# Study the effect of oxytocin injection on the quantity of milk produced and some biochemical parameters in the Iraqi local sheep and goats

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***Abstract:** This study was carried out commercial animal field in Aboalkassib village/ Basrah. to investigate the influence of injected of oxytocin hormone on milk production and some biochemical parameters (glucose, cholesterol, total protein and albumin) and some hormones concentrations ( prolactin, TSH and progesterone) in the Iraqi sheep and goats . A total of 40 dry adult Arabi ewes and local black female goats (20 for each type of animals) aged between 2.5-3 years old were divided randomly into two groups: 10 ewes as a control group and 10 ewes treated with oxytocin hormone at dose 12 ml/head. Also, 10 female goats as a control group and 10 female goats treated with oxytocin hormone at the same dose by injecting in intramuscular at 6:00 o`clock in the morning. The results showed significant (P<0.05) increase in milk yield in local black goats, but not in sheep, during the morning and evening periods milking when treated animals with oxytocin hormone at dose 12 ml/head in intramuscular, Also, the results showed that the concentrations of glucose (after 30min. of injection), cholesterol and prolactin (after 1h. of injection) were significant (P<0.05) increase in the blood of sheep and goats. Glucose concentration was higher in sheep compared with goats except after 30min. of the injection, also, the level of cholesterol was higher in sheep compared with goats in all periods. The concentration of progesterone decreased significantly (P<0.05) in both types of animals after oxytocin injection during all periods. Sheep and goats treated with oxytocin were not significantly different in the concentrations of total protein, albumin and TSH hormone.*

***Key words:** Oxytocin injection, milk production, biochemical parameters, Arabi sheep, local black goats.*

## 1. INTRODUCTION

Sheep and goats could produce a high amount of milk to feed and provide the nutrition requirements for most people in the world, because of their milk is rich in protein, fats, lactose, minerals and vitamin (Popescu, 2017). On the other hand, milk is important to the early growth and lamb survive, especially after the birth. The Arabi breed and local black goats are the main domestic farm animals in the south of Iraq, characterized by a low milk production, where the maximum of milk production do not more than (550, 827) g/day for

Arabi sheep and a local black goat respectively. But, those breeds could be reared under semi-condition because they have a high ability to tolerate the difficult environmental conditions and diseases. (Al-Saigh and Al-Qas, 1999).

Many factors could effect on milk production such as age, lactation stage, nutrition, environment conditions, endocrine system, health,… etc. (Jackuliakova and Tancin, 2011). While, the quality milk is influenced by the blood metabolic compounds such as carbohydrate, lipids, proteins, vitamins and minerals. During suckling, there are many factors that stimulate the receptors of milking secretion, such as smell the odor of the food, touch the udder by a farmer or/ and suck the teats by the kids (Hashimoto et al., 2012), those reporters will stimulate the paraventricular and supraptic nuclei of the hypothalamus throughout the nerve impulses (Richard, 1972). Those nuclei will be active to synthesis oxytocin hormone (Crowley and Armstrong, 1992),oxytocin then transports by blood vessels to mammary tract and causes an increase in contraction of smooth muscles of mammary vesicles.

Oxytocin is nonpeptide hormonal (it is structure include nine amino acids) and considered one of the hormones which synthesis in nerve cells of the hypothalamus, especially in paraventricular and supraptic nuclei (Gimpl and Fahrenholz, 2001) and secretion from the posterior lobe of pituitary glands after transport through the axons of the hypothalamus, then, when the posterior lobe is stimulated the oxytocin released into the blood vessels (Chard, 1985). Oxytocin has many functions in the body, such as 1) increases the contraction of the smooth muscles of either uterine or ovary duct during and after mating to transport the sperm from the vagina to the fertile area in the third top of ovary duct and in the same time transport the ovum from the top of the ovary duct to the fertility area to guarantee the fertilization (Watson et al., 1999). 2) Increases the contraction of the myoepithelial cells and other vesicle mammary glands to output the milk from the udder (Fernandez et al., 1995). 3) Increases the contraction of the pelvic muscles just before some hours and during parturition (Ayad et al., 1990; Campbell and Lasley, 1985). The half- life of oxytocin in the blood is about 4 minutes in sheep and around from 7 to 9 minutes in cow (Wachs et al., 1984).

