# Effect of Choline Chloride Supplementations on Productive Performance of Ettawa Crossbred Goats

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**ABSTRACT:** We evaluated the effect of supplementation with choline chloride through forced drinking technique on productive performance of Ettawa Crossbred (EC) does. Choline chloride is an essential component in ruminant diet required for fat metabolism and a methyl group donor for the formation of methionine. The experiment was conducted in a randomized block design with three treatments (T0, T1 and T2) and eight replications. The trial had two successive experimental periods: during the last eight weeks of gestation and the first 12 weeks of lactation. The treatments were: T0–control, T1-supplemented with 4 g choline chloride/head/2days, and T2-supplemented with 8 g choline chloride/head/2days. Choline chloride was given to the animals through force drinking technique, after dissolving it in 60 ml drinking water. The initial body weight of does were 38.81 ± 3.66 kg. The does were penned individually, and given fresh chopped King Grass (3 to 4 kg/head/day) and concentrate (700 g/head/d) during feeding trials. Water is available ad libitum through nipple. Variables of productive performance observed were DMI, ADG, FCR and productivity of does at kidding. Results showed that supplementations of choline chloride had no significant effects on the DMI, ADG and FCR during the late gestation. However, supplementations of choline chloride at both levels significantly increased the DMI ($P<0.017$) and ADG ($P<0.003$) during the lactation. There was no difference between choline chloride levels. The productivity of does at kiddings (number of kids, an average of birth weight, total birth weight and litter size) were not affected by treatments. In conclusion, supplementations of choline chloride through forced drinking technique increased the DMI and ADG during the lactation period of EC does.

**Keywords:** Choline chloride supplementation, Ettawa Crossbred does, Productive performance

## INTRODUCTION

Choline is chemically known as P-hydroxy ethyl trimethylammonium ion (Baldi and Pinotti, 2006), an essential component in ruminant diet, required for fat metabolism and a methyl group donor for the formation of methionine (Sales *et al*., 2010). Choline or choline compounds can not entirely synthesized in the body. Therefore, it is necessary to supplement choline in the feed or drinking water, especially during the transition period. Choline can be absorbed from the lumen of the small intestine. The addition of choline chloride in feeds improved nutrient digestibility, feed efficiency, milk production, and milk quality in dairy cows (Sales *et al.,* 2010; Mohsen *et al.,* 2011) and dairy goats (Pinotti *et al.,* 2008). The choline chloride supplementation also increased conception rate and pregnancy rate in cows (Oelrichs *et al.,* 2004) and increased productive performance in goats (Savoini *et al.,* 2010).

Choline is available in market in the form of choline chloride compounds. Choline chloride is a white crystalline solid, in the form of an aqueous solution that is approximately 70-75% w/w in water. Also, there are in the choline chloride medium feed ingredients such as wheat pollard or corn cobs meal containing 60% choline chloride. Choline found in barley, corn, corn gluten meal, fish meal, soybean meal, cotton meal, and alfalfa hay; which the level of choline is less than

0.68 mg/g of dry matter and digestibility values varying from 0.80-0.84 (Sharma and Erdman, 1989). In ruminant, choline is extensively degraded in the rumen (Atkins *et al.,* 1988; Sharma and Erdman, 1988a). To improve the utilization of choline in ruminants, administration were carried out by dissolving choline chloride in water, through abomasal infusion (Sharma and Erdman, 1988a; Kerri *et al.,* 1998), duodenal infusion (Sharma and Erdman, 1988b), or supplementation with rumen-protected choline (Mohsen *et al.,* 2011). In this research, we evaluated the effect of supplementation with choline chloride through forced drinking technique on productive performance of EC does.

## MATERIALS AND METHODS

Commercial choline chloride, containing 60% choline chloride was used as a source of choline chloride. Twenty-four EC does from the second gestation period, with initial body weight of 38.84 ± 3.66 kg were used in this experiment. The experiment was conducted in a randomized block design with three treatments (T0, T1 and T2) and eight replications. The trial had two successive experimental periods: during the eight weeks of late pregnancy and the first 12 weeks of lactation. The treatments were: T0 – control, T1-supplemented with 4 g choline chloride/head/2days, and T2 supplemented with 8 g choline chloride/head/2days. Choline chloride was given through force drinking technique, after dissolving it in 60 ml drinking water. The does were penned individually, and given fresh chopped King Grass (3 to 4 kg/h/d) and concentrate (700 g/h/d) during feeding trials. The chemical composition of grass and concentrate is presented in Table 1. Water is available ad libitum through nipple. Total feed intake was measured daily, and the animals were weight every two weeks. The variables of productive performance observed were body weight (BW) changes, dry matter intake (DMI), average daily gain (ADG) of does and the productivity of does at kiddings (number of kids, an average birth weights, total birth weights and litter size). Grass and treatment diets were analysed by using AOAC methods for dry matter, crude protein, acid detergent fiber, calcium, phosphorus (AOAC, 2005) and neutral detergent fiber (AOAC, 1995). Gross energy was determined by using bomb calorimeter and the result used for total digestible nutrients (TDN) calculation (NRC, 1981).

