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Fertility Improvement of Baladi Goats Using Dexamethasone and GnRH-dependent Protocols

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ABSTRACT

This study aimed to evaluate the effect of dexamethasone and gonadotropin releasing hormone (GnRH) on improvement of the fertility of Baladi goats. To accomplish this study, twenty does were synchronized for estrus using PGF-2α agonist. Then, they were divided into four groups randomly (5/ each). Group-I was injected with dexamethasone, while, group-II was injected by three doses of gonadotropin releasing hormone (GnRH). Group-III, was injected by dexamethasone and GnRH, while group-IV was injected with saline to be used as control group. The fertile bucks were allowed to mount the does for fertilization. Ovarian response to the treatment and diagnosis of pregnancy were monitored using ultrasonography. Results revealed that compared to control group, all the treatment protocols have a significant intensifying and improving effect on the appearance of signs of estrous, the day of mount, day of pro-estrus, day of ovulation and day of mature corpus luteum formation. However, the treatment with dexamethasone seems to have more effect over the other treatment protocols. Also, the number of the detected mature corpora lutei was significantly increased upon application of the treatment protocols as compared to control group but this effect was more obvious in group I. Finally, the treatment protocols tend to have no significant effect on the number of the formed mature follicles, weights of feti at birth or their weights after 60 days, on the other hand the treatments protocols has proved to decrease the percent of fetal losses when compared to control group.

1-INTRODUCTION

As showed by the archaeological evidence, goats are considered as one of the first farm animals to be domesticated, also, they have been associated with man in a symbiotic relationship for up to 10,000 years (Ensminger and Parker, 1986). Goats are distributed all over the world due to their great adaptability to the environmental variation and the different nutritional regimes under which they were evolved and subsequently maintained. The goats play an important and critical role for communities living in arid and semi-arid regions for production of meat, milk, leather, and fiber (Al-Sobaiyl, 2010; Castel et al. 2010).According to FAO (2018), most of the dairy goats are raised in Asia (52.1%) and Africa (39.6%), with smaller numbers in Europe (4.3%) and the Americas (4.0%). Goat milk is used widely in human diet in many developing countries and especially in the Mediterranean, Eastern Europe, Middle East and South American countries (Haenlein, 2004; Ribeiro and Ribeiro, 2010).Concerning the improvement of goat's fertility, dexamethasone was proved to have a crucial effect on perfection of goat's reproductive state through different mechanisms including that it has the ability to stimulate the release of follicle stimulating hormone (FSH), luteinizing hormone (LH)(Brann et al. 1991), enhancing FSH action in follicular phase of the estrous cycle (Huan and Li, 2001), also, it may accelerate timing of ovulation and increase in the number of the produced oocytes (Daly et al. 1984; Degreef and Vandershoot, 1987; Brann et al.1990; Roh et al. 2016). Moreover, Dexamethasone was used for treatment of premature ovarian failure and modulated the responsiveness of ovary to gonadotropin stimulation (Keay et al. 2001; Parsanezhad et al. 2002; Badawy et al. 2007). Likewise, dexamethasone enhanced reproductive function and fertility of gonadotropin-primed immature

rat (Rockwell and Kroos, 2009).The function of GnRH is to control the synthesis and secretion of FSH and LH from pituitary gland, and through the actions of these hormones, it regulates folliculogenesis and ovulation(Avet et al. 2018).Exogenous GnRH treatment is used widely in veterinary reproductive enhancement protocols, for example, injection of GnRH immediately after insemination has increased the multiple birth rates of low fertility Awassi ewes by enhancing ovulation (Turk et al. 2008). Also, the administration of GnRH at the time of mating (Lashari and Tasawar, 2010) or before the maternal recognition of pregnancy (Cam et al. 2002) could improve the luteal functions and induces luteinization of the developing follicles, which may elevate the circulating progesterone levels and thereby embryo survival in many ruminant species (Inskeep, 2004; Khan et al. 2007; Lashari and Tasawar 2010). This work was designed to evaluate the effect of dexamethasone and gonadotropin releasing hormone (GnRH) on improving the fertility and decreasing the fetal losses of native goats breed.

