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ORIGINAL ARTICLE

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Effect of Gonadotrophin Releasing Hormone (GnRH) on the Reproductive Performance in Ossimi Ewes

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Abstract

This study aimed to evaluate the influence of gonadotrophin releasing hormone (GnRH) administration to Ossimi ewes before mating on their conception, lambing and prolificacy rates, and their mean lambs' birth weights. Twenty-one (three to five years old) Ossimi ewes and five (three to four years old) rams, (58.6±4.75kg) were recruited for this study. Ewes were allocated into three groups (7 ewes each) and synchronized with two doses of prostaglandin F2 alpha (PGF2 α) 11 days apart. Ewes of the first group (35.3±5.62kg) were flushed with corn (0.5 kg/ewe/day) for two weeks before and two weeks after mating, while ewes of the second group (37.37±7.03kg) received one ml of GnRH, 24 hours after the second dose of PGF2α. Ewes of the third group (35.28±4.11kg) served as a control. Results of this study illustrated that GnRH group had higher conception (85.71%) and lambing (85.71%) rates than corn (71.43%, 71.43%) and control (42.85%, 42.85%) groups respectively. But the difference was not significant ($p > 0.05$). Prolificacy rate (100%) was the same for all groups ($p > 0.05$); there was no twin lambing in all groups. Also, the mean lambs' birth weight was non-significantly ($p > 0.05$) higher in GnRH (1.88 kg) than corn (1.82 kg), and control (1.87 kg) groups respectively. In conclusion, administration of GnRH to Ossimi ewes before breeding non-significantly enhanced their conception and lambing rates, and the effect on mean lambs' birth weights was very limited.

Keywords

Birth Weight, GnRH, Prolificacy, Ossimi Ewes

1. Introduction

Sheep are considered one of the most important farm animals after cattle as a source of red meat all over the world which contribute to about 6 % of the total red meat produced. Sheep are considered a paramount component of livestock production in Egypt; accounts for approximately 30% of total agricultural income **(Elshazly and Youngs, 2019).** The total population of sheep in Egypt has increased notably in the last two decades to reach about 5.69 million heads in 2019; this increase was attributed to their grazing ability and their need to very low amount of concentrate food **(Elshazly and Youngs, 2019).**

One of the most common breeds of sheep in Egypt is Ossimi breed which characterized by extended breeding season, high fertility and low prolificacy **(Gabr et al., 2016; Emeash and Mostafa, 2010; Almahdy et al., 2000).** Also, it is considered small to medium sized breed **(Elshennawy, 1995);** its population is over 514,000 heads and it is found in South of Nile Delta **(Galal et al., 2005).** Improving the reproductive performance of ewes will increase the number of lambs born which is considered an important demand in the development of sheep production in Egypt **(Mostafa and Farghal, 2022).**

Ovulation rate in sheep can be improved by giving GnRH at different times such as at the onset of estrus **(Naqvi and Gulyani, 1998)** or two days after the second dose of PGF2 alpha **(Sirjani et al., 2012)** or four days after insemination **(Fernandez et al., 2019).** It was reported that exogenous GnRH treatment immediately after insemination increased the multiple birth rates of low prolific ewes through enhancing ovulation **(Türk et al., 2008).** Treatment with GnRH agonists results in an endogenous release of LH surge within one to four hours post-administration **(Cam and Kuran, 2004; Cavalcanti et al., 2012).** This surge is essential for the occurrence of many critical reproductive

events such as oocyte maturation and ovulation **(Khan et al., 2003; Inskeep, 2004).**

Furthermore, **Sirjani et al., (2012)** mentioned that adminstration of a dose of GnRH at the onset of estrus increased the lambing and twinning rates in Afshari ewes of the control and FSH (Follicular stimulating hormone) treated groups. Additionally, **Lashari and Tasawar (2010)** declared that GnRH treated Lohi ewes had higher ovulation rate than ewes of control group, but the difference was non-significant, while higher pregnancy, lambing and twinning rates ($P<0.05$) were observed in GnRH treated group than control group and the lambs born from GnRH treated ewes had higher birth weight than those from control ewes.

