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INFLUENCE OF MASS GAIN DURING GESTATION ON MILK PRODUCTION OF EWES

P. le Roux

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Matopos Research Station, Private Bag K 5137, Bulawayo

OPSOMMING: INVLOED VAN MASSATOENAME GEDURENDE DRAGTIGHEID OP MELKPRODUKSIE VAN OOIE

Uit 'n totaal van 50 Dorpertipe-ooie van tussen drie en vier jaar ouderdom uit wat in die proef uitgesoek is, was 40 uiteindelik vir melkproduksiewaarnemings beskikbaar. Die ooie is gedek van die middel van Mei tot die einde van Junie. Die basiese rantsoen het uit veldweiding bestaan en die ooie is snags gekraal. Van die begin van September is aan die een groep ooie (18 ooie) 70,0 g verteerbare proteïen per dag elk in die vorm van katoensaadmeel as 'n supplement gevoer. Die ooie in die ander groep (22 ooie) het gedurende dieselfde tydperk 154,4 g verteerbare proteïen per ooi per dag ontvang. Die massatoename is uitgedruk as 'n persentasie van die massa met dekking. Vanaf dekking tot partus het die ooie wat die kleiner hoeveelheid proteïen gevoer is gemiddeld 6,56% en die ander groep ooie 14,45% in massa toegeneem. Die onderskeie gemiddelde melkproduksie gemeet oor 'n periode van 21 weke was 65,11 en 71,47 kg (Tabel 1). Daar was 'n neiging vir die melkproduksie van ooie om te verbeter met 'n toename in liggaamsmassa, maar sodra die ooie meer as 15% in massa toegeneem het is melkproduksie onderdruk (Fig. 1). Die optimum massa-toename gedurende die dragtigheidsperiode om maksimum melkproduksie te verseker lê blykbaar tussen 10 en 15%. Verder skyn dit ook die geval te wees dat die hormone thyroxine betrokke is veral by die oorvet ooie waar die melkproduksie laag was. Die moontlikheid van vetneerlegging in die uier is ook nie uitgesluit nie.

SUMMARY

Two comparable groups of three- to four-year-old Dorper-type ewes were fed a protein-rich supplement in addition to veld grazing to make either small mass gains (6,56%) or substantial mass gains (14,45%) during the gestation period. The quantitative milk production was determined by the lamb-suckling technique and the results indicated that when ewes gained up to 12% mass during the gestation period, there was a corresponding increase in the milk yield. When the mass gained was in excess of 15%, there was a marked suppression in the milk yield of ewes.

In the medium rainfall regions of Rhodesia the regrowth of vegetation which follows the onset of the rains in early December normally provides sufficient nutrients for ewes in early lactation. However, during the latter half of the dry season, i.e. August to November, feed conditions deteriorate to such an extent that all types of ruminants loss mass rapidly when kept on free range (Vorster, 1964). The main cause for the loss in body mass can be related to the low protein content of the natural pastures (Plowes, 1957). Such losses may be circumvented by appropriate supplementation.

Sheep tend to rear more lambs to weaning when well cared for during winter (Le Roux, 1970). The importance of the plane of nutrition following the 14th week of gestation on the subsequent milk yield of the ewe has been well documented (Wallace, 1948; Barnicoat, Logan & Grant, 1949; Forbes, 1969; Peart, 1967 and 1970; and Treacher, 1971) and in general in improvement in the plane of nutrition during gestation results in an increase in milk yield. The results obtained by Treacher (1971), however, suggest that an optimum body condition exists for maximum milk production and that an improvement beyond this optimum at lambing has no real benefit on subsequent milk yield. Observations at this Station (Le Roux, 1970) indicated that ewes gaining 3% and 20% in body mass during gestation had similar milk yields, whereas ewes gaining 11% in body mass during pregnancy produced ± 55% more milk than those in the other two groups. These results, however, require confirmation from larger numbers of animals.

It has been demonstrated in cattle that overfeeding of dairy heifers can give rise to reduced milk yields in the first and subsequent lactations (Swanson, 1969) and it has also been suggested (Johansson, 1962) that milk yield is positively related to growth rate and skeletal size, but negatively correlated with muscular development. This paper describes the effect of different mass gains during gestation on the subsequent milk yield of Dorper-type ewes.

Procedure

Experimental animals

The experimental animals were three- and four-year-old Dorper-type ewes. All ewes reared a lamb to weaning the previous season and were dry for two months when the experiment commenced at the time of mating.

Treatment of experimental animals

Two comparable groups consisting of 25 ewes each were mated from the middle of May 1969 until the end of June 1969. All ewes were hand mated and the date recorded. They were herded as one flock on veld grazing by day and kraaled at night to prevent losses due to theft and predators. The necessary precautions against disease and parasites were taken. All sheep were weighed at weekly intervals at 06h30, after being starved overnight.

