EFFECT OF THE LENGTH OF FATTENING PERIOD ON GAIN AND CARCASS TRAITS IN SHEEP

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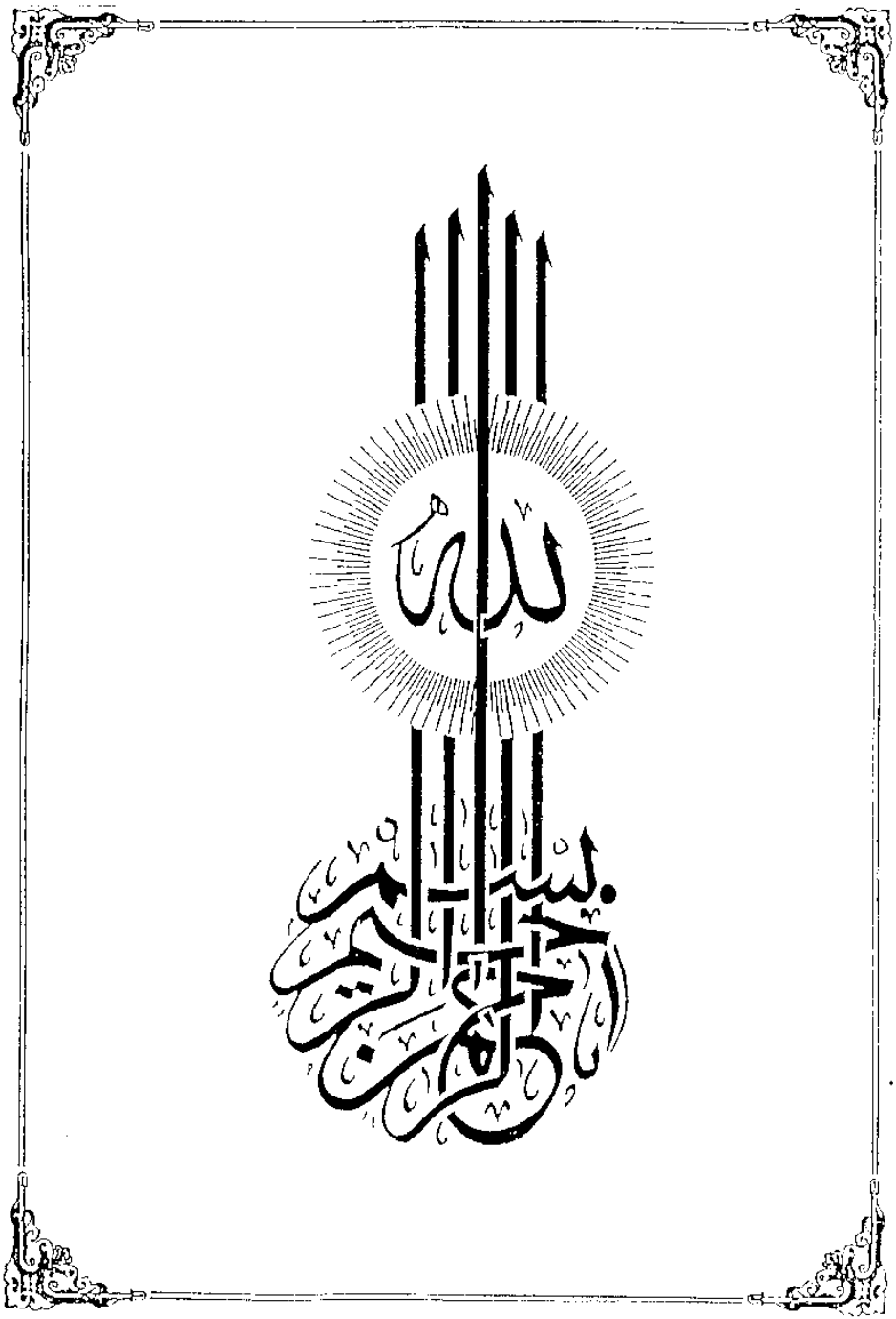

INTRODUCTION

In Egypt there are almost two million head of sheep, of which one third is raised in the North Western Coastal desert. The main income of raising sheep in Egypt comes from lamb production, while the wool clip represents secondary income.

