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# Effect of niacin supplementation on milk production and composition and lamb performance of sheep ewes

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## ABSTRACT

A group of 10 pregnant Awassi ewes was used in this study in order to evaluate the effect of niacin supplementation on milk yield, milk composition and lamb performance. The animals were divided into two equal groups. Ewes of the first group (experimental group) were given the niacin diet supplement (100ppm/head/day), where niacin was hand-mixed into the concentrate and supplementation was given eight weeks after the adjustment period (two weeks). Animals of the second group served as the control group and were fed niacin-free diet. The feeding system was individually and the group diets were offered in two equal proportions at 06H30 and at 18H30 in sufficient amounts (ad-libitum). The results showed that ewes receiving niacin diet supplement produced more milk, consumed more food, and their lambs were slightly heavy than those of the control group (especially in the first week of treatment) There was no difference in the milk fat and milk protein percentage for either supplemented niacin group or control group. In consequence, the addition of crystalline niacin to the diet of Awassi ewes had a little effect on milk yield and lamb performance, but not on milk composition (fat and protein).



## KEYWORDS

Niacin;
Awassi sheep;
Body weigh;
Milk yield;
Milk composition.

## INTRODUCTION

Since almost five decades, niacin (3-pyridine carboxylic acid), was known and recommended by several research workers and rumen nutritionists as a very important micronutrient for lactating animals, with acceptable results, not only on the level of milk production, but also on body performance.

Numerous studies have shown that the positive metabolic effects of niacin on cows have resulted in an increased milk yield during early lactation[1-5], increased milk protein percentage[1,6-8], and an increased fat per-

TABLE 1 : Ingredient composition of first diet (for late gestation and early lactation)

| Ingredients | % |
|---|---|
| Barley | 63.38 |
| Wheat | 35.20 |
| Vitamin premix | 0.28 |
| Mineral premix | 0.14 |
| Salt | 1.0 |

centage[1,9]. Supplementary niacin increased also microbial protein synthesis in vitro and in vivo[10].

Niacin offers also favorable physiological responses for other animals like Egyptian Buffalo[11] where niacin supplementation modified some metabolic processes, and enhanced food consumption and energy mobilization which may be reflected in an improvement in the productive and the reproductive performance. It increases body and egg weights in Turkey hens[12], and improves the weight gain in swine[13].

Kollenkirchen et al., 1992[14], demonstrated that the feeding of diets with different nicotinic acid content affected apparent niacin synthesis in the rumen of sheep, and the nicotinic acid concentration in strained rumen liquor was positively related with niacin content on the diet.

Campbel et al. 1993[15], have maintained also, that the ruminal and duodenal concentration of nicotinic acid increased with niacin supplementation for lactating dairy cows.

In this study, niacin was given to Awassi ewes in late gestation, because during the 4th to 6th weeks of gestation, ewes need more energy to meet increased nutrient demands for fetal growth and development of the potential for high milk production[16], and early lactation. The objectives of this research were to evaluate the effect of niacin on milk yield, milk composition and lamb performance of Awassi ewes.

## MATERIALS AND METHODS

### Experimental animals and diet

From a flock of 157 animals, 10 pregnant Awassi ewes aged 1.5-2 years old, with an average weight of 47.98 kg were used in this study.

The experiment was carried out at the Patalya Farm, Başkent University, kizilcahamam, Ankara, Turkey. The farm is geographically, located at 40.5N and 32.5W, 1285m above sea level. The average climate is cold and humid, with an average annual temperature of 10.03°C, and with an average annual snowfall of 100kg/m$^2$.

TABLE 2 : Ingredient composition of second diet (for late lactation)

| Ingredients | % |
|---|---|
| Barley | 20 |
| Wheat | 17 |
| Corn | 20 |
| Sunflower | 27 |
| Oats | 13.5 |
| Dicalcium phosphate | 1.5 |
| Vitamin premix | 0.3 |
| Mineral premix | 0.2 |
| Salt | 0.5 |

During an experimental period of 12 months, the animals were assigned two treatment periods; adjustment and experimental period. During the adjustment period, all ewes were fed niacin free diet for two weeks, and then they were divided into two equal groups of five ewes each for the experimental period.