No supplements were fed until the 1st September when ewes in Group A were fed the equivalent of 70,0 g

and those in Group B the equivalent of 154,4 g of digestible protein each per day in the form of cottonseed cake meal. The concentrate was fed in the evenings and no attempt was made to control the mass gain of a particular group or to control the mass gain of any individual. The feed was withdrawn on the 8th November by which time sufficient green grass was available.

Determination of milk yield

Milk yields were recorded from 18 ewes in Group A and 22 ewes in Group B. These ewes gave birth to single lambs within 18 days of the first birth. The remaining ewes either had twins or lambed too late and were therefore, not considered. Milk production was initially determined four days *post partum* and thereafter on two days each week for 21 weeks. On each of these days lambs were allowed to suckle their dams at 06h00, 12h00, and at 16h30. Lambs were separated from their dams approximately 13 hrs prior to the first suckling on each recording day. The lamb was weighed immediately before and after each suckling, and the differences in mass were taken as the measure of milk production. During the day of test the lambs were herded separately from their dams.

Analysis of data

Because the feeding of the protein-rich concentrate commenced at a fixed date, the feeding period was not constant for all ewes. It was therefore decided to calculate the mass gained during the gestation period as a percentage of the mass at mating. The curvilinear regression was calculated using the method described by Snedecor (1966).

Results and Discussion

The differences in the length of the feeding period from the time feeding commenced until the time the ewe lambed resulted in different mass gains by ewes within each group. Irrespective of treatment, those ewes which lambed early gained less than those ewes which lambed at a later date. Ewes fed ± 154,4 g cottonseed cake meal per day gained more body mass than those fed ± 70,0 per day. When the gain during the gestation period is expressed as a percentage of the mass at mating, ewes in Groups A and B gained 6,56 and 14,45% respectively (Table 1).

The National Research Council's (1964) allowance for a 50 kg ewe in the last six weeks of gestation is 84g per day of digestible protein. Ewes in Group A of this experiment received 70 g per day digestible protein as a supplement to veld grazing, and made slight body mass gains. Ewes in Group B receiving ± 154 g per day digestible protein plus veld grazing made substantial body mass gains. These observations substantiate the fact that natural pastures are nearly devoid of crude protein from September until the onset of rain (Plowes, 1957), and also show that ewes are able to gain mass where there is adequate roughage when sufficient digestible protein is supplemented (Group B).

Milk yield

The milk yields recorded are rather low when compared with those of other breeds (Barnicoat, Murray, Roberts & Wilson, 1957; Forbes, 1969; Munro, 1955; and Peart, 1968). No information is available on the milk yield of Dorper ewes on free range conditions. It may also be argued that during the lactation period insufficient nutrients were available for maintenance and milk production as the ewes, shortly after lambing, depended solely on the natural grazing for their nutrient requirements. During the rainy season the grazing is of good quality (Plowes, 1957) and the feeding of any additional energy-rich feeds as a supplement to the natural grazing may be unnecessary and also uneconomical.

Table 1

The average mass at mating and lambing, average daily amount of protein fed per ewe, percentage mass gained during the gestation period, and total milk yield of Dorper-type ewes

	Average mass at mating (kg)	Average mass at lambing (kg)	Digestible protein derived from cottonseed cake meal (g)	Average percentage mass gained during gestation period	Average milk yield (kg)
Group A	50,59 ±0,694	53,90 ±0,795	70,0	6,56 ± 0,622	65,11 ±3,439
Group B	50,30 ±0,541	57,57 ±1,061	154,4	14,45 ± 1,281	71,47 ±3,228