In the desert where sheep are raised on poor natural pasture with small amounts of supplementary feeding such as concentrates, hay, and straw, it may be suitable to maintain flocks of mature sheep and lambs in store condition; this condition, however, would not be suitable to maintain high growth rates and body gain for the lambs produced before and during fattening. It is a common practice that some of the desert lambs are marketed and fattened away from the desert. However, a well-defined system of fattening seems to be lacking and initiating such a system would be of special importance. Before recommending any system of fattening for desert lambs, however, a study of the different aspects of fattening such as the age at which fattening should start, the effect of the length of fattening period on carcass traits, the efficiency of feed utilization, and the economics of fattening should be investigated. This study was therefore initiated to investigate the effect of the length of fattening period on gain and carcass traits for desert lambs.

REVIEW OF LITERATURE

Gain during Fattening

Fattening represents the process in which the animal is put on a relatively high plane of nutrition, thus allowing the animal to lay down edible tissues and to get the right finish. This seems to be the most acceptable definition for the fattening process.

Insuring a high body gain during fattening is always an object for sheep fatteners. High body gain during fattening results in reaching the required slaughter weight of the lamb at an earlier age and this in turn results in reducing the part of the ration which covers the maintenance requirements and subsequently the overall costs of feeding.

Gain during fattening is known to be affected by many factors, such as breed, plane of nutrition, sex and age, and conditions under which the animal starts fattening.

Lambs of the early maturing breeds such as Suffolk, Shropshire and Clun Forest achieve high growth rates early in their lives and usually are ready for slaughter at an early age (at weaning) while those of the late-maturing breeds usually have slow growth rates and probably are not ready for slaughter before 7 - 8 months or more. Breed differences in gain during fattening have been reported by many investigators. Seoudy (1970) found daily gain to be 195 and 185 gm. for Barki and Hungarian Merino lambs, respectively, over a fattening period of 70 days, the difference being not statistically significant.

Crossbreeding is a well established method for increasing growth rate and gain during fattening of crossbred lambs. This may

involve two or more breeds of sheep and may be referred to as stratification. In countries like England, New Zealand and Australia, fat lamb production is based on stratification between different breeds of sheep raised under different environmental conditions, thus utilizing breeds and environments in one production system.

Many workers have shown crossbred lambs to exceed purebred ones in gain during fattening. However, most of these comparisons lack studies on the relationship between gain and efficiency of feed conversion, which is a question of special importance. For example, Searle and Graham (1971) found halfbred lambs (Border Leicester x Merino) to eat more and grow faster than purebred ones (Merino). Therefore, studies on the effect of crossbreeding on gain should include a critical examination of the amount of food needed to produce one unit of gain.

In a comparison of the ability for fattening between Romney Marsh and Romney Marsh x Tsigai rams, Haritonov (1969) reported daily gain to 7 - 8 months of age to be 125 and 126 gm., respectively. In a study on the fattening ability and meat production of purebred and crossbred Mongolian wethers, Batsukh (1971) reported an average weight gain over $5\frac{1}{2}$ months of fattening on pasture of 19.8, 17.4, 17.9 and 17.8 kg. for Mongolian, Altai x Mongolian (F_1), Tsigai x Mongolian (F_1) and Mongolian x Altai x Tsigai breed groups, respectively. Serudy (1970) studied the performance of the local Barki breed, imported Hungarian Merino and their F_1 (MB) and reported a daily gain over a 70 day fattening period of 195, 185 and 207 gm. for the three breeding groups, respectively.

There is almost full agreement in the literature that crossbred lambs exceed purebreds in gain (Molnar, 1962; Rodin, 1964; Arsenjev, 1965; and Vance et al., 1967). Other investigators compared different crosses; the difference in the performance in such comparisons depended on the genetical constitution of the different breeds involved in the crossing system. Markinova and Kadaachii (1968) reported daily gain to be 191, 183 and 136 gm. for lambs born to crossbred ewes from fine x coarse-wooled matings when sired by Lincoln, Lisken or Caucasian rams, respectively.