The first group was given the diet with niacin (100ppm/head/day) for eight weeks, whereas the second group served as the control group, and was given niacin free diet. The niacin manufacturer was Pfizer, Turkey.

The animals were housed indoors in especially constructed stables made of cement, wood and brick with a 4m high roof, and were normally fed: straw and clover mixed with the concentrate diets shown in TABLE 1 and 2 (N.B.: Each diet contain: % 85 of diet + % 15 clover).

The group diets were offered in divided equal proportions at 06H30 and at 18H30 with sufficient amounts (ad-libitum intake). In addition, all components of the diet were ground and mixed to facilitate feeding.

The feeding was available from one diet to the other diet, while fresh water was available all the time. Feed refuse was removed before giving a new diet on daily basis.

### Milk measurements and sampling

For each ewe, we took two consecutive milk samples at three time intervals (5 and 6th day, 15 and 16th day and 30 and 31st day) for analytical purposes.

TABLE 3 : Milk average (Liters) of experimental group

| Ewe umber | Daily milk average(L) | Total(L) (49days) |
|---|---|---|
| 4 | 1.62 | 79.42 |
| 28 | 1.50 | 73.56 |
| 29 | 1.49 | 72.87 |
| 31 | 2.62 | 128.03 |
| 33 | 1.83 | 89.75 |

TABLE 4 : Milk average (Liters) of control group

| Ewe number | Daily milk average(L) | Total(L) (49days) |
|---|---|---|
| 14 | 1.54 | 75.57 |
| 19 | 1.36 | 66.83 |
| 35 | 1.89 | 91.00 |
| 41 | 1.47 | 71.81 |
| 42 | 1.34 | 65.83 |

TABLE 5 : Milk yield (Liters) during a lactation period of 49 days

| Group | minimum | maximum | $\overline{X} \pm$ Sd |
|---|---|---|---|
| Experimental group | 72.88 | 128.03 | 88.73 ± 22.99 |
| Control group | 65.84 | 91.00 | 74.21 ± 10.17 |

The first milk samples were taken five days after birth, i.e. after the colostrums period. The second samples were taken after fifteen days, and the last after thirty days of lamb birth. The samples were stored at -4°C until analysis for fat and protein using Gerhardt Units.

Milk yield estimation started just after one month after the lamb birth, and was carried out daily until the seventh week, a total period of 49 days, and ewes were hand-milked twice daily; in the morning at 07H00 and in the evening at 19H00. The lambs were separated from their mothers and were bottle-fed.

## Weight recording

The lambs were weighed after three hours of the birth and then weekly in the morning before feeding and drinking, until the 14th week after the birth. The number of lambs used per treatment was five lambs for experimental group and six lambs for control group (in this group there was a twins for ewe number 35).

## Statistical analysis

Milk yield estimation and milk composition as well as protein and fat percentage, and lambs performance, were tested by Mann-Withney U statistics test .and the effects were considered significantly different at P< 0.05.

# RESULTS

## Milk yield

The results illustrated in TABLE 3, 4 and 5 show that the average daily milk yield for experimental group was: 1.81 ± 0.45, and for control group was: 1.52 ± 0.21 during a lactation period of 49 days. The maximum daily milk yield average of experimental group was: 2.61 litters and 1.81 litters for the control group.

The morning milk yield was higher than the evening milk, and this was found for both the control and supplemented group. The milk yield declined with lactation period, after one month of the birth.

## Milk composition

## According to the results showed in tables 6 and 7 we concluded that

The statistics test for the experimental group show that there was no differences between ewes for milk protein percentage ($x^2 = 3.313$; sd = 5; $P = 0.652 > \alpha = 0.05$) and there was also no differences for milk fat percentage ($x^2 = 6.765$; sd = 5; $P = 0.24 > \alpha$).

The statistics tests for the control group show also that there was no differences in milk protein, between ewes ($x^2 = 4.006$; sd = 5; $P = 0.549 > \alpha$). And there was no differences for milk fat percentage ($x^2 = 7.778$; sd = 5; $P = 0.169 > \alpha$).

There was no differences in milk protein percentage, according to the date of milk sampling, for each group ($P_{1-2} = 0.463 > \alpha$; $P_{1-3} = 1.00 > \alpha$; $P_{1-4} = 1.00 > \alpha$; $P_{1-5} = 0.295 > \alpha$; $P_{1-6} = 0.916 > \alpha$).

