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The Effect of Urea-Treated Barley Straw on the Reproductive Performance and Post-Partum Ovarian Activity of Libyan Barbary Sheep

Research Article

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ABSTRACT

Forty ewes (3-6 years of age, average weight 41.2 kg) were randomly chosen from the flock of the sheep experiment station of Tripoli University. Ewes were divided into two groups, control group (C) received untreated barley straw and treatment group (T) received barley straw treated with 10% urea solution applied as 40% (V/W). Barley straw was sprayed with molasses when fed to animals. Both groups received commercial concentrate according to physiological state. Experiment started by introducing the rams in June. Average concentrations of progesterone did not significantly differ and were 2.96 ng/mL and 2.38 ng/mL during 9 weeks for T and C groups, respectively. In T group, 53.3% of ewes were fertilized during the early period (two weeks after the introduction of the rams) and maintained levels of 3.5 ng/mL of progesterone. However, no ewes of C group were fertilized in this period. Conception rate, prolificacy and viability were 83.3%, 1.07 lamb/ewe, 93.75% and 78.94%, 1.13 lamb/ewe, 88.23% for T and C groups, respectively. These differences were not significant. Progesterone concentrations were below of 0.07 ng/mL during 9 weeks post-partum in both groups. Cereal straws can be treated with urea without adverse effects on reproductive performance.

KEY WORDS conception rate, ovarian activity, progesterone, urea.

INTRODUCTION

Appropriate nutritional management is essential for successful reproduction (Chagas *et al.* 2007). There is a shortage of forage in arid and semi arid environments and cereal straws represent the basic diet of cattle and sheep for long period of year. Urea treatment is a method in which straw is treated by ammonia released from urea, and it is technically feasible method to improve the nutritive value of straws (Schiere and Nell, 1993). Urea treatment was significantly improved the voluntary intake and apparent digestibility of organic matter, crude fibre and hemicellulose (Cloete *et al.* 1983). Cereal straws can be treated with urea and incorporated in ewe's diet without negative effects on growth parameters of their lambs (Akraim *et al.* 2009). High roughage diets can be supplemented with urea without reducing reproductive performance (Thompson *et al.* 1973). Using urea-treated rice straw has been significantly improved reproductive performance of dairy cattle in Vietnam (Doan *et al.* 1999).

However, high dietary protein leads to elevated systemic concentrations of ammonia and urea, which have been associated with reduced fertility in cattle (Canfield *et al.* 1990). Excess urea in ewes diet (30g vs. 15 g/kg^{-} feed) ele-

vates urea and ammonia in plasma and in uterus, with an associated increase in embryo mortality (McEvoy *et al.* 1997). Santos (2001) suggested that toxic compounds of nitrogen metabolism (ammonia or urea) may affect uterine environment and impair sperm, ova, or early embryo survival, or reduced plasma progesterone concentration. Ferguson *et al.* (1993) indicated that conception rate in dairy cattle decreases with serum urea N of > 14.9 mg/dL. The use of urea might retard puberty age and fertility in young growing ram lambs (Abi Saab *et al.* 2003). In many cases, negative effects were mentioned only when urea was applied in excess. Since that the treatment of straw with urea may find wide application in small holder sector in Libya, the aim of this experiment was to investigate the effect of dietary urea-treated barley straw on reproductive performance of Libyan Barbary sheep.

MATERIALS AND METHODS

This study was performed in the sheep experiment station of the Faculty of Agriculture of Tripoli University. Forty Barbary ewes (3-6 years, average weight of 41.2 kg) were randomly chosen from the flock. There were no reproductive problems reported in the flock. Ewes were subdivided in two groups each with 20 ewes. The study began by introducing two rams (selected on the basis on health status and physical appearance) per group in June. One ewe of control group and two of treatment group were died. The two groups received supplement of commercial concentrate according to their physiological stage, based on corn and soybean meal, and offered (*ad libitum*) barley straw (control group or C) or urea-treated barley straw (treatment group or T).

Water was offered *ad libitum*. Sheep mineral blocks were provided. Barley straw was treated with 10% urea solution applied as 40% (V/W). Chemical composition of commercial concentrate, treated and untreated straw are presented in table 1.

Table 1 Chemical composition of commercial concentrate (CC), urea-treated (UBS) and untreated (BS) barley straw

	DM (%)	CP (%)	EE (%)	CF (%)	Ash (%)
CC	89.1	18	1.8	5.1	5.1
UBS	93.5	12.9	2	30	8.7
BS	98	2.6	1	37.8	7.5

DM: dry matter; CP: crude protein; EE: ether extracts and CF: crude fibre.

Barley straw treated or untreated with urea was sprayed with molasses when fed to animals. Adaptation period of 15 days to urea was carried. Blood samples were collected from jugular veins twice weekly for 9 weeks after the introduction of rams and weekly after lambing for 60 days. Samples were centrifuged and plasma was frozen until analysis for progesterone.

Progesterone analysis was carried with RIA technique according to Assay protocol version 3.1, (1996). Conception rate (ewes lambed/total ewes), viability (lambs born live/lambs born) and prolificacy (lambs born/ewes lambed) were calculated for each group. Results of progesterone concentration were presented as means and compared with unpaired t-test. Conception rate, viability and prolificacy were analyzed by the chi-square test (Snedecor and Cochran, 1956).

RESULTS AND DISCUSSION

Progesterone concentration in T and C groups for 9 weeks after the rams introduction are presented in Figure 1.

