

REFRIGERATION, FREEZING AND THAWING

Influence of the Way of Breeding Fattened Lambs
on Yield and Meat Quality

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Two ways of breeding fattened lambs have been included in this investigation such as fattening by means of mother's milk and mixture, and fattening of the early weaned lambs only by means of mixture until the weight of about 30 kg is achieved (112 day old lambs).

The early weaned lambs stopped getting mother's milk at the age of 21 days and were fed with mixture consisted of animal proteins from different sources (dried skim milk or fish meal) in the first phase of fattening (21 - 56 days), and with mixture without animal proteins in the second phase of fattening (56 - 112 days).

The results obtained from the investigation have shown the following conclusions.

1.- The applied way of breeding gives priority to the fattening of the early weaned lambs because better yield of muscle tissue is obtained in comparison with the fattened lambs dependent on mother's milk and mixture.

2.- The different sources of the animal proteins (dried skim milk or fish meal) of the early weaned lambs in the first phase of fattening, as well as the sex, don't influence significantly the yield and the chemical composition of meat.

3.- Tenderness, juiciness, flavour and general acceptability of meat are not affected by the protein sources in the food, but as for the sex, it is a factor which has a significant influence on the juiciness ($P < .05$).

Influence de la manière d'élevage des agneaux
engraissés sur le rapport et la qualité de la
viande

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Dans ces recherches étaient inclus deux manières d'élevage d'agneaux engraisés: engraissement au lait maternel et aliments concentrés et engraissement des agneaux sevrés tôt, uniquement avec aliments concentrés atteignant un poids de cca 30 kg (âge des agneaux 112 jours).

On a cessé de donner du lait maternel aux agneaux sevrés tôt, âgés de 21 jours et on les a nourris, dans la première phase de l'engraissement (du 21 au 56 jour) avec un mélange de fourrage où il y avait des protéines animales d'origine diverse (lait en poudre ou farine de poisson), et dans la deuxième phase de l'engraissement (du 56 au 112 jour) avec un mélange de fourrage sans protéines animales.

Les résultats des recherches permettent de tirer les conclusions suivantes.

1.- La manière d'élevage appliquée donne l'avantage à l'engraissement des agneaux sevrés tôt, car on obtient un meilleur rapport de tissus musculaires en comparaison avec les agneaux engraisés, nourris au lait maternel et aliments concentrés.

2.- L'origine diverse des protéines animales (lait en poudre ou farine de poisson) chez les agneaux sevrés tôt dans la première phase de l'engraissement, ainsi que le sexe, n'ont aucune influence sur le rapport et la structure chimique de la viande (MLD).

3.- La délicatesse, la saveur et l'odeur ainsi que la convenance générale, ne sont pas sous l'influence des protéines dans la nourriture, tandis que le sexe se montre comme facteur, ayant une influence significative sur la saveur ($P < .05$).

Einfluss der Zuchtweise der Mastlämmer auf
den Ertrag und die Qualität des Fleisches

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In diese Untersuchungen waren eingeschlossen zweierlei Art und Weise der Aufzucht von Mastlämmern und zwar: eine Mastung mit der Muttermilch und Konzentraten und die andere Mastung von abgesonderten früh Lämmchen nur mit Konzentraten bis zur Erreichung eines Gewichtes von cca 30 kg (Alter der Lämmer 112 Tage).

Die früh abgesonderten Lämmchen haben aufgehört zu empfangen die Muttermilch im Alter von 21 Tagen und wurden ernährt in der ersten Phase der Mastung (21 bis 56 Tag) mit Futtermischungen in welchen eingefügt waren die Animalproteine aus verschiedenen Quellen (Milchpulver oder Fischmehl), und in der zweiten Mastungsphase (56 bis 112 Tag) mit Viehfuttermischungen ohne animalischer Proteine.

Die Untersuchungsergebnisse gestatten, dass folgende Beschlüsse gefasst werden.

1.- Die angewandte Art der Aufzucht gibt den Vorzug der Mastung der früh abgesonderten Lämmchen weil man dabei einen besseren Zuwachs der Muskelgewebe bekommt im Vergleich mit Mastlämmern die gehalten wurden an der Muttermilch und Konzentraten.

2.- Die verschiedenen Quellen der animalischer Proteine (Milchpulver oder Fischmehl) bei den früh abgesonderten Lämmchen in der ersten Phase der Mastung, sowie das Geschlecht haben keinen bedeutenden Einfluss auf den Ertrag und die chemische Zusammensetzung des Fleisches (MLD).

