary to study age regularity and then try to find other factors which influence to meat quality. Data received studying changes mutton quality against animals' age testifies that young animals' meat food value is higher than at adult sheep (N.P. Chirvinski [2]). Thus the research was conducted at our work with a glance of character age of experimental young animals. The results of their appraisal were used at general estimation of animals.

1. Live weight was defined by individual weighting of experimental rams, dams, experimental lambs accurate within 0,5 kg.

2. Exterior features were set by taking 8 main examples: height at withers, skew length of trunk, height at sacrum, depth of breast, width of chest, folding of chest, skew of metacarpus.

3. Ewes' reproductive ability was set with calculation of fecundated and yeaned ewes and obtained new born lambs. Ewes' milkness was set by lambs' live weight during 20 days with further calculation of general and average daily milkness. 4. Young animals' growth and progress were studied by lambs' live weight calculation at birth, 2, 4, 6 and drawback in 4 and 2 month fattening after drawback from ewes in one month age.

5. Meat productivity and meat quality were studies by control slaughter of 3-5 heads at birth, 2, 4, 6 and 16 months lambs. In this case carcass weight and fat tail, slaughter weight and output, morphological structure, meat coefficient, meat chemical structure and its calorie content.

6. Profiled and morphological structure of carcass by state standard 7596-81 "Mutton and goat's flesh dressing for retail trade".

7. Histological studying of the longest muscle spin, four head muscle of thigh and radial extensor muscle of wrist by Merkureva E.K. method [3] Chemical structure, biological and energy value of meat by medium tests of carcass flesh part as well as by the longest muscle of spin. 8. Functional, technological and culinary properties of meat by average sample of carcass flesh part and by the longest spin muscle.

9. Lipidic structure of meat by average sample of carcass flesh part on biochemical

## **results**

Data of experienced lambs' live weight changes in milky period confirm high earliness. Fat-tail male-lambs reached high live weight to the moment of weaning from dam in 4 month age: Unit x KG 42,7 kg or 65,7 % Edilbay breed, KPG x KG - 39,1 kg or 71,1 % of Kazakh fat-

analyzer "Star -Fax" 1904 PLUS. Photo electrical calorimeter method is on the base of biochemical parameters.

tail semi coarse wool, KG x KG -41,6 kg or 69,3

% of Kazakh fat-tail coarse wool adult dam's live weight. There with experienced male - lambs' live weight to the moment of weaning increased: mongrel received from rams of Edilbay breed is 7,3.

Table 1 - The live weight of the experimental lamb birth and weaning from the ewes

Breedtype	n	Live weight at the birth X±m	Quantity milk of the sucking days	Live weight at depriving from ewes X±m	Average daily gain, gram	Relative gain, %	Index of growth, %
Traditional way of cultivation of lambs							
KGxKG	25	5,80±0,13	120	36,30±0,60	254,2	144,9	625,9
KKGxKG	21	4,29±0,31	120	33,78±0,31	245,7	155,0	787,4
EdxKG	18	4,69±0,16	120	35,85±0,52	259,7	153,7	764,7
Separate& sucking way of cultivation of lambs							
KGxKG	20	5,75±0,11	120	40,0±0,75	285,4	149,7	695,6
KKGxKG	25	4,14±0,23	120	36,59±0,42	270,4	159,4	883,8
EdxKG	31	4,42±0,25	120	35,85±0,96	286,9	159,2	878,9
Separate&sucking way of cultivation of lambs with dressing concentrated feed							
KGxKG	20	5,85±0,10	120	42,70±0,41	307,1	151,8	729,9
KKGxKG	16	4,41±0,12	120	39,10±0,39	289,1	159,5	886,7
EdxKG	21	4,68±0,10	120	41,60±0,34	307,7	159,5	888,8

Kazakh fat-tail semi coarse wool is 8,9; Kazakh fat-tail 8,9 times with average daily gain makes up 307,1, 289,1 and 307,7 g. Requirements of the standard of live weight were corresponded to M.F. Ivanov's statement[4]: "Those ewes which lambs' average daily gain live weight at milky period makes up 260 g. and higher, can be covered to earliness breeds" which are considerably exceeded standard requirements.