2-MATERIAL AND METHODS

2.1. Animals:

This study was carried out on twenty clinically apparently healthy female Baladi goats (Native breeds), belonging to a small private farm on Matrouh – Alexandria road, they were about 3-4 years and weighting about 40-50 kg. These does had a history of 2 parturition producing only 1 offspring at each time. The farm was confirmed to follow an accurate protective program against most of infectious diseases.

2.2. Housing and Nutrition:

The goats were kept in corrals during day and night all over the year. The daily ration, offered to each animal consisted of 2kg of hay during the dry season, or 6 kg of barseem during the green season. In addition, 600 -1000 gm concentrates (in the form of pellets containing 14% protein) was also offered daily to each animal all over the year. Water and salt lick blocks were offered *ad-libitum.* Breeding of the animals depended on natural service by 2 fertile bucks.

2.3. Experimental design:

The experiment was carried out during the period from September to February 2019(in the breeding season), whereas these breeds tend to breed all the year with peak of estrus activity throughout winter and autumn which is associated with short photoperiod. All animals were synchronized for estrus using a double intramuscular (I/M) injection of (1ml=250µg of PGF2α) (Estrumate®, Schering-Plough, Germany), 11 days apart interval. Twenty four hours following the end of synchronization protocol (second doses of PGF-α), does were divided randomly into four groups, each consisting of 5 animals.

Group-I: was injected with 1ml=1.52mg of dexamethasone I/M (Dexaphan®, Pharma Swede-Egypt) single dose in on day 1 after estrus synchronization.

Group-II: was injected with 1ml=4µg of gonadotropin releasing hormone (GnRH) I/M (Receptal®, Intervet, Egypt), on day 1 after estrus synchronization. On day 7, apart from initial dose, the does were injected with another dose of 1ml GnRH and this was repeated again on day 14 from the second dose.

Group-III: was injected with 1ml dexamethasone (I/M), in addition to 1ml (I/M) of (GnRH) on day 1 after synchronization.

Group-IV: was injected with saline to act as a control group.

All does were noticed twice daily (at 6 A.m and 3 p.m) for appearance of estrus signs, the goats that exhibited estrus were allowed to be mounted by the fertile bucks.

2.4. Pregnancy diagnosis:

Pregnancy diagnosis was carried out on day 50 post service using ultrasonography, real time, B- mode to detect the number of pregnant females and number of feti in the following manner All animals were scanned in the standing and recumbent position, after shaving of the abdomen. Before examination a specialized gel (**MARAMCO**, Egypt) was spread over the shaved area of the animal and the flat area of the transducer. In the rectal manner the probe was fitted to a plastic rod (1×30 cm) as an adapter to enable the insertion of the probe into the rectum. The rectal and abdominal examinations were used to compare their efficiency in diagnosis and accuracy.

Diagnosis was based on the stage of gestation, upon the recognition of fluid filling the uterus, placentomes and foetal structures such as heart, thorax and limbs, and/or foetal body movements. The confirmation of the pregnancy was based upon kidding. Percentage of fetal losses for each group was measured and recorded. This was achieved by ovarian ultrasonography which was started the next day after the initiation of treatment and continues daily until the 7th day to monitor the formation and the number of follicles and corpus luteum after ovulation for each animal to record them, after that, the pregnancy diagnosis was carried out to calculate the losses percent. This method was further confirmed upon parturition time by counting parturited feti number for each group.

2.5. Statistical analysis: The obtained data was analyzed using one way ANOVA test to obtain the difference between mean values and the results were confirmed

using one way ANOVA test Post Hoc Tukey test by the aid of the SPSS statistical package v22.0 for Windows (IBM, Armonk, NY, USA).