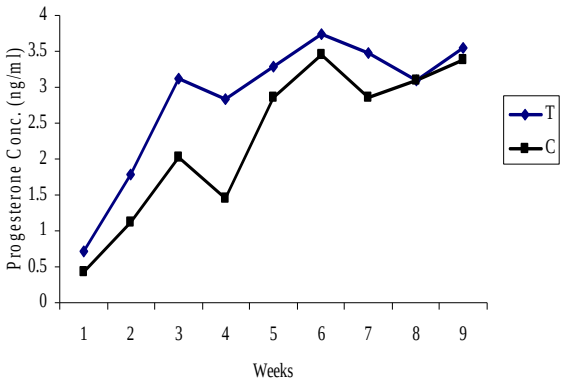

Figure 1 Progesterone concentrations in ewes fed with barley straw treated (T) or not (C) with urea, during 9 weeks after the rams introduction

During the first two weeks, progesterone concentration was below 2 ng/mL. The hormone concentration in group T increased rapidly up to 3 ng/mL in the third week and after that began to increase gradually.

However, in C group, the progesterone concentration did pass the level of 2 ng/mL only in the fifth week. These results apparently suggested that successful fertilization was occurred in T group in the first two weeks in comparison with C group. Progesterone levels in plasma were similar in ewes with single or twins during the first 50 days of gestation (2-3 ng/mL) (Stabenfeldt *et al.* 1971).

Literature data not support these results and mentioned (Thompson *et al.* 1973, in sheep with 2.1% urea; Bond *et al.* 1973, in beef cattle with 3.4% urea) that diets containing urea did not affect fertilization rate at first service. In contrary, Plasma progesterone concentration was altered in alpine goats fed urea, and the hormone levels on the 15th day after estrus were linearly reduced according to the percentage of urea in the diets (Alves *et al.* 2011).

Adaptation of the animals to urea may affect reproductive performance.

Dawuda *et al.* (2002) indicated that there was no deleterious effect on the embryos recovered 7 days after breeding when urea feeding was initiated during the previous midluteal phase, and the introduction of a similar diet 10 days later, at the time of insemination, was deleterious. In our experiment, adaptation to the urea began 15 days before the introduction of the rams.

It's not clear to conclude a positive specific effect of urea on early mating period of this experiment and additional data are needed.

Urea-treated barley straw was offered *ad libitum* and the feed intake was not measured in our experiment, so the comparison with the experiments in the literature is difficult. Treatment of barley straw with urea increased the digestible energy value of straw by up to 20% (Hadjipanayiotou, 1982).

Increased dietary energy (Dunn and Moss, 1992) increases ovulation rate in ewes, but this increase was accompanied by an increase in body weight. Conception rate, viability and prolificacy in both groups are presented in table 2.

Table 2 Conception rate, viability and prolificacy in groups of ewes fed with barley straw treated (T) or not (C) with urea

Treatment	Conception rate (%)	Prolificacy	Viability (%)
C	78.94	1.13	88.23
T	83.30	1.07	93.75

Prolificacy is low in Libyan Barbary sheep and ranged from 1.0 to 1.12/ewe (Magid *et al.* 1992). Conception rate, viability and prolificacy of ewes were not affected by the consumption of urea-treated barley straw in this study (P>0.05). Comparable results were reported on sheep (Thompson *et al.* 1973).

In dairy cattle, the intervals from calving to the onset of ovarian activity, oestrus and conception and the calving interval in urea-treated rice straw group were significantly shorter than those in the control group (Doan *et al.* 1999). Ovarian activity was monitored for 9 weeks after lambing by the plasma progesterone concentrations. The results are presented in figure 2.

Progesterone concentrations were low and still below 0.4 ng/mL during 9 weeks post-partum and there was no significant difference between the two groups (P>0.05). Lower progesterone concentration indicates the absence of corpus leutum and the estrus cycle.

Progesterone concentration levels in corpus leutum stage of estrus cycle in sheep are about 2-3 ng/mL (Stabenfeldt *et al.* 1971). Benhaj *et al.* (1990) reported the absence of ovarian activity in Libyan Barbary sheep for 60 days after lambing.

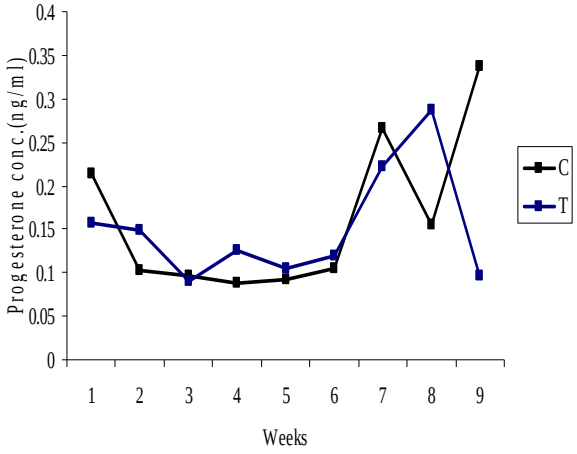

Figure 2 Post-partum progesterone concentrations in ewes fed with barley straw treated (T) or not (C) with urea

Data on the occurrence of estrus showed that ovarian function and fertility in cows fed urea were equal to that of cows fed soybean meal (Thompson *et al.* 1973).

CONCLUSION

It is difficult to conclude positive effects of urea on the early mating period under the conditions of this experiment and additional data is needed. Conception rate, viability, prolificacy and post-partum ovarian activity of ewes were not affected by the consumption of urea-treated barley straw. Post-partum progesterone concentration was not affected by the consumption of urea-treated barley straw. There was no ovarian activity in the two groups for 60 days post-partum in agreement with previous studies on Libyan Barbary sheep. Urea can be used to upgrade the nutritive value of straws at the levels mentioned in this experiment without detrimental effects on the reproductive performance of sheep.

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