Table 2 - Relative lethal indicators of experimental male lamb of different age in comparative aspect with indicators of 16 months of Edilbay ram

Age, month	Breed-type	The preslaughter mass		The mass of ink with a fat tail		Mass of a fat tail		Mass of internal fat		Lethal weight		Lethal exit	
		кг	%	кг	%	кг	%	кг	%	кг	%	кг	%
birth	KGxKG	4,5	8,0	2,25	8,6	0,15	4,6	-	-	2,25	8,6	50,0	107,5
	KKGxKG	4,0	7,1	1,9	7,3	0,10	3,1	-	-	1,90	7,2	47,5	102,1
	EdxKG	5,8	10,3	2,90	11,1	0,16	4,9	0,06	40,0	2,96	11,3	51,0	109,7
2	KGxKG	28,0	49,7	12,7	48,7	2,50	76,9	0,42	280,0	13,12	50,1	46,8	100,6
	KKGxKG	26,0	46,2	11,4	43,8	2,10	64,6	0,44	293,3	11,84	45,2	45,5	97,8
	EdxKG	29,5	52,4	14,0	53,7	2,70	83,3	0,50	333,3	14,50	55,3	49,1	105,6
4	KGxKG	40,6	72,1	20,0	76,8	3,50	107,7	0,50	333,3	20,50	78,2	50,5	108,6
	KKGxKG	37,2	66,1	17,1	65,6	3,10	95,4	0,54	360,0	17,64	67,3	47,4	101,9
	EdxKG	41,5	73,7	21,4	82,1	3,70	113,8	0,65	433,3	22,05	84,2	53,1	114,2

Continuation of Table 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
6	KGxKG	45,1	80,1	23,1	88,7	4,0	123,1	0,72	480,0	23,83	90,9	52,8	113,5
	KKGxKG	42,2	74,9	19,5	75,0	3,30	101,5	0,60	400,0	20,1	76,7	47,6	102,4
	EdxKG	46,0	81,7	24,0	92,1	4,60	141,5	0,80	533,3	24,8	94,6	53,9	115,9

Male-lambs' slaughter weight at the age of 4-6 months has reached 23,8 -24,8 kg yield to 1,5 age wethers on 1,4 - 2,0 kg and by slaughter weight exceeded to 52,8 -52,9%. Such increasing of slaughter weight (1,4 - 2,0 kg) gained during 10 months by 1,5 age wethers don't justify overexposure till the next autumn.

Thus it's important and our experience confirms that maximal using of biological peculiarities of fat-tail sheep breeding – premature is the large reserve of lambs' production and quality improvement.

Size and form of fat-tail in lambs' production plays important role which is essentially exterior - productive, constitutional feature of fat-tail sheep. It serves as a resource of energy for supporting of organism at unfavourable periods of year. Thanks to fat - tail sheep are able to withstand long - term malnutrition. Sheep at the period of in –lamb use the reserve of fat for the growth and development of fetus supporting of normal feeding and physiological function of organism.

At our research experimental male-lambs had medium size and small size of fat-tail with the mass at birth 0,10 up to 0,16 kg with output of 2,5-3,3 % to weight.

Size of male-lamb and fat -tail increase with upgrowth, meat increasing and fat-tail size reaches up to 2,20-2,70 kg with output of 8,1-9,1% to the age of 2 months or increases from the birth till the age of 2 months from 16,8 up to 21 times, to the age of 4 months mass of fat-tail increases up to 3,10 - 3,70 or quintuple up to 20,1 - 37 times. This argues about compensation of inchoate

Table 3 - Protein quality index of mutton n=3

Table options

extent and size of fat-tail in embryonic period at the expense of fast precocious appearing at milk period. To the age of 6 months the mass of fat-tail reaches to 3, 30 - 4,60 kg with the output of 7,8 tiil 10% of pre-slaughter mass. Size of fat-tail was not paid attention in selection of animals because of standard absence to lambs' fat-tail size. It's a pity but nowadays current standards of fat-tails' size doesn't take into account in defining quality of carcass. In future it is well - handled to make selection in the direction of animals' storage with large size of fat-tails in connection with increasing of precociousness<sup>5</sup> lambs' meat quality<sup>7</sup> as well as increasing assortment of lambs' meat products especially halyal.

Protein quality of mutton index, amino acid and, lipid content of muscle tissue was examined by jointly with scientific staff of SRSIMMI (Scientific Research Structural Institute of Meat and Milk Industry), "Technology of meat, milk and food products" Chair of Shakarim Semei State University, the All-Russian research Institute of meat industry VM Gorbatov). According to Cuvier D [5], calculation of protein quality index is the best spread method of protein quality estimation.

