YIELD AND COMPOSITION OF MILK AND THEIR RELATIONSHIP WITH PREWEANING LAMB GROWTH IN YANKASA EWES AND THEIR CROSSES WITH SIRES OF SUFFOLK X WENSELEYDALE BREED

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(Received 6 June 1990; accepted 10 October 1990)

ABSTRACT

Milk production in Yankasa ewes and their crosses with sires of Suffolk/Wensleydale breed was measured at weekly intervals following oxytocin administration. The influence of age and breed of dam on yield and composition were investigated and the relationships between milk yield, milk composition and lamb weight gain were determined. Daily milk production in Yankasa and crossbred ewes averaged 348.1 and 505.7g respectively. The mean fat and protein content over the entire lactation were 5.86 and 5.07% for Yankasa and 6.19 and 4.96% for crossbreds, respectively. Crossbred ewes produced significantly higher (P<0.01) milk than Yankasa at all stages of lactation. Age of the ewe had significant effect (P<0.05) on total milk yield but not on fat or protein content. The correlations between lamb weight gain and milk yield at various stages of lactation ranged from 0.51 to 0.66 and 0.62 to 0.71, respectively, for Yankasa and crossbred lambs. Sheep milking can make a significant contribution to rural daily production in Nigeria.

Keywords: milk yield, milk composition, lamb growth, Yankasa, suffolk x Wensleydale crosses.

However, the recent import restrictions and the reduction of government subsidy on imported dairy products has led to increased interest in sheep and goat milking to augment the domestic milk supply from cattle.

The Yankasa is the most widely distributed and most numerous breed of sheep in Nigeria. The characteristics and distribution of the Yankasa breed have been described by Adu and Ngere (1979). They also reported that the preweaning growth rate of the Yankasa is slow with the result that the lambs are weaned at comparatively lighter weights. The poor preweaning performance of the Yankasa may partly be due to inadequate milk supply in the dam.

The objectives of this study were (1) to determine the milk yield and composition of the Yankasa ewes and their crosses with sires of Suffolk/Wensleydale breed and (2) to determine the relationship between milk production of the ewes and preweaning weight gain of their lambs.

MATERIALS AND METHODS

Animals and Management

The sheep used in the study were maintained at the National Animal Production Research Institute, Shika, Zaria, located in Northern Nigeria. Animals were grazed on improved pasture during the wet season (May-September) while in the dry season (October - April) they were fed hay and concentrates made up of maize, Cottonseed cake and wheat offals.

Forty seven 3 - 4 years old ewes consisting of 25 Yankasa and 22 Yankasa X Suffolk/Wensleydale crosses were used. The crossbred ewes included in this study were 50% of Yankasa inheritance and 25% each of imported Suffolk and Wensleydale breed. All the ewes were nursing single lambs.

Lambing commenced in late November and continued until March. Within 12 hours of parturition, each ewe with her lamb were placed in a separated pen. The ewes were fed mixed hay

YIELD AND COMPOSITION OF MILK

(Digitaria smutisi predominating) as libitum. In addition, each animal received 1/2 - 1/4 kg per day of concentrate mixture consisting of 60% maize, 20% cottonseed cake and 20% wheat offals. Mineralized salt block and fresh water were also made freely available to the animals. The lambs received similar food (as libitum).

Milking procedure

Milk yield was measured by hand milking following intrajugular injection of oxytocin. McCance (1959), Coombe et al, (1960) and Doney et al found this method to be a more accurate estimate of milk production in sheep than the lamb - suckling weight differential method which has been widely used in the past to obtain yield estimate.

Milk yield was measured at weekly intervals for 12 weeks. During milking, each ewe was injected in the jugular vein with 5 I.U. of oxytocin to stimulate milk "let down". She was then rapidly hand milked by two milkers until the udder was empty. This single dose of 5 I.U. of oxytocin was found to be adequate in emptying the udder of the sheep as judged by milk flow and udder palpation. After this initial milking the ewe was held away from her lamb for a period of 4-6 hours, followed by a second injection and milking. This time interval was agreement with the observation of McCance (1959) that milk synthesis over an interval of 4 to 6 hours after complete removal of milk from the udder was a reliable reflection of milk synthesis throughout the day. At the second milking, milk obtained from each animal was weighed and 25 ml sample was collected and frozen for analysis. The total yield for a 24 hour period was calculated in proportion to the time interval between initial and final milkings. Lamb weights were recorded at birth and on the days that milking was done.

Milk fat was determined by the Gerber method (British Standard 696, part II, 1969) and milk protein by the Kjeldahl method (A.O.A.C. 1975).