3.- Die Zartheit, Saftigkeit, Geruch und die allgemeine Eignung des Fleisches stehen nicht unter dem Einflusse der Quellen der Proteine in der Nahrung, wogegen sich das Geschlecht zeigt als ein Faktor, der einen signifikanten Einfluss hat auf die Saftigkeit ($P < .05$).

Влияние метода кормления ягнят на
количества и качества мяса

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В этом опыте испытывались два метода кормления

ягнят на мяса: кормлением ягнят с материнского молока и концентрированными кормами и кормление рано отбитых ягнят только концентрированными кормами приблизительно до 30 кг живого веса /старости ягнят 112 дней/.

Рано отбитые ягнята получали материнского молока до возраста 21 дня и кормили в первой фазе кормление /21 - 56 дней/ концентрированными кормами в которых содержали животные протеины од различных источников /молоко в порошок или рыбная мука/, а в второй фазе кормление /56 - 112 дня/ концентрированными кормами которые не содержали животные протеины.

На базе полученных результатов можно сделать следующие выводы.

1.- Прямой метод кормления рано отбитых ягнят дает лучше привес мышечной ткани по сравнению с кормлением ягнят материнского молока и концентрированными кормами.

2.- Различных источников животных протеинов /молоко в порошок или рыбная мука/ к рано отбитых ягнят у первой фазы кормление, а также пол, не имеет значительное влияние на количество и химического состава мяса /MLD/.

3.- Источники протеинов в кормах не имели влияние на нежность, сочность, аромат и вкусовые качества мяса, а пол является как фактор которые имеет ситнификантное влияние на сочность / $P < .05$ /.

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There are reports in the literature on the effects of breed, feed, management practices, age etc. on the yield and quality of lamb. So, for instance, Pauline et al. (4) found in the carcasses of a group of lambs, fed by alfalfa hay plus whole barley, significantly higher percent of lean than in the carcasses of another group of lambs fed by trefoil and ladino pasture. Weber and Loeffel (6) reported that roasts from weanling lambs were less pronounced in aroma and flavor of fat and lean, but more tender and juicy, than roasts from lambs fed 28 days after weaning. The same authors earlier reported that as fattening progressed, the flavor of the lean became less pronounced but the tenderness was not affected. Batcher et al. (1) reported that, with increasing percent of separable fat in older (11 to 14 months) animals, the percentage of lean and bone decreased, the ether extract increased and the moisture decreased in the lean; tenderness, juiciness, and flavor were not affected by any percent of separable fat. Palsson (3) stated that bone increased least, lean only slightly more, and fat most as the sheep aged from 4,5 to 13 months. Callow (2) found that young sheep fattened more slowly than older ones, and deposited less fat and more protein. Šokarovski et al. (5) reported that the percentage of lean of rib-chops is the highest and separable fat the least in the carcasses of lambs weaned in the 6th week; tenderness, juiciness and flavor of lamb increase if the lambs are weaned later.

We realize the project about the investigations of productive qualities of early weaned lambs in the case of

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loin), chemical composition of MLD, and taste panel scores.

RESULTS AND DISCUSSION

Final live weight of lambs and dead weight (kg and %) too, are shown in table 1. The live weight at the age of 112 days is the highest in the III group (mean value 29,67 kg), or about 13% higher than in I and II group. The difference is significant ($P < 0.01$).

Table 1. Final Live (112 Days) and Dead Weight of Experimental Lambs

Group	I		II		III	
	Male	Female	Male	Female	Male	Female
n	11	12	12	12	13	14
Live Weight (kg)	27,84	24,25	28,95	24,62	32,05	27,46
Dead (kg)	13,31	11,81	14,05	12,23	15,01	12,93
Weight (%)	47,81	48,71	48,52	50,08	46,82	47,08

The difference exists in live weight between mean value of male lambs too. The live weight of male lambs of the III group is the highest and shows significant ($P < 0.05$) difference in relation to the lambs of the I and II group. Final live weight of female lambs is the highest and the difference significant ($P < 0.05$) in the III in relation to the live weight of lambs of the I and II group.

The difference of live weight between the male and female lambs, independently of the group, is significant ($P < 0.01$) for the benefit of the males.

The lambs dead weight (%) of the I and II experimental group is higher than the control (III) group. Dead weight (%) of the female lambs, in all groups, is higher than the one of the males. But, the differences in all cases are not significant.

The live weight and the dead one of the lambs of the control (III) group, because they were fed by mothers milk plus mixture, were higher in comparison with experimental groups, and the differences were significant. The lambs live weight and the

the intensive fattening in SR Macedonia. Our task was to get the answer on the question whether the way of breeding of fattened lambs influences the yield and meat quality.