It was clear that after giving GnRH to Karayaka and Karayaka x Sakiz crossbreeds, the ewes in GnRH treated group had higher pregnancy, twinning and lambing rates when compared to control ($P<0.05$) group, but GnRH administration did not affect ($P>0.05$) the birth weight of the lambs **(Cam et al., 2002).** Moreover, **Jordan et al., (2009)** declared that administration of GnRH four days before introduction of rams or four days before and one day after introduction of rams increased the pregnancy rate than the ewes did not receive GnRH treatment. In a study by **Hashem et al., (2015)** on Rahmani sheep, they referred that giving single dose of GnRH at the time of estrus could be used to enhance lambing and fecundity rates through decreasing pregnancy loss from day 40 after mating.

Reyna et al., (2007) mentioned that the ovulation rate was 100% in Merino ewes given GnRH before mating during the breeding season. Moreover, during anestrous season in anestrous Romney ewes, 26.7 and 50% of the respective 125 ng/h and 250 ng/h GnRH-treated ewes ovulated and none of the control ewes ovulated **(McNatty et al., 1988).** In addition, **Naqvi and Gulyani (1998)** declared that using GnRH with PMSG (pregnant mare serum gonadotrophin) or with PMSG plus FSH treatment increased the ovulation rate in Fine Wool Synthetic ewes. Also, there was a significant greater fertilization rate in GnRH treated Merino ewes compared to ewes that did not receive GnRH before breeding **(Menchaca et al., 2009).**

2. Materials and Methods

2.1. Animals and Management

This study was conducted at Agricultural Research Center belonging to Minia University, Shosha village, Samalut city, El-Minia, Egypt throughout the period from January to July 2018.

Twenty-one (three to five years old) Ossimi ewes were housed in three pens (5 x 8m). Also, five rams (58.6 ± 4.75kg) three to four years old were recruited for this study. Ewes were kept outdoors with a shelter during the day and housed in a semi-open barn at the night. They start grazing at early morning and return to the farm after two or three hours. They were fed a well-balanced ration according to their body weight requirements that contains sugar beet meal (10%), soyabean meal (10%), yellow corn (48%), bran (18%), salt (1%) and vitamin & mineral mixture (1%); this ration was offered to the animals all the study period in addition to Egyptian barseem in winter and hay in spring. Clean fresh potable water was offered to animals as a free choice. All animals were clinically normal with a healthy appearance. In addition, they were vaccinated against foot and mouth disease, sheep pox, clostridial diseases and pasteurellosis as recommended **(OIE, 2021; Tizard, 2021).** Also, they were drenched against endoparasites with broad spectrum anthelmintics and sprayed against ectoparasites with suitable insecticide every three months **(Ward et al., 2020).**

The ewes were randomly selected, equally allocated into three groups (seven ewes each) and synchronized with two doses of prostaglandin F2 alpha (PGF2 α) 11 days apart. The ewes of the first group (35.3 ± 5.62kg) were flushed with 0.5 kg of corn grains for each ewe daily for two weeks before and two weeks after mating, while the ewes of the second group (37.37 ± 7.03kg) were administered one ml of GnRH (Overluin, Bayer Company, New Zealand) 24 hours after the second dose of PGF2 alpha or once the signs of estrus were detected **(Hashem et al., 2015).** Ewes of the third group (35.28 ± 4.11kg) served as a control. Ewes were subjected to natural mating by proven-fertile rams. Each ewe was introduced separately to the ram two days after the second PGF2 alpha injection at a mating pen (5 x 8m) designed especially for this purpose. To eliminate the ram's effect, each ram was allowed to mate equal numbers of ewes from each group (ram/4-5 ewes). After mating has occurred, the ewes returned to their pens. Then they rejoined the main flock after two weeks from the mating day.

2.2. Parameters Measured

Conception rate: (number of ewes conceived on day 35/ number of exposed ewes) x 100
Lambing rate: (number of ewes lambed/ number of exposed ewes) x100
Prolificacy rate: (number of born lambs/ number of lambed ewes) x 100
Birth weight of lambs: newborn lambs were weighed immediately after parturition.

