

#### APRW-74

##### Effect of Oxytocin Administration on Milk Yield of West African Dwarf Does during Late Lactation

A. O. Adelabu, I.J. James, U.I. Nwosu and Y.E. Iyanda  
Department of Animal Physiology, Federal University of Agriculture Abeokuta,  
P.M.B 2240, Abeokuta, Nigeria.

**Corresponding author:** A. O. Adelabu; E-mail: akintayoadelabu@yahoo.com; Tel: +2348062774719

#### Abstract

The evaluation of the effect of oxytocin administration on milk yield of West African Dwarf (WAD) does during late lactation was carried out over the period of four weeks. Twenty One lactating does kept intensively consisting of 1<sup>st</sup> and 2<sup>nd</sup> parity with live weight ranges from 9.5 kg to 16.5 kg with age ranges from 1 -3 years were grouped into 3 treatments consisting of T<sub>0</sub> (Control), T<sub>1</sub> and T<sub>2</sub> (intramuscular injection of 2 IU and 4 IU of oxytocin, respectively) with seven animals in each treatment. Daily milk yield was extrapolated from the 12 hours yield obtained by 7:00 am in the morning following the separation of kids in the 7:00 pm of the previous night. The result obtained revealed that milk yield was significantly ( $p < 0.05$ ) influenced by oxytocin administration and parity but not litter size of animals. Milk yield increased with increases doses of oxytocin up to 2IU and also with increase number of parity. Therefore it was concluded that oxytocin could be administered to lactating WAD does during late lactation to increase milk yield.

**Keywords:** Oxytocin, milk yield, milk secretion, goats, lactation

#### Introduction

In Nigeria and most African countries goat milk has not been sufficiently produced to meet the required quantity needed due to low level of milk production in dairy animal with smaller body size, and structure coupled with unreleased residual milk locked-up in the alveoli lumen (Malau-Aduli *et al.*, 2001). But with a conscious effort to increase the quantity of goat milk, a hormone called oxytocin which plays an important role by increasing the quantity of milk produced due to evacuation of residual milk in the alveoli lumen was discovered (Ely and Peterson, 1941) and its use to increase milk yield was demonstrated by Anderson (1951). Oxytocin stimulates contraction of myoepithelial cells causing milk ejection (Linzell, 1971). Oxytocin may be in natural form or produced synthetically but synthetic oxytocin is predominantly used in human as well as in dairy animals. The administration or release of oxytocin either in exogenous or endogenous form respectively causes ejection of milk from the alveolar lumen and a decreases intra mammary pressure within cistern and enlargement of the cisternal volume (Bruckmaier *et al.*, 1996). However it should be noted that pre milking teat- stimulation causes the release of oxytocin and induces milk ejection before milking begins, and this brings about fast and efficient milk removal (Nwosu, 2016). During late lactation, milk production reduced drastically and since it has been reported that the use of oxytocin can cause increase significant increase in the quantity of milk produced by dairy animals (Nostrand *et al.*, 1991).

Therefore, this study was carried out to determine the effects of oxytocin administration on milk yield of West African Dwarf goat (WAD) during lactation.

#### Materials and Methods

The study was carried out at a Smallholder dairy goat research farm located at Camp in Abeokuta, Ogun State, Nigeria. It falls within the rainforest vegetation zone of South-West Nigeria at latitude of 7°11' 30.65"N, longitude and 3° 25' 55.67"E (Google Earth, 2013). The climate is humid with an annual rainfall of 1037 mm and an annual temperature and humidity of about 34.7°C and 82 %, respectively. Twenty-one lactating West African Dwarf does were used for the experiment. The lactating does were in their first and second parities and their live weight ranged from 9.5 - 16.5 kg. The animals were assigned into three treatment groups of seven animals each, homogeneous by parity and body weight. The first group, T<sub>0</sub> was not injected with oxytocin while the remaining two groups (T<sub>1</sub> and T<sub>2</sub>) were injected with 2 and 4 IU of oxytocin respectively. The goats were under intensive management system with zero grazing ('cut and feed') and 0.3 kg per animal per day concentrate feed supplement, consisting of about 17.1 % crude protein, 8.63 % crude fibre, 3.92 % ether extract and 8.80 MJ/kg metabolisable energy was fed to the animals in the morning and fresh *Panicum maximum* grass was chopped and 1.0 kg per

animal per day was fed to the goats in the evening with free access to water until the end of the experiment. The proximate composition of the grass consisted of 84.35 g/kg of dry matter, 8.14 g/kg of crude protein, 32.13 g/kg of crude fibre, 13.26 g/kg of ash, 3.52 g/kg of ether extract, 42.78 g/kg of nitrogen free ether extract and 2.03 MJ/kg of gross energy, respectively.