EXPERIMENTAL PROCEDURE

Tests were made on 74 lambs, all of meliorated Onitarska polska sheep. The lambs of experimental groups were weaned at the age of 21 day. One group of lambs, in the first phase of fattening (21st to 56th day), was fed by mixture with dried skim milk (I), and the other one by mixture with fish meal (II). The lambs of control (III) group were sucking their mothers to the end of experiment plus fed by mixture ad libitum. In the first group there were 11 male and 12 female, in the second group 12 male and 12 female, and in the control (third) group 13 male and 14 female lambs. The lambs of the I and II group were fed, in the second phase of fattening (from 56th to 112th day), by mixture in which the animal proteins were not present as the components.

All lambs were killed at the age of 112 days. The carcasses were weighed after cooling of 24 hours, and then by means of saw cut, and the loin from the left half because of dissection, in order to determine its physical composition, and the rib-chop (from 8 to 12 rib) because of roasting and determining its sensoric qualities, were taken out. Dissection of loin was performed after 24, and roasting of rib-chop after 48 hours of meat cooling (+4°C in the middle of meat). The panel included 10 persons. The samples were served hot, and scored in scale ranged from +5 to -5, with descriptive terms, as follows: tenderness, very tender to very tough; juiciness, very juicy to very dry; natural flavor of lean, none to very pronounced; general acceptability, very good to very poor. Chemical composition of MLD was determined as follows: moisture (drying at 105°C, for 24 hours), protein (micro Kjeldahl), and lipids (ether extract Soxhlet).

The effect of studied factors was followed through carcass weight, physical composition of carcass (on the base of

dead one of the II (fish meal) in comparison with I (dried skim milk) group are higher, but the differences are not significant. It is possible to conclude, from the above results, that the various sources of animal proteins, in the first phase of experimental lambs fattening do not influence the total meat yield.

Physical composition of carcasses (on the base of loin) is shown in table 2. It was stated that differences of mean

Table 2 Physical Composition of Lamb Loins

Group	I		II		III	
	Male	Female	Male	Female	Male	Female
n	6	6	6	6	6	6
Weight of Loin (g)	643,97	610,25	633,07	605,65	680,52	666,10
Separable Lean (%)	59,99	57,95	59,70	57,95	59,08	54,73
Separable Fat (%)	23,48	26,94	23,15	26,11	25,98	32,71
Bone (%)	16,53	15,11	17,15	15,94	14,94	17,41
	2,38	2,84	1,47	1,38	3,65	2,33

$P < 0.05 = 3,68$ $P < 0.01 = 6,36$

values of lean among the groups are not marked. There is not marked difference in yield of lean among the male lambs in all groups. However, the difference in female lambs of the III group, in comparison with I and II group, is significant ($P < 0.05$), that is to say that female lambs carcasses of the III group contained 4% less separable lean than those of the I and II group.

There was significant influence ($P < 0.01$) of sex, independently of the group, on the content of separable lean, or the carcasses of male lambs contained higher quantities of lean than the females.

The carcasses of the III group of lambs contained the highest quantities of separable fat (mean value 29,10%). If this percentage would be considered as 100%, the separable fat in carcasses of the I group would be present with 87%, and in those of the II group with 85%. The differences in content of separable fat among the III (control) and the I and II (experimental) groups are significant ($P < 0.01$). Those differences in content of separable

REFRIGERATION, FREEZING AND THAWING

fat among female lambs are significant (for the benefit of the III group), but there is not such difference in male animals.

There is significant ($P<0.01$) influence of sex, independently of the group, on the content of separable fat, or the carcasses of female lambs contained 15% more fat in comparison with those of the males.

There are differences in content of bone among the groups but they are not marked. The carcasses of male lambs contained a little bit higher percentage of bone in comparison with the females, but the III (control) group less than the I and II (experimental) group.

It can be concluded that the applied way of fattening (I and II experimental groups) gives high yield of lean and less of fat in comparison with the control (III) group. Considering that there are not differences in yield of lean between the I and II experimental group, the feeding of early weaned lambs can be recommended, in the first phase of fattening, by means of mixture in which the fish meal is present as a source of animal proteins, because it is cheaper in comparison with dried skim milk.