The plane of nutrition is known to affect livebody gain during fattening greatly, and lambs of fast growing breeds may be very slow in reaching their optimum slaughter weight if kept on a low plane of nutrition. The terminology "plane of nutrition" is usually used in the literature to describe the level of a specific nutrient, the type of ration or the duration of feeding.

Many investigators have worked on the effect of different energy and protein levels on gain during fattening and a recent review of the subject was provided by Soleman (1971). In his own work the author reported that average daily gain for Rahmani lambs over a 139 day experimental period was highest for a group of lambs fed a high energy-high protein diet (172 gm.), followed by those on the high energy-medium protein diet (171 gm.); the lowest daily gain was obtained by lambs kept at the low energy-low protein level (122 gm.). Orskov et al. (1971) reported mean rates of live weight gain for lambs kept on low, medium and high protein diets were, respectively, 191, 270 and 330 gm. per day

for males and 177, 225 and 301 gm. per day for females, the increase with protein concentration being highly significant. Likewise, Jones and Hogue (1960) found that lambs fed a high level of protein gained faster than their mates which were fed a low level diet.

Lambs can be fattened on rations ranging from whole roughage such as grass to whole concentrates. The ratio of roughage to concentrate in fattening diets was reported to affect daily gain during fattening. Younis et al. (1972) found daily gain for Ebeidi lambs over a 30 week fattening period to be 87, 119 and 116 gm. when concentrate to roughage ratio in their diets was 52.9, 64.1 and 81.4, respectively. Similar results were reported by El-Shobokshy et al. (1973), who found daily gain to be 74.4 and 118 gm. for two groups of Ebeidi lambs when fattened on rations containing 38 and 54% concentrates, respectively, with the rest in the form of roughage. The same authors concluded that a ration containing less than 60% concentrates is more likely to be unsuitable for fattening lambs. However, the ratio of concentrate to roughage for rations of fattening lambs would depend on availability and relative cost and their effect on the type of product.

Working with digestibility trials and feedlot performance of Sudan Desert sheep, Hassan and Mukhtar (1970) reported that the type of ration influenced daily gain during fattening. They used three rations: A, B and C. Ration A consisted of 25% berseem hay, 25% cottonseed cake and 50% sorghum grain; ration C consisted of berseem hay only, while ration B was composed of equal parts by weight of rations A and C. The average daily gains were 254, 236 and 150 gm. for rations A, B and C, respectively.

McClure and Carter (1967) compared three feeding systems and their effect on gain during fattening. Average daily gain for unsheared lambs was 0.07, 0.11 and 0.15 kg. when lambs were fed in dry lot, pastured with grain feeding, and pastured only, respectively.

The length of fattening period (length of feeding) is expected to have a marked effect on daily gain. Daily gain for a group of Rahmani lambs put on a high energy-high protein ration was found to be 146 gm. over 236 days and 172 gm. over the first 139 days of the previous period (Soleman, 1971). Younis et al. (1972) reported differences in the rate of gain of Ebeidi lambs due to the length of the fattening period.

Ray and Kromann (1971) studied the effect of sex, age of lamb and length of feeding upon energy metabolism and carcass traits of Rambouillet lambs. They reported daily gain to be 160, 190 and 180 gm. for 30, 60 and 90 days of fattening, respectively. Efner (1972) studied the slaughter yield of wethers killed at different ages, i.e., 80 days, 100 days, 135 days, 8 months or 10 months of age. Slaughter weight was found to be 25.75, 29.50, 34.68, 43.70 and 49.10 kg., respectively. The corresponding average daily gain was 252, 239, 216, 158 and 145 gm., showing a decline with the advancement of age at time of slaughter.

Sex has been reported by many authors to affect daily gain during fattening, and there is almost complete agreement in the literature that male lambs gain faster than female ones. Seoudy (1970) found daily gain for Barki male lambs over a 70 day fattening period to be 207 gm., as compared to 135 gm. for female ones. Reynolds et al. (1966) reported sex to have a highly significant effect on daily gain from

birth to slaughter. However, other authors (Btyikoglu, 1967 and Kinsman, 1967) reported only a slight superiority in weight gain of male lambs over female ones.