There are many studies about the effect of treatment with oxytocin on various functions such as improve the quality and quantity of milk (Abbas et al., 2014; Alkass and Merkhan 2012; Zamiri et al., 2001; Bencini et al., 1992), regulate the reproductive performance, and improve the function of corpus luteum in cattle (Tahawy and Sharkawy, 2014; Metwelly and EL-Bwab, 1999).

The purpose of this study was to determine the effect of oxytocin injected on milk production, biochemical parameters and some hormone concentrations at different periods in local sheep and goats in south of Iraq.

## 2. MATERIALS AND METHODS

This study was conducted in the commercial animal field in Aboalkassib village/ Basrah, to investigate the influence of injected of oxytocin hormone on the milk yield and some biochemical parameters in the Iraqi local sheep and goats. A total of 40 dry adult Arabi ewes and local black female goats (20 for each type of animals) aged between 2.5-3 years old were divided randomly into two groups: 10 ewes as a control group and 10 ewes as treated group with oxytocin hormone (manufactured by the Anova Joint Venture company, Vietnam) at

dose 12 ml/head. Also, 10 female goats as a control group and 10 female goats as treated group with oxytocin hormone by injecting in intramuscular at 6:00 o`clock in the morning.
All animals were housed in clean yards and fed on the same diets included (60, 25, 10, 4, 1) % of barley, wheat bran, yellow corn, soybean meal, vitamins and mineral premix respectively. During the study, the animals grazed about 3 hours in the morning and 2 hours in the evening with offer ad libitum good quality water.
The milk was collected during the day before treatment and on the day of treatment by using the hand milking of animals and weighted the kids before and after suckling, to measure the total milk yield during two periods, first after 4h. of injection (10:00 a.m. in the morning) and the second at 3:00 p.m. in the evening. At night and between two periods the kids were separated from their dams. Seven ml of blood was collected from the jugular vein before and after 30 minutes, 1h, 2h, and 3h. Blood samples were separated by centrifugation at 3000 rpm for 15 minutes, All serum samples were frozen under -20$^{o}$C until analysis time.
Glucose concentration was measured by a chemical kit of the England Plamatec company. Cholesterol, total protein and albumin concentrations were determined by using a chemical kit of the France. Prolactin, Thyroid stimulating hormone (TSH), Progesterone concentrations were determined by using a procedure associated with the kit of Monobind Inc – USA Company. The obtained data were analyzed statistically using the SPSS (2013). Statistically significant differences were determined at the $P<0.05$ level of significance.

## 3. RESULTS AND DISCUSSION

Effect of oxytocin injection on milk yield in Arabi sheep and local black goats was observed in Figure 1. No significant ($P<0.05$) differences were observed in milk yield in both types of animals in the day before injection either in the morning or evening periods, while, in the day of injection, the milk yield increase significantly ($P<0.05$) in goats either after 4h of injection or in the evening period, compared with sheep, may due to that oxytocin stimulate milk removal from lumen of alveoli to the secondary ducts and then to major duct and cistern (Marnet et al., 1998). On the other hand, oxytocin when arrive to the mammary alveoli attach to specific receptors, placed on the myoepithelial cells, led to contraction the wall of this alveoli to ejecting milk from the top of the mammary tract to the teats (Lollivier et al., 2006; Marnet and McKusick, 2001). Alkass and Merkhan, (2012) suggested that oxytocin reducing the pressure inside alveoli and preventing the lactation inhibitors that surrounding alveoli. This result was similar to that found by Nezamidoust et al., (2015); Ribeiro et al., (2007); Awoniyi, (2003) and Zamiri et al., (2001), in spite of, those studies were on the sheep. Milk yield in sheep was higher in the evening period, compared with morning once in the day of injection. We believe that the variance in the amount of milk between those periods does not relate to oxytocin treatment, but, to the frequency of milking (Wilde and Peaker, 1990). However, milk production was higher in goats compared with goats either in the day before or on the day of injection. This result may explain as follows: the morphology of the udder limits the amount of the milk, which is stored in it, and according to Fernandez et al., (1995) there is a positive correlation between milk production and both the length and depth of udder, including the capacity of the cisterns. Most of goats have a large cistern, which play a major role in the collection and storage the milk (Marnet and McKusick, 2001), compared

with sheep. Therefore, naturally the amount of milk, which products from goats is more than that comes from sheep, because of 75% of milk production stored in the cistern of goats, while less than 50% of milk production stored in the cistern of sheep (McKusick et al., 2002; Marnet and McKusick, 2001).

