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Impact of different doses of a preparation with gonadotropic action on reproductive parameters in ewes in the estrous season

Tsvetomira Bancheva* and Svetoslava Stoycheva

Agricultural Academy, Research Institute of Mountain Stockbreeding and Agriculture, 5600 Troyan, Bulgaria
**Corresponding author:* cvetomira_16@abv.bg

Abstract

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The study was conducted to determine the effect of the administration of different doses of PMSG (Pregnant mare's serum gonadotropin) on reproductive performance in ewes of the Staroplaninski Tsigai breed.

The experiment was conducted at the beginning of the estrous season (July-August) on 30 Staroplaninski Tsigai ewes. 3 groups of 10 animals were formed (1 control and 2 experimental groups). Induction of synchronous estrus was performed with vaginal tampons containing 60 mg of medroxyprogesterone acetate (MAP). In both experimental groups, the vaginal tampons remained in the ewes vagina for 12 days, and on the day of removal of the tampons, the ewes of the 1st experimental group were injected with 400IU PMSG and those of the 2nd experimental group 500IU group. Animals in the control group were not treated according to the above scheme. The insemination was natural with siring rams, by the hand release method.

In the ewes of the 1st experimental group (400IU), estrus was synchronized in 100% of the animals at the 56th hour. While in the 2nd experimental group (500IU), the estrous synchronization was recorded in 90% of the animals, with one ewe did not show any estrous traits and was not inseminated. In the control group, which included non-treated animals according to the adopted estrous synchronization scheme, no ewes were recorded in estrus and were not inseminated.

The results show that the two doses of gonadotropin (400UI and 500UI) increased the studied reproductive indicators in Staroplaninski Tsigai ewes, at the beginning of the estrous season. The following values of the reproductive indicators were reported in the two experimental groups: 1st experimental group – fertility – 90.0%, 155.5% biological fecundity and 44.4% twinning; 2nd experimental group – 70.7% fertility, 150.0% biological fecundity and 33.2% twinning. The gestation length of ewes in the present study averaged 146 days.

Keywords: ewes; estrous synchronization; estrous season; fertility; fecundity; PMSG

Introduction

A key element in biotechnology for intensification of the reproductive process in small ruminants is the estrous synchronization and ovulation. It provides the fastest way to carry out the insemination of ewes, lambing, weaning and the realization of lambs of equal age and live weight (Abecia et al., 2012), as well as to concentrate the work and labour costs of farmers (Habeeb & Kutzler, 2021).

The administration of progestagens together with gonadotropins is a routine method of inducing estrous and ovulation. Estrous synchronization focuses on controlling the luteal phase of the cycle because it is longer and easier to manipulate. Exogenous progesterone is most commonly administered in the form of fluorogestone acetate (FGA) or medroxyprogesterone acetate (MAP) impregnated vaginal tampons that remain in the ewes vagina for 6–14 days (Wildeus, 2000; Mohan, 2017).

Preparations with gonadotropic action are injected from -48 to 0 hours after removal of the tampon. The most commonly used preparation has the active ingredient equine cho-

rionic gonadotropin (eCG). In ruminants, eCG stimulates follicle growth by binding mainly to the FSH (Follicle-stimulating hormone) receptor, but also to the LH (luteinizing hormone) receptor (Murphy, 2012).

A significant problem in estrous synchronization is achieving higher fertility and fecundity (Monika, 2001).

Injection of PMSG after exposure to progestagens has been found to improve synchronization, increase the number of ovulatory follicles and the rate of multiple parturitions (Boscos et al., 2002; Maurel et al., 2003). However, the response of each breed to the type, time and amount of gonadotropin used is not identical (Gokçen et al., 1992).

The dose of the applied gonadotropic preparation needs to be tailored to the breed, the body condition of the ewe and the season (Gibbons & Cueto, 2012).

During the estrous season, the dose of gonadotropin should be higher in breeds with lower fertility and lower in breeds with higher fertility (Bonev et al., 2002). Increasing the dose of exogenously administered serum gonadotropins (800 – 1000IU PMSG) leads to an increase in the number of antral follicles and multiple pregnancy, but carries risks of the occurrence of cystic changes and increased fetal mortality (Ralchev et al., 2007).

In the breeding season, Timurkan & Yildiz (2005) administered different doses of PMSG (500, 600, 750IU) to Hamdani ewes. The authors found that increasing the dose of gonadotropin (750IU) increased the estrous synchronization, as well as fertility, fecundity and twinning. Identical conclusions were drawn by Aköz et al. (2006) for Akkaramn-crossbred ewes, in the breeding season. According to them, injection of 700 IU PMSG improved the reproductive performance of ewes, regardless of the dose of progestagen (30 mg or 40 mg FGA).

In Assaf ewes, Atalla (2018) reported an increase in reproductive performance after estrous synchronization with 60 mg of MAP and injection of 300 and 600IU PMSG during the anestrous season.

Zonturlu et al. (2011) naturally inseminated Awassi ewes after estrous synchronization with vaginal tampons impregnated with progesterone and different doses of PMSG (300, 400 and 500UI). Estrous response was similar between groups – 81.0–92.6%, fertility in all three groups was between 80.0–82.6% and fecundity was 107–121%.