3-RESULTS

As shown in Table (1), the results revealed that the difference of quantitive data between the studied groups regarding to the signs of estrus appear, the day of pro-estrus, the day of mount, day of ovulation and day of mature CL formation were significantly different between these groups (F= 11.879, p=0.000), but difference was statistically significant in group-I (p=0.00) when compared to control group. Concerning the numbers of the ovulatory follicles, the means value of all groups did not record any significant differences, but, the highly mean value of the numbers of follicles was (5.2±0.837) belonged to group-III (t=2.449, p=0.040). In addition, to the numbers of mature CL and Pregnancy diagnosis were statistically different significantly between the treated groups (F=3.733, p=0.033 and F=8.561, p=0.001, respectively) and also when compared to control group, but the highest values was recorded in group-I (2.6±0.548). Finally, the difference between mean values of weight (kg) of feti at parturition day, weight after 60 day from parturition (kg) and number fetal loses were statistically insignificant among all the groups and between each groups and the control group. The percent of fetal losses were recorded in Table (2).

Table (1): The effect of the treatment protocols on reproductive performance parameters of the different groups:

Variables		Studies groups				One way ANOVA		ANOVAPost HocTukey
		Group-I	**Group-II**	**Group-III**	**Group-IV**	**F**	**P value**	
Day of pro-estrus	**mean± SD**	1.6±0.548	3.2±0.447	2.6±0.548	**3.4±0.548**	11.879	**0.000***	• A=0.000* • B=0 .930 • C=0.115
	P	**0.001***	0.545	**0.050***				
Signs of estrus appear	**mean± SD**	2.6±0.548	4.2±0.447	3.6±0.548	**4.4±0.548**	11.879	**0.000***	• A=0.000* • B=0.930 • C=0.115
	P	**0.001***	0.545	**0.050***				
The Day of mount	**mean± SD**	3.6±0.548	5.2±0.447	4.6±0.548	**5.40 ±0.548**	11.879	**0.000***	• A=0.000* • B=0.930 • C=0.115
	P	**0.001***	0.545	**0.050***				
Numbers of follicles	**mean± SD**	5.2±1.095	5.0±1.0	5.2±0.837	**4.0±0.707**	1.941	0.164	• A=0.209 • B=0.348 • C=0.209
	P	0.074	0.105	**0.040***				
Day of ovulation	**mean± SD**	3.6±0.548	5.2±0.447	4.6±0.548	**5.4±0.548**	11.879	**0.000***	• A=0.000* • B=0.930 • C=0.115
	P	**0.001***	0.545	**0.050***				
Day of mature CL formation	**mean± SD**	10.6±0.548	12.2±0.447	11.6±0.548	**12.4±0.548**	11.879	**0.000***	• A=0.000* • B=0 .930 • C=0.115
	P	**0.001***	0.545	**0.050***				
Numbers of mature CL	**mean± SD**	2.6±0.548	2.2±0.447	2.8±0.837	**1.6±0.548**	3.733	**0.033***	• A=0.084 • B=0.433 • C=0.032*
	P	**0.020***	0.094	**0.028***				
Pregnancy diagnosis	**mean± SD**	2.6±0.548	2.0±0.0	2.40±1.14	**0.60±0.548**	8.561	**0.001***	• A=0.002* • B=0.025* • C=0.004*
	P	**0.000***	**0.005***	**0.013***				
Weight(kg) of feti at parturition day	**mean± SD**	**2.28±0.45**	**2.50±0.33**	**2.11±0.91**	**1.48±1.47**	0.903	0.461	• A=0.812 • B=0.385 • C=0.872
	P	**0.301**	0.200	**0.441**				
Weight after 60 day from parturition (kg)	**mean± SD**	6.39±0.92	6.43±1.20	5.22±1.77	**4.16±3.79**	1.038	0.406	• A=0.50 • B=0.439 • C=0.902
	P	0.265	0.261	0.599				
Number Fetal losses	**mean± SD**	0.0±0.0	0.20±0.447	0.40±0.548	**1.0±1.0**	2.489	0.098	• A=0.084 • B=0.206 • C=0.433
	P	0.089	0.141	0.273				

Post hoc One way ANOVA A= between group 1 and group IV B= between group II and group IV C=between group III and groupIV, F=One way ANOVA, * Significant difference P ≤ 0.05. t, Levene's Test independence difference mean.