Statistical Analysis

The effects of age and breed of dam on cumulative milk yields to various stages of lactation and on fat and protein percentages were determined by least squares procedures (Hargcve 1960).

The relationships between part and whole lactation between milk yield, protein and fat percentages and between lamb weight gain and milk yield were determined by simple regression analysis. Fat and protein percentages were also added as independent variables to the model considering weight gain and milk yield.

RESULT AND DISCUSSION

The mean lactation curves calculated from the weekly milk yield data are illustrated in figure 1. For Yankasa ewes, daily milk yield increased to a maximum of 554g at approximately 2 weeks postpartum and then decreased steadily to the

<table>
<thead>
<tr>
<th>TABLE 1: REGRESSION EQUATION BETWEEN PART (X) AND WHOLE LACTATION (Y)</th>
<th>Breed</th>
<th>Part record</th>
<th>Regression equation</th>
<th>r*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yankasa 2</td>
<td>Y = 2.222 + 1.874X</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Y = 1.545 + 1.405X</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossbred 2</td>
<td>Y = 2.252 + 2.530X</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Y = 1.045 + 1.761X</td>
<td>0.89</td>
<td></td>
<td></td>
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</tbody>
</table>

*All significant at P < 0.01.

| TABLE 2: ANALYSIS OF VARIANCE OF AGE BREED EFFECTS ON MILK YIELD AND COMPOSITION |
| --- | --- | --- | --- | --- | --- | --- |
| Mean squares | DF | 8Milk 2 | 8Milk 4 | 8Milk 8 | 8Milk 12 | Fat % Protein % |
| Age of dam | 1 | 0.13 | 1.31 | 4.89* | 7.60* | 0.02 | 0.25 |
| Breed of dam | 1 | 2.50** 10.61** | 30.48** 41.66** | 1.28* | 0.13 |
| Error | 44 | 0.16 | 0.45 | 1.02 | 1.43 | 0.27 | 0.13 |
| R² | 0.27 | 0.38 | 0.44 | 0.46 | 0.10 | 0.06 |

**, **P < 0.05 and P < 0.01, respectively

^Cumulative milk yield 2, 4, 8, or 12 weeks.
TABLE 3: PHENOTYPIC CORRELATIONS BETWEEN YIELD, FAT AND PROTEIN CONTENT

<table>
<thead>
<tr>
<th>Breed</th>
<th>Milk Yield</th>
<th>Fat %</th>
<th>Protein %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yankasa</td>
<td>0.212</td>
<td>0.430*</td>
<td>-0.321</td>
</tr>
<tr>
<td>Crossbred</td>
<td>-0.047</td>
<td>0.173</td>
<td>0.003</td>
</tr>
</tbody>
</table>

12th week when production averaged only 224g/day. Similarly milk production of the crossbred ewes increased to a maximum of 813g at about 2 weeks postpartum and then declined gradually to 295g/day at the end of lactation. The milk yield values observed in this study are lower than the average lactation. The milk yield values observed in this study are lower than the average yield estimate of 603/day reported for West African ewes maintained in an intensive production system (Comellas, 1981).

The possibility of estimating total milk yield to 12 weeks of lactation from past production was investigated. Correlation coefficients were high for both Yankasa and crossbred ewes (Table 1) but the 4 weeks yield was a better predictor of total milk production than 2 weeks yield.

The influence of age and breed of the ewe on cumulative milk yield to 2, 4, 8 and 12 weeks of lactation are shown in Table 2. Age of the ewe did not influence 2 weeks and 4 weeks milk yields. However, there was significant evidence (P < 0.05) for age of the ewe effect on 6 weeks and 12 weeks yields. The reports on the effect of age of ewe on milk yield are not consistent. Owen (1957) and Torres Hernandez and Hohenboken (1979) found little difference in milk yield between 3 and 4 year old ewes. Barnicoat et al (1949) and Corbett (1979) found that age was an important factor in milk yield. Breed of the ewe had significant effect on milk yield. The crossbred ewes produced more milk (P < 0.01) than Yankasa ewes at all stages of lactation. The coefficient of determination indicated that age and breed of the ewe accounted for 27-44% of the variation in milk yield.

The mean fat and protein contents over the entire lactation respectively were 5.86 and 5.07 for Yankasa and 6.19 and 4.96 for crossbred ewes. For both breeds percent fat declined in early lactation to minimum values between weeks 4 and 5 and then rose steadily to maximum values in weeks 11 and 12 (Figure 2). Protein % decreased rapidly to minimum values between 2nd and 3rd weeks of lactation and then increased gradually reaching pewak values at the end of lactation. Corbett (1968) and Torres-Hernandez (1979) observed highest values of fat and protein at the beginning and end of lactation.