The prefattening weight (initial weight) was reported by many authors to affect daily gain. Seoudy (1970) found that the smaller the average initial weight of the experimental group, the higher was its average daily gain. It would appear that undersized lambs within a group of the same breed are usually underfed as compared to the rest of the group. Therefore, they tend to compensate for this with a gain once they have the chance for a relatively high level of nutrition during fattening. On the other hand, lambs with relatively high initial weight are usually well fed before fattening. This might explain the negative correlation between initial weight and daily gain during fattening ($r = -0.95$) reported by Horak (1965). The sudden rise in daily gain for the undersized lambs during fattening is usually referred to as compensatory growth (Wilson and Osburn, 1960 and Osman and Bradford, 1967). The degree of such compensatory growth depends on many factors, of which the degree of food restriction before fattening, the length of the period of restriction and the age at which the lambs are restricted are considered the most important. However, there is a variation between different breeds in their ability to recover after a period of food restriction. Wilson and Osburn (1960) showed that different breeds within species differ in their ability to recover from the effects of undernutrition.

Efficiency of Conversion of Feed to Meat

Feed efficiency is defined as the gain in body weight resulting from the consumption of a given amount of feed or its inverse (Koch et al., 1963). Feed efficiency is usually expressed in the literature as the amount of dry matter, organic dry matter, starch equivalent or total digestible nutrients needed for the production of one kilogramme of gain. Working on efficiency of feed use in beef cattle, Koch et al. (1963) have indicated that the variation in the composition of gain (fat, lean or bone) and in maintenance requirements prevents this measure from being a precise estimate of energy conversion rate.

Another point of special interest is that the definition of the efficiency of feed conversion ignores the fact that at zero gain the animal is still in need of food to maintain life since the definition implies that the relationship between food intake and gain is linear.

Variation in the amount of the digestive tract contents (fill) between different animals will introduce another error to the amount of gain measured and, subsequently, the efficiency of feed conversion values. To eliminate such error, efficiency of feed conversion may be expressed as the amount of food needed for each kilogramme increase in the empty body weight. The latter is defined as the slaughter weight after subtracting the weight of the digestive tract contents.

Some other workers have expressed efficiency of food intake as the amount of food required to produce a kilogramme of carcass or even a kilogramme of lean or fat, i.e., edible parts. Conniffe and Hart (1967) working on cattle expressed efficiency of feed conversion (E.F.C.)

faster the growth rate of any given animal, the higher is the proportion of food that is devoted to productive process. However, it has to be borne in mind that a faster growing animal of a certain breed might be eating twice as much as another lamb of another breed for a relatively small increase in growth rate. Therefore, comparisons between different breeds in their efficiency of meat production should be rather based on an input-output relationship basis.

Koch et al. (1963) calculated heritability estimates for efficiency of feed conversion in cattle and found it to be 0.62 for gain adjusted for differences in feed consumption, 0.20 for feed consumption adjusted for differences in gain, and 0.36 for the ratio of gain to feed consumed.

Haritonov (1969) compared efficiency of feed conversion between purebred Romney Marsh and Romney Marsh x Tsigai rams and found that efficiency of feed conversion to 7 - 8 months of age to be 7.7 and 7.8 food units/kg. gain for the two groups, respectively. On the other hand, Molnar (1962) found that crossbred lambs (Ile-de-France x Merino) were able to convert their food more efficiently than purebred Merino lambs.

Plane of nutrition may affect efficiency of feed conversion. Jones and Hogne (1960) found that lambs fed a high level of protein were more efficient in converting their food to livebody gain than others kept at a low level. Soleman (1971) studied the effect of the energy/protein relationship on the fattening performance of Rahmani lambs and found that efficiency of feed utilization was highest for the group of lambs fed a low energy-high protein diet, while lambs on the high energy-low protein diet were the least efficient.