Milking of animals was between 9<sup>th</sup> and 12<sup>th</sup> week of lactation. Separation of the kids from their dam started from 7:00pm, ten minutes was given between separations in order to avoid clashing of milking time of the does. After separation, the does were restrained and injected intramuscularly with 1 IU synthetic oxytocin and milked immediately by hand in order to evacuate the residual milk. Thereafter, does were returned to their pens, while their kids were kept in separate pens. At 7:00 am (12 hours of separation of the kids from their dams) does were injected with the specific oxytocin dose (2 IU and 4 IU) depending on the treatment group. The 12 hr milk yield obtained from each doe was measured using graduated glass cylinder (100 mL capacity) while sensitive scale was used to measure the quantity of the milk in grams and was used to calculate for 24-hour yield (daily milk yield) since Linzell (1966) reported that the rate of milk synthesis in the mammary glands of small ruminants is constant within 24-hr period. The approach of measuring daily milk yield at weekly intervals, instead on daily basis, can be justified based on the observation of Cardellino and Benson (2002) that milk production is not likely to vary significantly within a span of eight days.

The data collected were subjected to analysis of variance (ANOVA) using the General Linear Model of Analytical Computer Package, Version 5.02 (SYSTAT, 1992). The fixed effects of dose of oxytocin administration, parity and litter size of does were included in the model. Differences in their means were considered as significant at ( $p < 0.05$ ) using Tukey post hoc test of the same statistical package.

## Results and Discussion

The result shown in the Table 1 revealed that daily milk yield was significantly ( $p < 0.05$ ) influenced by oxytocin administration and parity but not by litter size of does. The least square means as depicted in table 2, showed that daily milk yield increased correspondingly with increase in oxytocin dose up to 2 IU (exceeded that of the control by 40.48 % and 39.06 % for milk volume and weight respectively). Also, milk yield of does in second parity exceeded that of their counterpart in first parity by 2.04%. The observation that daily milk yield of oxytocin-treated does exceeded that of control supports the fact that oxytocin has ability to cause contraction of myoepithelial cells of the alveoli that leads to milk ejection thus substantially evacuating residual milk locked up in the mammary gland (Linzell, 1971). Also, Nostrand *et al.* (1991) reported up to 50 % increase in milk output of cow by intramuscular injection of oxytocin. The result is in agreement with the observation of Awoniyi (2010) who reported that West African Dwarf ewes administered 2 IU of oxytocin had higher milk output than the control.

The observation that does in the 2<sup>nd</sup> parity had higher daily milk production than does in the 1<sup>st</sup> parity could be attributed to larger udder size and larger population of milk secreting cells (alveoli) available for higher milk synthesis and secretion. Improvement in udder development occurs with increased number of lactations and mammary involution which occurs towards the end of each lactation cycle does not bring back the mammary size to its original size before lactation. This finding corroborates the observation of (James and Osinowo, 2004) who reported that udder size is positively correlated with milk yield in West African Dwarf, Red Sokoto and Sahel goats of Nigeria.

Table 1: Summary of analysis of variance showing the effects of oxytocin administration, parity and litter size on milk yield of West African Dwarf goats during late lactation

| Sources of variation | DF | Mean Square           |                      |
|----------------------|----|-----------------------|----------------------|
|                      |    | Daily milk yield (mL) | Daily milk yield (g) |
| Treatment            | 2  | 30754.64***           | 29869.40***          |
| Parity               | 1  | 22885.62**            | 23162.60**           |
| Litter size          | 1  | 158.45                | 187.33               |
| Error                | 79 | 2041.67               | 2130.23              |