Fat and protein percentages were not influenced by age of the ewe (Table 2) but there was evidence of breed effect on percent fat (P < 0.05). Crossbred ewes had higher percentage fat than the Yankasa. There was no significant difference (P 0.05) among breeds for percent protein. Slen et al, (1963) reported no significant difference among breeds for either percent fat or protein and concluded that the quantity of milk was the major factor influencing the weight gain of the lambs.

The relationships between milk yield, fat and protein percentages are shown in Table 3. In crossbred ewes the correlation between milk yield and percent fat was negative as in dairy cattle but smaller in magnitude. Percent fat was positively correlated with milk yield in Yankasa. Percent protein followed a reverse trend in crossbred and Yankasa ewes. The correlations between percents fat and protein was positive in both breeds.

The mean live weight of lambs at birth and cumulative lamb weight at various stages of lactation are shown in Table 4. The mean live weight of lambs at birth and cumulative lamb weight at various stages of lactation are shown in Table 4.
Figure 1. Daily milk yield during the course of lactation

- Yankasa ewes;
- Crossbred ewes

Figure 2. Fat and protein percentages during the course of lactation.

- Yankasa fat %
- Crossbred fat %
- Yankasa protein %
- Crossbred protein %
TABLE 6: CORRELATION COEFFICIENTS BETWEEN LAMB WEIGHT GAIN AT 12 WEEKS AND TOTAL MILK YIELD AND MILK COMPOSITION (%)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Correlation Coefficient*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield</td>
<td>Yankasa 0.66, Crossbred 0.71</td>
</tr>
<tr>
<td>Milk yield + Fat %</td>
<td>Yankasa 0.68, Crossbred 0.71</td>
</tr>
<tr>
<td>Milk yield + Protein %</td>
<td>Yankasa 0.57, Crossbred 0.72</td>
</tr>
<tr>
<td>Milk yield + Fat + protein %</td>
<td>Yankasa 0.68, Crossbred 0.72</td>
</tr>
</tbody>
</table>

* All significant at P < 0.01.

The relationship between lamb milk production and preweaning lamb growth rate was investigated separately for Yankasa and crossbred groups. Relationships were determined at different stages of lactation between lamb weight gain and cumulative milk yield (Table 5). In both breeds, correlation coefficients were large and significant (P < .01) at all stages of lactation. Thus, in Yankasa and crossbred ewes, milk production of the dam accounted for 44 and 50% respectively, of the variation in lamb weight gain at 12 weeks. The high correlations obtained between lamb weight gain and milk yield during late lactations docs correlations obtained between lamb weight gain and milk yield during late lactation does not agree with the results of Torres-Hernandez and Hohenboken (1980) and Coombe et al. (1960), where for both singles and twins, the highest correlations were observed in early lactation. However, high and positive correlation in studies by Peart (1968) and Owen (1957).

Analysis were also conducted to determine whether milk composition added information for predicting lamb weight gain to that milk composition added information for predicting lamb weight gain to that from milk production alone. The correlation coefficients when protein and fat percentages were added to regression model that included only milk yield are shown separately for Yankasa and crossbred ewes (Table 6). The addition of protein had little effect on the precision in Yankasa (.66 vs .67) and in crossbreds (.71 vs .72). Inclusion of fat added little value to the correlation in Yankasa lambs (.66 vs .68) but not in crossbred lambs (.71 for both models). Thus, for both Yankasa and crossbred lambs, addition of fat of protein or both was no more effective in explaining variation in lamb weight gain than milk production alone. In goats, addition of fat resulted in an increase in the coefficient from .57 to .76 in twin kids but not in singles (Ehoche and Buvanendran, 1983).

In conclusion the results of this study show that milk yields of West African Yankasa ewes are lower than those of Yankasa X Suffolk/Wensleydale ewes. Stage of lactation is an important variable for milk yield, and percent fat and protein. Milk production of the ewe is a major factor influencing preweaning lamb weight gain. Milk fat and protein are not important variables affecting lamb weight gain. In view of their large population, sheep milking can make a significant contribution to rural dairy production in Nigeria.

ACKNOWLEDGEMENTS

The authors wish to thank the Director of National Animal Production Research Institute, Shika, Zaria for facilities to carry out this study. The helpful advice of Prof. V. Buvanendran is gratefully acknowledged.

REFERENCES