Amino acid content of protein is the main index on the base of which it can be predetermined about meat biological value of different brans of muscle tissue including 18 amino acids among them 8 irreplaceable. The sum of free amino acids in lambs' meat is fluctuated from 28,55 up to 20,57 gram and content of irreplaceable amino acids makes up from 13.08 up to 9,05 gram/100 gram of protein.

Age, months	Tryptophane, mg %	Oxiprolin, mg %	Protein quality index
4	224,61±4,22	129,62±1,10	1,7±0,1
6	311,63±5,32	122,03±1,21	2,5±0,2
8	323,21±6,77	109,80±1,12	2,9±0,2
12	334,12±5,44	107,74±1,06	3,1±0,2

It's worth to point out that lamb at the age of 4 months (1,7) is the most valuable in food attitude. At other ages increasing of protein quality index especially at the age of 12 months (3,1) is

Table options

overseen. Lambs' and young animals' meat of fat - tail sheep grown in the conditions of grasslands, the content of copper is in 24 times, lead in 1,25

times, zinc in 16 times less than normative data

and toxic elements as mercury, arsenic, cadmium and pesticides didn't reveal. Research of lambs' toxic safety at the age of 4 and 6 months are up to qualities that's why sheep's slaughter is recommended at these age periods.

In whole it's worth paying attention that there is cholesterol in young animals' meat at the process of growth. Four month milky lambs' low level of cholesterol can be considered as favourable moment from the point of perspective processing of meat raw for the production of meat products with high food quality.

Table 4 - The content of cholesterol,  $\alpha$ ,  $\beta$ - Lipoproteidas in mutton of various age, % mg.

Age, months	Biologically active agents		
	General cholesterol	Lipoproteida of the high density (LHD)	Lipoproteida of the low density (LLD)
4	58,12±1,87	0,95±0,72	3,97±0,85
6	103,23±3,07	0,94±0,65	3,93±0,74
8	121,17±2,80	0,92±0,57	2,97±0,63
12	122,34±2,91	0,89±0,48	2,47±0,52

On the base of above mentioned research the standard of the Republic of Kazakhstan "Lambs for slaughter. Lambs meat. General technical conditions" was developed[6]. Standard introduction of objective measurable criterions of lambs estimation and received meat by food and technological adequacy (predetermined level of equivalence of technological processes to the specificity of processed raw quality) gives possibility to spread meat efficiently and rationally according to its quality to processing of sausages, semi-prepared meat products, tinned food and smoking foods.

Being founded on the received experimental data it's worth mentioning that intensive growing, complex estimation of meat productivity of fat- tail young rams, using (processing) of lambs' meta and young rams are rational and perspective direction at production of meat products of stock.

In the conditions of globalization of the markets including the markets of food staples, developments of production technologies of food and network retail business, come to the forefront the problems connected with ensuring food security.

The work is devoted to development of the new assortment of meat products from Lamb meat. At present, ready meat products from Lamb meat account for a small proportion in the assortment of industrially produced meat products, which is associated with in adequately development technologies of their production. Thus, developing the rational technology for production of meat products from nontraditional kind of raw material, lamb meat, and improving their quality make it possible to increase the volume of meat products Table options manufacture, broaden their assortment and improve their economic efficiency.

Issue of confirmation of meat product conformity to requirements of the Technical Regulations of the Customs Union. The registration of the declarations of conformity is carried out by the certification bodies included in the Unified register of certification bodies testing laboratories (centers) of the Customs Union or the authorized bodies of the states- members of the Customs Union and the Common Economic Space.

In the context of the globalization of markets, including the markets for food staples, technology development of food production and retail network to the fore issues related to food security.

Our collaboration with the named after V.M. Gorbatov All-Russian Meat Industry Institute devoted to the study of sensory and functional properties of lamb meat and the development of a new range of meat products from lamb meat. Currently, the finished meat products Meat Lamb account for a small share in the range of industrially produced meat products, due to the technology for the proper development of their production. Thus, the development of rational technology for the production of

meat products from non-traditional types of raw materials, lamb meat, and increase their quality make it possible to increase the production of meat products, to expand its product range and increase their economic efficiency.

Issuance of conformity assessment of products of meat the requirements of the Technical Regulations of the Customs Union. Registration of declarations of conformity carried out by certification bodies, are included in the Unified

Register of certification of testing laboratories (centers) of the Customs Union or the competent authorities of state officials of the Customs Union and Common Economic Space.