2.3. Statistical Analysis

All data were analyzed by using SPSS software (version 23, 2015). Shapiro-walk W test was used to investigate the normal distribution of the data. Due to the non-normality and the low sample size of the data, non-parametric tests were used for its analysis. Differences in conception, lambing and prolificacy rates of the corn, GnRH and control groups were analyzed by using fisher's exact test and the differences in the means of lambs' birth weights between corn, GnRH and control groups were analyzed by Wilcoxon test.

3. Results

The results summarized in **Fig (1)** referred that there are no significant differences ($p>0.05$) in conception (71.43%, 85.71%, 42.85%), lambing (71.43%, 85.71%, 42.85%) and

prolificacy rates (100%, 100%, 100%) between corn, GnRH, and control groups respectively. However, conception and lambing rates were higher in GnRH group than corn and control groups and there was no twin lambing in all groups.

Regarding the lambs' birth weights, the differences among means of corn-flushed (1.82kg), GnRH treated (1.88kg) and control (1.87kg) groups were non-significant (p>0.05) as illustrated in **Table (1).**

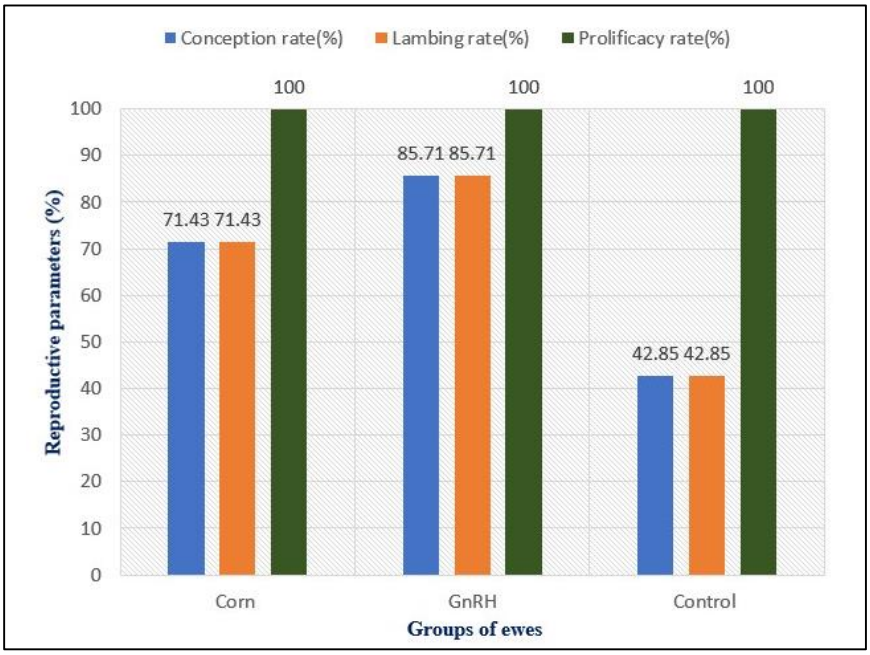

Fig 1. Effect of GnRH administration to Ossimi ewes on their conception, lambing and prolificacy rates

Table (1). Effect of GnRH administration to Ossimi ewes on their lamb's birth weights

	Treatments		
Parameters	**Corn-flushed**	**GnRH**	**Control**
Number of ewes	**7**	**7**	**7**
Number of lambed ewes	**5**	**6**	**3**
Number of lambs	**5**	**6**	**3**
Average lamb's birth weight (kg)	**1.82 ± 0.09**	**1.88 ± 0.06**	**1.87 ± 0.07**
p- value		**NS**	