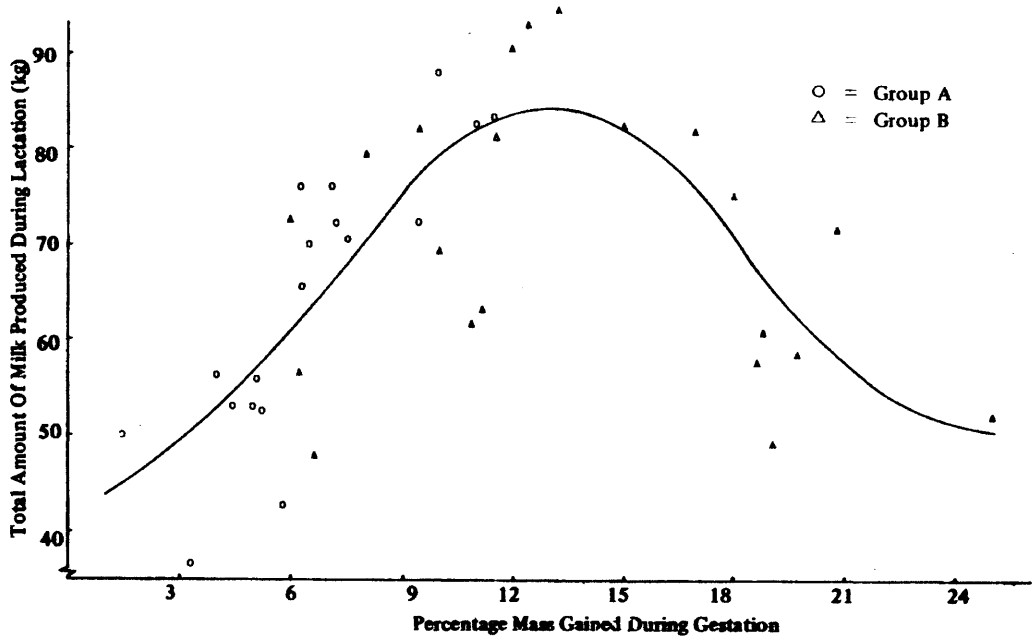

Fig. 1: *The influence of prenatal mass gain on the Milk Production of ewes*

The results in Table 1 suggest that mass gains of 14–15% during the gestation period had only a limited benefit because of the small increase of 6 kg in the milk yield over ewes which only gained 6–7%.

In Figure 1 the milk production, as influenced by the mass gained during gestation, is given and is described by the model:

$$Y = 45{,}66 - 3{,}0473\,x + 1{,}5363\,x^2 - 0{,}1116\,x^3 + 0{,}00222\,x^4 \quad (R^2 = 52{,}8\%)$$
$$(\pm 17{,}93)\ (\pm 7{,}3721)\ (\pm 1{,}004)\ (\pm 0{,}0530)\ (\pm 0{,}0094)$$

where Y = milk production of the ewe over 21 weeks, and
x = percentage mass gained during the gestation period.

(The standard errors for each of the estimated coefficients in the model are shown in bracketted form below the coefficients).

It is of considerable significance that nearly 53% of the variation in milk yield of ewes can be accounted for by mass gains during lactation. Small increases in the percentage mass gained during gestation is accompanied by significant increases in milk yield in the subsequent lactation. Results from earlier work (Le Roux, 1970) have demonstrated that when ewes are fed a protein-rich concentrate during the latter half of the gestation period, the survival rate of the lambs from birth to weaning were increased by as much as 28% over those lambs born to ewes which received no supplements. It is a well known fact that ewes in poor condition at lambing are in the majority of instances unable to suckle their lambs because of lack of milk. The lambs are also born weaklings and these two factors adversely affect survival. It is, therefore, evident that the conditions of a ewe at lambing has a significant influence on her milk production and the survival of the lamb.

It may be argued that ewes which had the better gains also produced the stronger lambs at birth, and that these lambs in turn were able to obtain more milk from their dams initially. It is, however, doubtful if this advantage will last for any length of time because of the rapid gains lambs make during the first few weeks of their life.

The influence of an increase in percentage mass gained during gestation on the subsequent milk yield is not linear and the beneficial effect appears to be arrested when the percentage mass gained exceeds 12%. When ewes gained more than 15% in mass their milk yields were reduced. Ewes which were grossly overfat at lambing produced roughly at the same level as those which showed only small mass gains during the gestation period.

Few studies have been designed to investigate the effect of overfeeding of sheep on the subsequent milk production, but Morrison (1957) specifically stresses the point that ewes must not be in too fat a condition at lambing. Treacher (1971) in a carefully controlled experiment fed ewes to gain either 6 or 16% from the 14th week of gestation to lambing but the small increase in milk production was not significant. His results also suggest a suppression in milk yield when ewes are overfed. There are indications, therefore, that an optimum body condition at lambing exists at which point milk yield will be at a maximum. From these results it would

appear that ewes on free range conditions should gain approximately 10 to 15% in mass from mating to lambing to ensure maximum milk yield.

The reason for the reduction in the milk yield of sheep when they are over-fed is not clear. Work with identical twin heifers (Swanson, 1957) showed that with overfeeding fat deposition interferes with the lobular development of the udder and that this interference is permanent, resulting in poor milk yields in subsequent lactations. In dairy cattle, under development does not reach its maximum until the fourth lactation (Johansson, 1962) and the same may be true for sheep. The ewes in this trial were either in their second or third lactation and it is possible that fat deposition took place in the udders of the over-fed ewes.

Turner, Yamamota & Ruppert (1957) have shown that when thyroxine is secreted at less than optimal rate, the milk secretion will be depressed below the normal potential of the cows. Thyroxine acts as a metabolic stimulant and by administration of this hormone to lactating cows it is possible to increase their milk yield temporarily. A relatively high intensity of the secretion of the thyroid seems to be associated with rapid skeletal growth and high milk yield but seems to be antagonistic to beefy type and high meat quality. Evidence can also be advanced to show that the correlation between fleshiness (muscle and fat) and milking ability is negative (Johansson, 1962).

It is possible that ewes which fatten easily have a low thyroxine production with a subsequent adverse effect on milk yield but it appears to be more likely that a combination of both a reduced level of thyroxine production and a "fatty" udder could be responsible for the poor milk in over-fat ewes. This matter does, however, require further investigation.

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