Therefore, the test of the organoleptic and functional properties of lamb meat and the development of a new range of lamb meat products, we plan to hold the in the named V.M. Gorbatov All-Russian Institute of Meat Industry

### **Conclusion**

Our experimental data confirm that, in general, Separate&sucking way of cultivation of lambs with dressing concentrated feed method is better than another.

The use of Separate&sucking way of cultivation of lambs with dressing concentrated feed is more efficacious than the use of traditional method of growth.

Test Center under the leadership of Doctor of Technical Sciences Lisitsyn A.B. At the present time work is in progress on improvement of meat products, production processes, promotion of innovations, improvement of nutrition quality of the population and production of safe products under the conditions of market, and globalization of all the spheres of scientific and economic life.

Fat-tail male-lambs reached high live weight to the moment of weaning from dam in 4 month age: Unit x KG 42,7 kg or 65,7 % Edilbay breed, KPG x KG - 39,1 kg or 71,1 % of Kazakh fat-tail semi coarse wool, KG x KG -41,6 kg or 69,3 % of Kazakh fat-tail coarse wool adult dam's live weight.

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## Түйін

Егін шаруашылығы қарқынды дамыған солтүстік «Бастау» ЖСШ, Ақмола өңірі және Мойынқұм, таулы жайылымды оңтүстік «Шаушен» ШҚ Жамбыл өңіріндегі құйрықты қойлардың тұқымдық қасиеттері мен өнімдерінің бәсекеге қабілеттілігін арттыруда селекциялық-технологиялық әдістерді-өндіріске енгізу мақсатындағы тәсіл бойынша құйрықты қой төлдерінің енесін еміп өсу мезгілінде, жаңа туған төлдердің қарқынды өсіп дамуы мен жетілгіштігін арттыруға арналған, «енесінен бөліп-емізу» инновациялық технологиялық әдіс-тәсілін арқылы негізделген. Құрастырылған тәсіл бойынша енесінен бөлініп-емізіліп, үстеме жем жеген тоқтылардың өсіп жетілуі жоғары көрсеткіштерге ие болды. Әсіресе, тәжірибедегі енесінен бөлініп-емізілген және жайылымда 2 ай бойы үстеме жем алған тоқтылардың тірілей салмағы 6-айлығында да жоғары болып, есейгені байқалды. Қылшық жүнді тоқтылардың салмағы 42,7 кг, орташа тәуліктік өсімі-307,1г, салыстырмалы өсімі-151,8%, шынайылығы  $P > 0,99$  қамтамасыз етеді.

## Резюме

В работе проведены исследования по применению различных вариантов раздельно-подсосной технологии выращивания курдючных ягнят в молочный период в ТОО «Бастау» Атбасарского района Акмолинской и КХ «Шаушен» района Т. Рыскулова Жамбылской областей Республики Казахстан. Исследования показали, что внедрение раздельно - подсосной технологии свидетельствуют о положительном влиянии к достижению достаточно высокой кондиционной массы до 45кг и более с различной скоростью роста, а именно: казахские курдючные достигли к 6 мес возрасту до 42,7 кг со среднесуточным - 307,1г, относительным приростом - 151,8%. Преимущество в живой массе этих же баранчиков по сравнению с традиционным методом выращивания достоверны  $P > 0,99$ ; самая высокая кондиционная живая масса достигнута при внедрении раздельно-подсосной технологии с подкормкой, при этом кондиционной живой массы 40 кг достигли почти все группы подопытных баранчиков к концу молочного периода, то есть в возрасте 4 мес.

## Summary

The article studied the application of different options of separately-suckling technology of fat-tailed lambs growing in the dairy season in the breeding farm "Bastau" of Akmola region and the farm "Shaushi" of Zhambyl regions of Kazakhstan. The introduction of separate - suckling technology have shown the positive influence to achieve a high weight to 45kg and more at a different rate of growth, namely: Kazakh fat-tailed reached to 6 months of age to 42.7 kg with an average daily gain - 307,1g, relative growth - 151.8%. The advantage of the live weight of the male-lambs in comparison with the traditional method of cultivating authentic  $P > 0.99$ ; highest conditionally live weight achieved in the implementation of separate-suckling technology with dressing, thus conditioned body weight of 40 kg reached almost all groups of experimental male-lambs by the end of the milk period, at the age of 4 months.