Results are expressed as means ± S.E, NS: Non-significant

4. Discussion

The effect of GnRH on the prolificacy rate in Ossimi ewes was summarized in **Fig (1).** The current results indicated that ewes treated with GnRH had non-significant higher (p>0.05) conception and lambing rates than ewes flushed with corn and ewes in control group. The prolificacy rate was the same and no twin birth was recorded in all groups. The obtained results were in the same line with prior research of **Olivera-Muzante et al., (2013)** who reported non-significant difference in ovulation and prolificacy rates between control and GnRH administered Corriedale ewes (P>0.05), as well as **Jordan et al., (2009)** reported that administration of GnRH at introduction of rams did not increase rates of pregnant or lambing ewes. Furthermore, **Hashem et al., (2015)** clarified that administration of GnRH at the time of estrus or at day seven post-mating or at both days did not increase ovulation or conception rates in low prolific Rahmani ewes, however, GnRH enhanced lambing and fecundity rates due to reduction of pregnancy loss. Also, it was referred to presence of non-significant differences in conception, lambing and twining rates in Egyptian Ossimi ewes when flushed with corn and soybean meals before mating **(Mostafa and Farghal, 2022).**

In contrast, **Sirjani et al., (2012)** illustrated that giving GnRH at the onset of estrus increased the lambing and twinning rates in Afshari ewes of the control and FSH treated groups. Moreover, it was declared that Lohi ewes treated with GnRH had higher lambing rate (83.30%) than control (60%) group (P<0.05) and higher twinning rate (P<0.05) than control (number of twins was 28 in treatment ewes Vs 10 in control ewes) group **(Lashari and Tasawar, 2010).** Furthermore, **Cam et al., (2002)** clarified from a study on Karayaka and Karayaka x Sakiz second generation crossbred ewes that the ewes in GnRH treated group had higher pregnancy rate (84%) than control (66%) group (P<0.05), higher twinning rate when compared to control group (P<0.05) and higher lambing rate than those in control group (P<0.05). The difference from our results may be attributed to the use of low prolific breed (Ossimi ewes), thus the prolificacy rate was low even after treatment with GnRH.

Therefore, it was expected to be less responsive to GnRH than high prolific breeds.

Many studies explained the reason for our non-significant results such as, **Mandiki et al., (2000)** clarified that the genotype of ewes may affect their response to exogenous GnRH and the response was better in the high prolific ewes compared with the low prolific ones. Also, it was observed that sexual behavior of Ossimi rams was greatly influenced by their age **(Mostafa and Farghal, 2019).** Therefore, the age of Ossimi ewes perhaps plays a factor as in Ossimi rams and needs to be studied as well.

Moreover, **Naqvi and Gulyani (1998)** declared that using GnRH at the onset of estrus prior to ovulation in combination with PMSG (pregnant mare serum gonadotrophin**)** improved the ovulation rate in crossbred Fine Wool Synthetic (FWS) ewes aged four to five years. So, the use of GnRH alone could not improve the ovulation rate in ewes.

Regarding the effect of GnRH administration on lamb's birth weight, the results illustrated in **Table (1)** revealed that there were no significant differences (p> 0.05) in birth weight of lambs born to ewes in corn, GnRH and control groups which run in parallel with results that reported by **Cam et al., (2002)** who found that administration of GnRH to ewes did not affect the birth weight of their lambs (P> 0.05) on a study in Karayaka and Karayaka x Sakiz second generation crossbreeds. Moreover, **Mostafa and Farghal (2022)** referred to flushing Ossimi ewes with corn or soybeans two weeks before and two weeks after mating did not improve the average birth weights of the lambs born to these ewes.

Conversely, these results were inconsistent with that reported by **Lashari and Tasawar (2010)** who illustrated that adminstration of GnRH to Lohi ewes resulted in higher birth weight of lambs than those from control ewes, which may be ascribed to the similarity in age (3-5 years) and body weight of ewes in corn, GnRH, and control groups.

5. Conclusion

The effect of GnRH administration to the Egyptian Ossimi ewes before breeding resulted in a limited non-significant improvement in conception and lambing rates and there was no improvement in the prolificacy rate. Also, the lambs' average birth weight to GnRH administered Ossimi ewes was not significantly different from the lambs born to the control ewes. So, it is not recommended to use GnRH to enhance the reproductive performance of Ossimi ewes due to its low effect and relatively high price. Perhaps the use of other alternatives such as genetic improvement would be a better choice.

6. Authors Contributions

All authors contributed equally to study design methodology, interpretation of results and preparing of the manuscript.

7. Conflict of Interest

The authors declare no conflict of interest.

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