Chemical composition of MLD is shown in table 3. From

Group	Sex	I		II		III	
		Male	Female	Male	Female	Male	Female
n		6	6	6	6	6	6
Protein	X	19,58	19,12	19,02	19,17	19,47	19,49
	S	0,09	0,34	0,48	0,56	0,18	0,23
Ether Extract	X	1,31	1,25	1,36	1,40	1,40	1,37
Content	S	0,06	0,06	0,06	0,06	0,10	0,06
Molasture	X	75,85	75,91	76,22	76,06	74,52	74,41
	S	0,50	0,67	0,57	0,15	0,30	0,20
Mineral	X	1,20	1,19	1,15	1,20	1,22	1,21
Batters	S	0,04	0,06	0,06	0,09	0,11	0,06

the aspect of way of breeding there were not marked differences among the groups in chemical composition of MLD. It can be concluded that the different sources of animal proteins, in the first phase of fattening of early weaned lambs, as well as the

accept the applied way of fattening of early weaned lambs (after 21 day), it ought to have in mind the economic effect first of all.

The fattening of lambs lasts 112 days. In that period, lambs produce more lean than fat and bone. Callow (2) stated the same. Later, if lambs further fatten, quantity of fat increases more and more instead of lean.

Results of sensoric qualities of lamb in our investigation confirmed the same of Weber and Loeffler (6). The flavor of lean of lamb, which contains more quantities of fat, was less pronounced but tenderness, juiciness and general acceptability were not affected.

It was confirmed, like in Batcher et al. (1) investigation, that with increasing percent of separable fat, the percentage of lean and bone decreased, as well as the present fat did not affect the sensoric qualities of lamb.

Conclusions

The results obtained from the investigation have the following conclusions.

1.- The applied way of breeding gives priority to the fattening of the early weaned lambs because better yield of lean is obtained in comparison with the fattened lambs dependent on mother's milk and mixture.

2.- The different sources of the animal proteins (dried skim milk or fish meal) of the early weaned lambs in the first phase of fattening, as well as the sex, do not influence significantly the yield and the chemical composition of meat.

3.- Tenderness, juiciness, flavor and general acceptability of meat are not affected by the protein sources in the food, but as for the sex, it is a factor which has a significant influence on the juiciness ($P<0.05$).

REFERENCES

- 1.- Batcher M., Dawson E., Pointer M., Gilpin G., Food Technology, 16 (1), 102, 1962.
- 2.- Callow H., J. Agr. Sci., 40, 1, 1950.
- 3.- Pallson H., J. Agr. Sci., 30, 1, 1940.
- 4.- Pauline Paul, Judith Torten, Glenwood S., Food

sex, do not influence the chemical composition of MLD.

Panel scores (table 4) show that the various kinds of animal protein sources, in the first phase of lambs fattening,

Table 4
Average Lamb Panel Scores

Group	Sex	I		II		III	
		Male	Female	Male	Female	Male	Female
n		6	6	6	6	6	6
Tenderness	X	3,87	3,70	3,73	3,83	4,10	3,43
	S	0,16	0,37	0,24	0,29	0,24	0,51
Juiciness	X	3,87	3,77	3,90	3,90	4,07	3,40
	S	0,39	0,23	0,21	0,17	0,30	0,42
Flavor of Lean	X	3,53	3,87	3,73	3,83	3,70	3,27
	S	0,30	0,47	0,24	0,19	0,54	0,43
General Acceptability	X	4,07	4,00	4,13	4,17	4,23	3,67
	S	0,16	0,25	0,10	0,23	0,32	0,51

do not influence significantly the tenderness, juiciness, flavor and general acceptability of lamb.

From the aspect of way of breeding, meat juiciness, flavor and general acceptability of experimental lambs are better than those of the control ones, but tenderness is slightly better in meat of the control group. However, those differences are not significant.

There is not marked influence of sex on tenderness, flavor and general acceptability of lamb. However, the sex significantly ($P<0.05$) influences the juiciness of lamb, that is the meat of male lambs shows higher juiciness than the meat of female lambs.

It is known from the literature that the more lambs are fed by rich protein mixtures during fattening, the higher yield of lean is in comparison with those which are not fed in the same way. Our investigations have proved, when the lambs get animal proteins with mixtures in the first phase of fattening, the total quantity of meat increases, in which lean is present in high percent. But, in our experiment, various sources of animal proteins (dried skim milk or fish meal) do not influence the production of various quantities of lean. Therefore, if we

Technology, vol. 18, No 11, 121-130, 1964.

5.- Jokarowski J., Džinleski B., Taškovski M., Tokovski T., Ilkovski R., Jordanovski N., Proceeding of 15th European Meeting of Meat Research Workers, 1969, Helsinki, Finland.

6.- Weber D., Loeffler W., Nebraska Univ. Agr. Exp. St., Bull. No 276, 1932.