Table (2): The effect of different treatment protocols on fetal losses percent among different groups:

			Fetal looses		Total
			yes	no	
drug groups	Group I (dexamethasone)	Count	0	5	5
		% within drug groups	.0%	100.0%	100.0%
	Group II (GnRH)	Count	1	4	5
		% within drug groups	20.0%	80.0%	100.0%
	Group III (dexamethasone +GnRH)	Count	2	3	5
		% within drug groups	40.0%	60.0%	100.0%
	Group IV (control)	Count	3	2	5
		% within drug groups	60.0%	40.0%	100.0%
Total		Count	6	14	20
		% within drug groups	30.0%	70.0%	100.0%

4-DISCUSSION

Improvement of the reproductive performance of goats which play an important role for communities living in rural areas as it represent the main source of meat, milk, leather, and fiber may assimilate a critical issue (Al-Sobaiyl, 2010; Castel et al. 2010).Regarding the results of our study, administration of dexamethasone after estrus synchronization has a favorable impact on the overall reproduction-related parameters including appearance of clear estrous signs, the day of mount, day of pro-estrus, day of ovulation and day of mature CL formation, and this may be explained on the basis of that dexamethasone could induced reproductive function and fertility hugely (Rockwell and Kroos, 2009) as it would stimulate the release of follicle stimulating hormone (FSH) and luteinizing hormone (LH) (Brann, et al., 1991),extensively it can enhance FSH action in follicular phase of the estrous cycle (Huan and Li, 2001)and may accelerate timing of ovulation and increase in the number of follicles (Degreef and Vandershoot, 1987; Brann et al. 1990). In addition, dexamethasone may modulate ovarian function directly through acting on the hypothalamus and pituitary, altering metabolic hormones and growth factors, such as insulin-like growth factor-1 which can modulate the ovarian functions, the ovarian response to gonadotropin stimulation is proved to be modulated by insulin-like growth factor 1 (IGF-1) which acts synergistically in vitro with FSH (Adashi et al. 1985) through granulosa cell receptors (Gates et al. 1987), or directly through alteration of circulating gonadotropins levels (Schreiber et al. 1982; Tetsuka, 1999). The significant elevation in the numbers of follicles may be attributed to that dexamethasone injection can decrease beta hydroxyl buteric acid (BHBA) (Sami et al. 2017), the elevated (BHBA) concentrations may impair GnRH and/or LH secretion (Beam et al. 1999) with consequent effects upon follicle growth and ovulation or delayed luteal activity (Wathes et al. 2007). The decrease in fetal losses which accompanied the administration of dexamethasone may be a result of that dexamethasone can inhibit PGF2 alpha synthesis and increase PGE2 secretion, which inhibits luteolysis and maintains the formed CL (Leung et al. 2001) or it may be due to that dexamethasone would increase serum cholesterol level (Sami et al. 2015) which is the precursor molecule for progesterone synthesis by CL (Reckawiecki et al. 2008).The effect on the day of mature CL formation, number of mature CL and the decrease in fetal losses upon administration of GnRH may be attributed to that GnRH may enhance formation of accessory CL which could produce more progesterone that may asses in reduction of fetal losses(Hashem et al. 2015). Finally, our treatment protocols did not reveal any significant effect on the birth weight of the feti or their weights after 60 day which did not run in the same track with the results of Koyuncu et al. (2008) who reported a significant elevation in these parameters upon administration of dexamethasone to ewe, this conflict may be owed to species differences, nutrition system or the administrated

dexamethasone dose. In conclusion, this study demonstrated that administration of dexamethasone, GnRH and the combination between them may serve as effective practical protocol for improving fertility in native Baladi goats by decreasing the time needed for appearance the signs of estrus, day of mounting, day of proestrus, the day of ovulation, day and numbers of mature CL formation. Furthermore, it improved the pregnancy rate and decreasing the fetal losses.

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