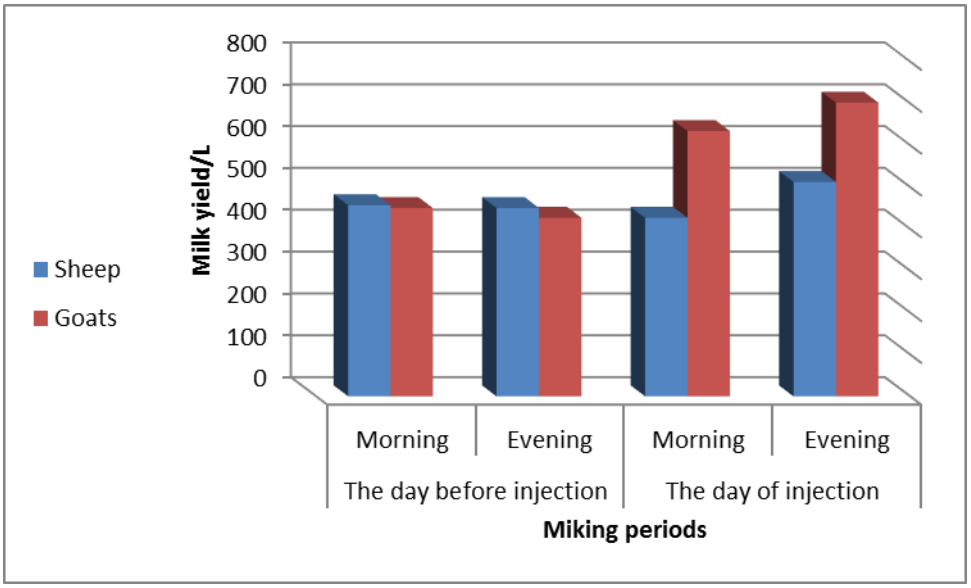


Figure (1) Effect of oxytocin injection on milk yield in Iraqi sheep and goats.

Table (1) obtained the concentrations of glucose and cholesterol after different periods oxytocin injection in the blood of Arabi sheep and a local black goat. The concentration of glucose was increased significantly ($P<0.05$) in goats and sheep after 30min. and 1h. of oxytocin treatment respectively, may due to that oxytocin when transported by blood to the hepatic cells the secretion of insulin will arise (in spite of, we do not measure the concentration of insulin in our study) from pancreas gland and the analysis of glycogen will elevate (Gao, 1992; Paolisso et al., 1988). This result agrees with (Wallin et al., 1989). According to Akar et al., (2012) which reported that treated cows with oxytocin do not effect on total protein and albumin concentrations compared with the control group. However, the glucose concentration was increased significantly ($P<0.05$) after 30min. of oxytocin injection compared with other periods.

Cholesterol concentration was increased significantly ($P<0.05$) after oxytocin injection in both sheep and goats where the values were between 56.67 to 96.13 mg/100ml and from 56.71 to 67.24 mg/100ml respectively. The concentration of cholesterol was significant ($P<0.05$) higher in sheep compared with goats. The reason for this result may be due to that oxytocin receptors needs to cholesterol to become active and turnover from a low- to a high affinity state, the attachment and interaction between the oxytocin receptors and cholesterol is a high specificity (Gimpl, and Fahrenholz, 2001). According to this fact, a higher amount of sources of the lipids will be rapidly converted to cholesterol, leading to an increase in concentration of cholesterol in the blood. However, the cholesterol concentration was increased significantly ($P<0.05$) after 1 h. of oxytocin injection compared with other periods.