**Table 1.** Chemical composition of grass and the concentrate diets (on DM basis)

| Variable | Grass | Level of supplementation | | |
|---|---|---|---|---|
| | | T0 (0 g) | T1 (4 g) | T2 (8 g) |
| Crude protein (%) | 10.51 | 14.49 | 14.65 | 14.45 |
| Gross energy (kcal/kg) | 3871 | 4088 | 4098 | 4070 |
| Total digestible nutrients (%) | 66.48 | 70.21 | 70.38 | 69.90 |
| Neutral detergent fiber (%) | 71.03 | 26.27 | 25.74 | 26.24 |
| Acid detergent fiber (%) | 49.35 | 12.82 | 12.79 | 13.15 |
| Calcium (%) | 0.26 | 2.72 | 2.65 | 2.60 |
| Phosphorus (%) | 0.18 | 0.55 | 0.54 | 0.55 |

Data were evaluated statistically by a standard analysis of variance (SAS 2002). If there was a significant difference between treatments, the difference then was compared using Duncan's Multiple Range Test.

## RESULTS AND DISCUSSION

Results showed that the supplementations of choline chloride did not affect the DMI, ADG and FCR values during the last eight weeks of gestation. The supplementation also increased DMI and ADG (P<0.05) during the first 12 weeks lactation period (Table 2).

**Table 2.** Body weight, DMI, ADG and FCR performance of goats during trial

| Variables | Level of supplementation | | | SEM | P-value |
|---|---|---|---|---|---|
| | T0 (0 g) | T1 (4 g) | T2 (8 g) | | |
| Gestation period: | | | | | |
| Initial body weight (kg) | 38.88 | 38.75 | 38.81 | 3.81 | 0.998 |
| Body weight pre-parturition (kg) | 45.38 | 45.25 | 44.83 | 4.02 | 0.958 |
| Dry matter intake (g/d) | 1177 | 1248 | 1187 | 67.47 | 0.095 |
| Average daily gain during late pregnancy (g) | 116.07 | 119.07 | 107.14 | 33.18 | 0.826 |
| Feed conversion ratio | 10.14 | 10.48 | 11.08 | 2.85 | 0.840 |
| Lactation period: | | | | | |
| Body weight at kidding (kg) | 36.75 | 37.13 | 35.80 | 3.64 | 0.757 |
| Body weight decreased at kidding (kg) | 8.63 | 8.13 | 9.01 | 1.69 | 0.584 |
| Body weight at 12 weeks lactation (kg) | 37.38 | 40.44 | 40.06 | 3.24 | 0.144 |
| Dry matter intake (g/d) | 1168b | 1233a | 1229a | 44.18 | 0.017 |
| Average daily gain 12 weeks (g) | 7.44b | 39.44a | 50.74a | 23.08 | 0.003 |

SEM= standard error of means

[ab]Values followed by different superscripts in the same row differ significantly (P<0.05).

Supplementations of choline chloride did not affect DMI and BW during the last eight weeks of gestation. These results were in agreement with those obtained by earlier researchers (Piepenbrink and Overton, 2003; Guretzky *et al*., 2006; Mohsen *et al*., 2011) who supplemented cows' diets with choline during the late pregnancy. Furthermore, the additions of choline chloride increased DMI (P<0.05) during the first 12 weeks lactation period. These results agree with those obtained by earlier researchers (Piepenbrink and Overton, 2003; Guretzky *et al*., 2006; Mohsen *et al*., 2010). They found that rumen-protected choline supplementation for cows affected nutrient intakes during the first three weeks postpartum. The improvement of nutrient intake might be due to the better nutrient digestibility, as reported by Mohsen *et al*. (2010). The supplementation of choline chloride did not affect BW at kiddings and 12 weeks lactation of does (P>0.05). But the supplementation increased ADG (P<0.05) of does during lactation periods. The different levels between 4 g/h/2d and 8 g/h/2d dissolved choline chloride in water gave no differences in DMI and ADG during the lactation period. The level of 8 g/h/2d choline chloride in this trial was similar with the level as reported by Pinotti *et al.* (2008) who supplemented of 4 g/h/d of choline to dairy goats.The productivity of does at kiddings (number of kids, an average birth weight, total birth weight and litter size) were not influenced by supplementation of choline (P>0.05) (Table 3). Birth weight and litter size of EC kids in this study were similar to average birth weight of 2.9 to 3.5 kg and litter size of 1.5 reported in previous studies (Sutama *et al*. 2008; Supriyati *et al.* 2008).

**Table 3.** The productivity of does at kiddings

| Variables | Level of supplementation | | | SEM | P-value |
|---|---|---|---|---|---|
| | T0 (0 g) | T1 (4 g) | T2 (8 g) | | |
| Number of kids (n/doe) | 12 | 12 | 13 | - | - |
| Average birth weight (g/h) | 3.22 ± 0.59 | 3.00 ± 0.60 | 3.20 ± 0.73 | 0.69 | 0.651 |
| Total birth weight (kg/doe) | 4.83 ± 1.58 | 4.50 ± 1.24 | 5.28 ± 1.20 | 1.35 | 0.524 |
| Litter size | 1.50 ± 0.53 | 1.50 ± 0.53 | 1.63 ± 0.52 | 0.53 | 0.893 |

Values are expressed as mean ± sd
SEM= standard error of means

## CONCLUSION

Supplementation of choline chloride at both levels (4 or 8 g/head/2days) through forced drinking technique did not affect the DMI, ADG and FCR values during the last eight weeks of gestation. But the addition of choline chloride increased the DMI and ADG during the first 12 weeks lactation period. The productivity of does at kiddings (number of kids, an average birth weight, total birth weight per doe and litter size) were not affected by treatments of choline chloride.

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