The statistics show that there was only a difference in milk fat percentage at the 5th and 6th day after the birth ($P_{1-2} = 0.027 < \alpha$), but after there was no differences ($P_{1-3} = 0.401 > \alpha$; $P_{1-4} = 0.586 > \alpha$; P1-5 = $0.917 > \alpha$; $P_{1-6} = 0.0.075 > \alpha$). And this for treatment and control group.

## Weight

During a period of 14 weeks (after the birth), the lambs of the supplemented group were slightly heavy than those of control group (TABLE 8). The bootstrap hypothesis testing and confidence intervals showed that the first week is significant. then we can say that treatment has influence only for the first week(P =0.05 >α).But after the first week, the results show that there

TABLE 6 : Protein %

| Date of sampling | Experimental group | Control group |
|---|---|---|
| Day after the birth | $\overline{X} \pm S$ | $\overline{X} \pm S$ |
| -5th | 5.42±0.51 | 5.36±0.44 |
| -6th | 5.06±0.37 | 5.20±0.59 |
| -15th | 5.24±0.50 | 4.98±0.75 |
| -16th | 5.44±0.47 | 5.22±0.44 |
| -30th | 5.22±0.40 | 5.64±0.58 |
| -31st | 5.22±0.58 | 5.18±0.47 |

TABLE 7 : Fat %

| Date of sampling | Experimental group | Control group |
|---|---|---|
| Day after the birth | $\overline{X} \pm S$ | $\overline{X} \pm S$ |
| -5th | 6.7±0.55 | 6.78±0.64 |
| -6th | 6.5±1.02 | 5.20±0.59 |
| -15th | 5.76±0.72 | 6.28±0.77 |
| -16th | 6.08±0.56 | 6.12±1.13 |
| -30th | 5.8±1.09 | 6.18±1.06 |
| -31st | 6.3±0.89 | 5.78±1.03 |

was no difference between groups. (P (after thirty days of the birth) = 0.347> $\alpha$).

## DISCUSSION

Milk yield estimation was slightly higher for ewes supplemented with niacin; and the difference was not significant (P = 0.175 > $\alpha$ = 0.05). The increase of milk yield caused by niacin supplementation is possibly due to the role of niacin in the rumen, i.e. the supplementation affected the apparent niacin synthesis in the rumen sheep[14].

The statistics tests show also that milk protein was not affected by the supplementation of niacin.

Milk fat percentage was slightly higher for each group at the beginning of the study, and there was no statistically significant differences among the treated and control group for the percentage of milk fat, and milk protein.

Lamb body weight performance was slightly affected by the source of niacin in experiment reported. The lambs of the supplemented group were slightly heavy than those of control group at birth. However, there was no difference between groups after 30 days after the birth and the difference was not significant.

It appears that more detailed test will be carried at the same breed "Awassi", and at the Moroccan breed "SARDI" (our researches are on the way of realization).

## CONCLUSION

During this study, the results showed that the milk yield was numerically higher for ewes when supplemented with niacin the difference was significant at the first week (P = 0.05). Milk fat proportion was higher during the first week of sampling; while after there was

TABLE 8 : lambs weight average at birth and at the 14th week after the birth (kg), Where: $\overline{X}$ is the average and S is the Standard error

| Date of weight | Experimental group | Control group |
|---|---|---|
| | $\overline{X} \pm S$ | $\overline{X} \pm S$ |
| After 3 hours after birth | 4.42± 0.52 | 4.00± 0.46 |
| After 14 weeks | 29.98± 3.78 | 28.86 ±3.72 |

no differences between groups. For milk protein there was also no difference between groups.

It appeared that feeding diets with niacin affected slightly milk yield and lamb performance performance, but had no effect on milk composition.

At last, our results show that, the Awassi breed give birth to weighty lambs, and produce adequate milk yield with milk components of good quality which can be utilized in the cheese; milk and yoghurt making industries (our experience with Awassi ewes milk yielded a good cheese product with good taste). An increase in the economic return of the current sheep production systems may be achieved by breeding Awassi ewes in Morocco for milk production, wool and meat, and sheep producers may adopt new production systems for the Awassi breed such as the fattening of Awassi lambs.

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