Table (1): Means (± S.E.) of glucose and cholesterol concentrations (mg/100ml) after different periods of oxytocin hormone injection to sheep and goats (Total No. 40).

| Biochemical parameters | Glucose | | | Cholesterol | | |
|---|---|---|---|---|---|---|
| Type of animal / Period | Arabi | Goats | Mean | Arabi | Goats | Mean |
| Before injection | 24.09 ±1.78 | 24.54 ±1.24 | 24.31$^{D}$ ±1.12 | 56.67 ±3.47 | 56.71 ±3.58 | 56.69$^{C}$ ±3.90 |
| After 30 Min. | 47.93 $^{b}$ ±1.03 | 61.09 $^{a}$ ±1.44 | 54.51$^{A}$ ±1.45 | 77.40 $^{a}$ ±3.31 | 62.23 $^{b}$ ±2.99 | 69.81$^{C}$ ±3.12 |
| After 1 h. | 53.51$^{a}$ ±1.66 | 35.48 $^{b}$ ±1.38 | 44.49$^{B}$ ±1.09 | 110.82 ±3.42 | 99.47 ±3.60 | 105.14$^{A}$ ±3.00 |
| After 2 h. | 41.58 ±1.84 | 36.36 ±1.86 | 38.97$^{B}$ ±1.34 | 92.54 ±2.79 | 85.37 ±2.41 | 88.95$^{B}$ ± 3.67 |
| After 3 h. | 33.92 ±1.10 | 32.61 ±1.60 | 33.26$^{C}$ ±1.54 | 96.13$^{a}$ ±3.92 | 67.24$^{b}$ ±3.81 | 81.68$^{B}$ ±3.01 |

Different capital and small letters within a column and class means significant difference ($P<0.05$) between periods and type of animal respectively.

No significant ($P<0.05$) differences were observed in total protein and albumin concentrations in the serum blood of sheep and goats after oxytocin injection during all periods (Table 2). So, based on our data, we could suggest that injected Arabi ewes and local black female goats at dose 12 ml/head in intramuscular will does not effect on total protein and albumin levels. However, the values of those two parameters were within a normal range, which recorded by Kassim and AL-Hellou (2018) in Arabi ewes. Our results were agreed with the results of Akar et al., (2012) which reported that treated cows with oxytocin do not effect on total protein and albumin concentrations compared with the control group.

Table (2): Means (± S.E.) of total protein and albumin concentrations (g/100ml) after different periods of oxytocin injection to sheep and goats (Total No. 40).

| Biochemical parameters | Total protein | | | Albumin | | |
|---|---|---|---|---|---|---|
| Type of animal / Period | Arabi | Goats | Mean | Arabi | Goats | Mean |
| Before injection | 4.95 ±0.39 | 4.53 ±0.36 | 4.74 $^{C}$ ±0.36 | 2.88 ±0.07 | 2.74 ±0.13 | 2.81 $^{B}$ ±0.09 |
| After 30 Min. | 5.72 ±0.15 | 5.21 ±0.12 | 5.46 $^{B}$ ±0.12 | 3.73 ±0.39 | 3.15 ±0.42 | 3.44 $^{AB}$ ±0.38 |
| After 1 h. | 6.00 ±0.16 | 5.61 ±0.21 | 5.80 $^{AB}$ ±0.19 | 3.48 ±0.28 | 3.87 ±0.32 | 3.67 $^{A}$ ±0.30 |
| After 2 h. | 5.68 | 6.16 | 6.42 $^{A}$ | 3.05 | 3.30 | 3.17 $^{B}$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | ±0.11 | ±0.12 | ±0.17 | ±0.10 | ±0.11 | ±0.12 |
| After 3 h. | 5.93 ±0.30 | 5.23 ±0.26 | 5.58 $^{AB}$ ±0.25 | 3.91 ±0.23 | 3.31 ±0.19 | 3.61 $^{A}$ ±0.22 |

Different capital letters within a column means significant difference (P<0.05) between periods.