\*\* $p < 0.01$  and  $p < 0.001$ \*\*\*

Table 2: Least squares means showing the effects of oxytocin administration, parity and litter size on milk yield of West African Dwarf goats during late lactation

| Factors               | No. of observation | Milk yield (Mean $\pm$ SEM)    |                                |
|-----------------------|--------------------|--------------------------------|--------------------------------|
|                       |                    | Daily milk yield (mL)          | Daily milk yield (g)           |
| Oxytocin dose         |                    |                                |                                |
| Control (0 IU)        | 28                 | 144.96 $\pm$ 8.90 <sup>b</sup> | 146.45 $\pm$ 9.09 <sup>b</sup> |
| T <sub>1</sub> (2 IU) | 28                 | 203.65 $\pm$ 9.04 <sup>a</sup> | 203.65 $\pm$ 9.23 <sup>a</sup> |
| T <sub>2</sub> (4 IU) | 28                 | 202.64 $\pm$ 9.56 <sup>a</sup> | 203.64 $\pm$ 9.76 <sup>a</sup> |
| Parity                |                    |                                |                                |
| First                 | 56                 | 165.85 $\pm$ 7.48 <sup>b</sup> | 165.85 $\pm$ 9.76 <sup>b</sup> |
| Second                | 28                 | 203.71 $\pm$ 8.65 <sup>a</sup> | 203.31 $\pm$ 8.83 <sup>a</sup> |
| Litter size           |                    |                                |                                |
| 1                     | 60                 | 182.71 $\pm$ 6.30              | 182.71 $\pm$ 6.44              |
| 2                     | 20                 | 186.44 $\pm$ 10.25             | 186.44 $\pm$ 10.47             |

<sup>ab</sup> Means with different superscripts in the same column differ significantly (P<0.05).

### Conclusion and Recommendation

Oxytocin administration and parity had significant effect on the daily milk yield of West African Dwarf does and it was concluded that oxytocin administration can be used to achieve progressive increase in milk yield of West African Dwarf does during late stage of lactation. Based on the findings from this study, it is recommended that 2IU dose of oxytocin can be used for effective milk yield in WAD does and further research should be carried out to determine the optimum physiological dose of oxytocin required by West African Dwarf does for optimum milk yield.

### References

- Awoniyi, K. A. (2010). Effects of oxytocin on milk yield of West African Dwarf sheep. B. Agric. Project. Department of Animal Breeding and Genetics, Federal University of Agriculture, Abeokuta Nigeria.
- Bencini, R, Martin, G.B., Purvis, I.P. and Hartmann, P.E. (1992). Use of oxytocin to measure milk output in Merino ewes and its effect on fat content. *Aus. J. Exp. Agric.*, 32:601-603.
- Bruckmaier, R.M. and Blum J.W. (1996). Simultaneous recording of oxytocin in release milk ejection and milk flow during milking of dairy cows with or without pre-stimulation. *J. Dairy Res.*, 63:201-208.
- Ely, F. and Petersen, W.E. (1941). Factors involved in the ejection of milk. *J. Dairy Sci.* 24:211
- Linzell, J. L and Peaker, M. (1971). The effects of oxytocin and milk removal on milk secretion in the goat. *J. physiol.* 216: 717-734.
- Malau-Aduli, B.S., Eduvie, I.O., Lakpini, C.A.M. and Malau-Aduli, E.O. (2001). Effects of supplementation on the milk yield of Red Sokoto does. *Proc. Ann. Conf. Nig. Soc. Anim. Prod.*, March 2001, ABU, Zaria, Nigeria, pp 353–355.
- Nostrand, S.D., Galton, D.M., Erd, H.N. and Baum D.E. (1991). Effect of daily exogenous oxytocin on lactation, milk yield and composition in lactating cows. *J. Dairy Sci.* 74:2119-2127.
- Nwosu, E.U. (2016). Effects of oxytocin administration on milk yield and composition of lactating West African Dwarf does. M. Agric. Thesis. Department of Animal Physiology, Federal University of Agriculture, Abeokuta Nigeria
- Google Earth (2013). <http://www.google.earth>. Retrieved on the 19<sup>th</sup> July, 2014.
- Cardellino, R.A and Benson, M. E. (2002). Lactation Curves of commercial ewes rearing lambs. *J. Anim. Sci.* 80: 23-27.
- James, I.J. and Osinowo, O.A. (2004). Changes in udder size and live weight of West African Dwarf, Red Sokoto and Sahel goats during lactation and their phenotypic relationship with partial daily milk yield. *Nig. J Anim. Prod.*, 31(1): 119-129.