Working on digestibility trials and feedlot performance of Sudan Desert sheep and using three types of rations varying in ratios of roughage to concentrate, Hassan and Mukhtar (1970) reported food consumed/unit liveweight gain to be 6.07, 6.82 and 9.30 for rations A, B and C, respectively. Ration A consisted of 25% berseem hay, 25% cottonseed cake and 50% sorghum grain. Ration C consisted of berseem hay alone. Ration B was composed of equal parts by weight of rations A and C.

With the advancement of the fattening period, lambs tend to lay down fatty tissues, and since one kilogramme of fatty tissues requires almost 7 - 8 times the amount of energy needed to produce one kilogramme of lean, the efficiency of feed conversion tends to decline with the advnacement of the fattening period. Soleman (1971) found that the efficiency of feed conversion declines with the prolongation of the fattening period in Rahmani lambs.

Younis et al. (1972) studied the effect of different levels of energy intake produced through alteration of roughage to concentrate ratio in rations for fattening Ebeidi lambs. The efficiency of feed conversion was reported by these authors to decline with the advancement of the fattening period. The efficiency of feed conversion from 0 - 10, 0 - 20, and 0 - 30 weeks was found to be 4.7, 5.2 and 5.7 kg. starch equivalent, respectively, for each kilgramme gain for a group of lambs fed on a low concentrate-high roughage ration. The corresponding figures for similar lambs fed on rations of medium and high concentrate were found to be 4.6, 4.8 and 5.3 and 4.3, 5.2 and 5.7 kg. SE/kg. gain, respectively. This study also shows an effect on the efficiency of feed

conversion due to the type of ration since in the first 20 weeks of the fattening period, and over the whole period (30 weeks) lambs fed a ration with a medium level of concentrate content showed marked superiority in efficiency of feed conversion as compared to those fed on rations either high or low in concentrate content. Likewise, El-Shobokshy et al. (1973) found the efficiency of feed conversion to be 5.5 and 7.9 kg. SE/kg. gain for two treatment groups of Ebeidi lambs fed on high (54%) and low (38%) concentrate rations, respectively.

Castration is known to affect the efficiency of feed conversion. Entire males are considered to be superior to castrated ones in efficiency of feed conversion. However, many of the workers quoted in the literature who have reported on the effect of castration on gain and carcass traits in sheep have ignored the estimation of efficiency of feed conversion for both entire and castrated animals. Korotkov (1966) found that castrated Altai lambs needed 10.9 F.U. for each kg. gain while the entire ones needed only 9.4 F.U./kg. gain.

Turton (1969) reviewed the effect of castration on meat production from cattle, sheep and pigs. In almost all the work on cattle, entire animals were more efficient in converting their food to body gain than castrated ones.

Spedding (1965) discussed the efficiency of meat production in sheep and indicated that the efficiency of feed conversion for meat production in fat lambs should include the whole food required for the production of the lamb. The latter will be represented by the maintenance requirements for the ewe, extra food required for foetal growth during

pregnancy, food required for milk production and food (other than milk) required by the lamb up to slaughter. The efficiency in this case will be highly affected by the size of ewe, litter size and growth rate of lambs.

Working on the biological efficiency of meat production in sheep expressed as weight of carcass produced per 100 units of digestible organic matter consumed, Large (1970) found that ewes from the smaller breeds mated to rams from larger breeds gave high growth rates and bigger lambs and produced a large number of lambs. They were also most efficient for meat production. The same author added that a small ewe producing twins might be as efficient as a large ewe producing three or four lambs.

Kemp:undercoat ratio was also found to have a bearing on the efficiency of feed conversion. Loboda (1971) studied the effect of kemp undercoat ratios on the fattening of young Romanov sheep and reported that the consumption of F.U./kg. gain was 6.8, 7.2, 7.2 and 7.2 for ratios of 4, 7, 10 and 15, respectively.

Effect of Fattening and Breed on Carcass Traits

Fattening was previously defined as the process in which the animal is put on a relatively high plane of nutrition, thus allowing the animal to lay down edible tissues and to get the right finish. The effect of fattening on different important carcass traits will be discussed within this definition.

It is not the aim, however, to make a list of all carcass traits; the traits selected are considered of special importance. On