The concentration of prolactin was increased significantly (P<0.05) in both sheep and goats after 1h. of oxytocin injection compared with before and after 3h of oxytocin injection (Figure 2). According to many researchers there is a relationship between prolactin and oxytocin through many ways: 1) The administration oxytocin into lactotrophs cells in vitro causes an increase in prolactin secretion. 2): Elevation the level of oxytocin in the blood vessels causes an increase in prolactin secretion. 3) Oxytocin stimulates the prolactin secretion because of oxytocin active the positive feedback for oxytocin prolactin excretion (Jessica and De'Nise, 2012; Samson et al., 1986). Our results were agreed with the results of Linzell, (1971) when he injected oxytocin to goats.

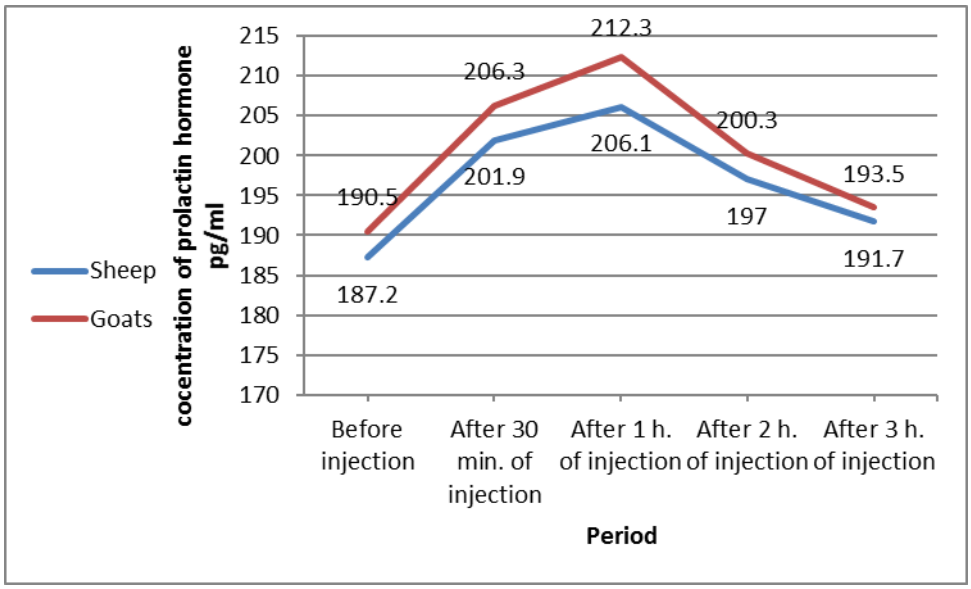


Figure (2): Means of Prolactin concentration after different period of Oxytocin hormone injection to sheep and goats.

No significant (P<0.05) differences were presented in TSH concentration in the serum blood of sheep and goats after oxytocin injection during all periods (Figure 3). However, there was an increase in this level in both types of animals before and after 2h. of injected. We suggest that injected Arabi ewes and local black female goats at dose 12 ml/head in intramuscular do not effect on TSH concentration. According to Petersson, (2002) there was a metabolic relationship between oxytocin and TSH-thyroid hormone because of when treated the rats with oxytocin caused decreases in TSH hormone.

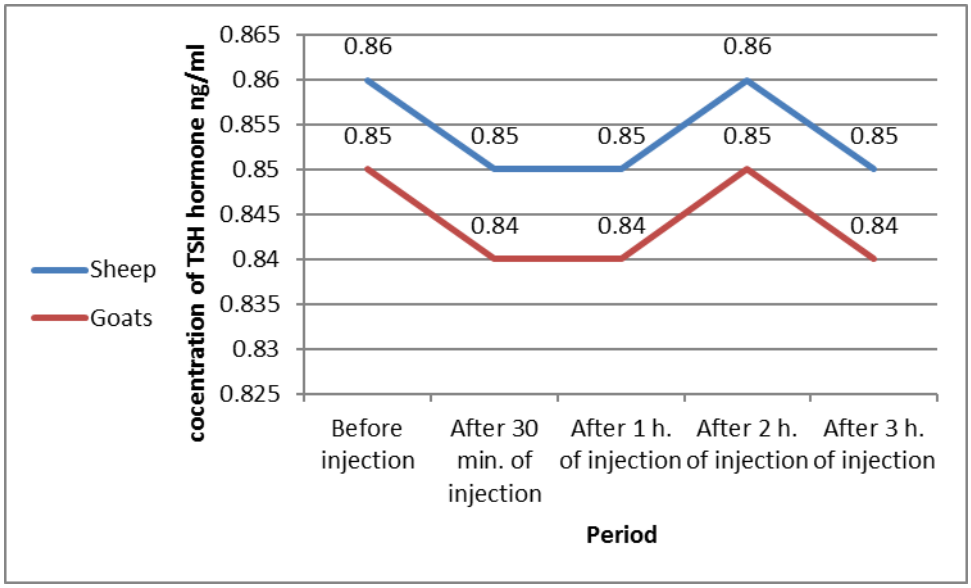


Figure (3): Means of TSH concentration after different period of Oxytocin hormone injection to sheep and goats.

After injecting sheep and goats with oxytocin, showed a significant ($P<0.05$) decrease in the concentration of progesterone (Figure 4) from (1.92, 1.9) ng/ml to (1.54, 1.56) ng/ml before and after 3h. of oxytocin for sheep and goats respectively. Labhsetwar et al., (1964) reported that treated cattle with oxytocin caused regression in both weights of corpus luteum and the concentration in blood. A similar result was found by Simmons and Hansel (1962). While, Mohamed and Abd El-Hakeam reported that injected oxytocin at dose 20 LU/IM in Ossimi sheep caused non-significant increase in progesterone concentration compared with the untreated group.

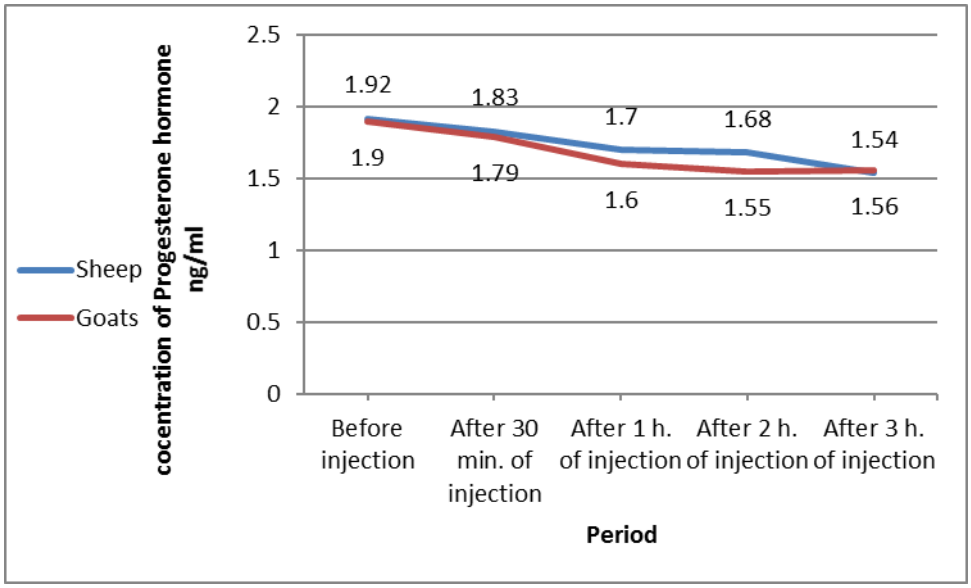


Figure (4): Means of progesterone concentration after different period of Oxytocin hormone injection to sheep and goats.

## 4. CONCLUSION

From our results, we concluded that injected oxytocin hormone at dose 12 ml/head in intramuscular, almost, improves the milk yield and milk production in local black goats, but not in sheep, during the morning and evening periods milking. Additionally, this dose increases the concentrations of glucose (after 30min. of injection), cholesterol and prolactin (after 1h. of injection) in the blood of sheep and goats**.** The responsible for the elevation in glucose concentration was faster in goats compared with sheep after injected, while, the level of cholesterol was higher in sheep compared with goats. Also, the concentration of progesterone decreased directly in both types of animals after oxytocin injection during all periods. The injection of oxytocin does not effect on total protein, albumin and TSH hormone either in sheep or on goats.

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