The gestation length in ewes was 142 to 152 days and is affected by the year, age of the ewes, type of birth, weight of the lamb and other factors. Differences are observed, both between breeds and between individuals (Öztürk & Aktaş, 1996).

For the Staroplaninski Tsigai breed, there is little information in the literature regarding the dose of gonadotropin and its impact on reproductive indicators in the estrous season.

The aim of the present study is to evaluate the effect of the administration of different doses of PMSG on reproductive performance in Staroplaninski Tsigai ewes breed at the beginning of the breeding season.

Materials and Methods

The study was conducted at the Scientific and Experimental Base of the Research Institute of Mountain Stockbreeding and Agriculture, Troyan. The site is located at an altitude of 400 m, 42.883N degrees latitude and 24.717E longitude. During the experiment, all ewes were kept in the shed and fed with a ration containing 1.5 kg hay/per head and 0.5 kg/per head of concentrated feed. Free access to water and salt was provided.

The experiment was conducted at the beginning of the estrous season (July–August) on 30 ewes of the Staroplaninski Tsigai breed. 3 groups of 10 animals were formed (1 control and 2 experimental groups). The ewes from the experimental and control groups were equalized according to the principle of analogues, by breed composition, age (2.5–5.5 years), number, live weight (45–48 kg) and reproductive status (all ewes lambed in January).

Induction of synchronous estrous was performed with vaginal tampons Syncropart (Seva Sante Animale, France), containing 60 mg of medroxyprogesterone acetate (MAP). In both experimental groups, the vaginal tampons remained in the ewes vagina for 12 days, and on the day of removal of the tampons, the ewes of the 1st experimental group were injected with 400IU Folligon (Intervet, Holland) and those of the 2nd experimental group 500IU group. Animals in the control group were not treated according to the above scheme.

We performed the clinical manifestation of estrus using tester rams, on the 24th, 48th, 56th and 68th hours after tampon removal. The manifestation of the "immobility reflex" of the ewe towards the tester ram was accepted as a sign of manifestation of estrous activity.

The insemination was natural with siring rams, by the hand release method. The rams of the Staroplaninski Tsigai breed, aged 3–4 years, in good physical and healthy condition, were used.

Reproductive characteristics, such as synchrony in the manifestation of estrus, fertility, biological fecundity and twinning, were calculated according to the following formulas:

- Synchronicity in the manifestation of estrus after removal of tampons, % – number of ewes in estrus/total number of ewes × 100;
- Fertility, % – number of ewes inseminated/total number of ewes inseminated × 100;
- Biological fecundity, % – the total number of lambs

(liveborn+stillborn+abortions)/number of lambed ewes × 100;
– Twinning rate, % – number of ewes that gave birth to twins/number of pregnant ewes × 100;
– The duration of pregnancy was also recorded for each ewe.

One ewe from the 2nd experimental group aborted in the third month of pregnancy.

The obtained data were processed by variational analysis. The effect of dose on biological fecundity and gestation days was determined by one-way analysis of variance (ANOVA), the significance of the effect of the factor was determined by Fisher's F-test values. Statistical processing was done with Microsoft Excel.

Results and Discussion

In the control group, which included animals not treated according to the adopted estrus synchronization scheme, no ewes were recorded in estrus and were not inseminated.

In ewes from both experimental groups, estrous was recorded in 90% (500UI PMSG) and 100% (400UI) of the animals at the 56th hour. During the next 12 h some of the animals still manifested estrus. One ewe from the 2nd experimental group did not show estrous signs and was not inseminated.

Our high results for synchrony in the manifestation of estrus confirm the effect of treatment with progestogens and gonadotropins established in many studies.

According to different authors, it varies between 85 and 100%, as indicated by Ataman et al. (2006) and Aköz et al. (2006) for Akkaraman crossbred ewes; by Zeleke et al. (2005) for the Dorper breed and by Timurkan & Yildize (2005) for the Hamadani breed). Barrett et al. (2004) reported 100% synchronization of oestrus, in the breeding season, in the Western White Face breed (a cross between the Columbia and Rambouillet breeds).

Similar results to ours, but for another Bulgarian breed, were obtained by Stoycheva & Kirilov (2014) with calls from the Pleven Black-headed. In their study, 98.33% of treated animals showed signs of estrus between 48 and 60 h after PMSG treatment.

The presented high effect of the preparations on synchronization according to foreign studies is also observed in the non-breeding season. In Persian Karakul breed, Hashemi et al. (2006) applied a synchronization scheme identical to ours, but in the non-breeding season. The authors reported 100% synchronized estrus.

While Simonetti et al. (2000) recorded 80.9% estrous synchronization in Merino ewes treated with 60 mg MAP alone, without the injection of gonadotropin. The lower percentage of synchrony in estrous could be explained by the lack of gonadotropin, which accelerates the onset of estrous.

The results of the study by Da Silva et al. (2021) showed that 70–80% of Santa Inês ewes showed signs of estrous by the 54th hour. The lower values of the indicator are probably due to the influence of the breed.

The preparation injection with a gonadotropic effect affects the number and growth of ovarian follicles. A decisive condition for its application is the refinement of the dose, since it is too individual for each animal and breed (Simonetti et al., 2002).

Salehi et al. (2010) reported that variation in superovulatory response was observed among different sheep breeds.

In the present study, high fertility was reported in both experimental groups – 90% (1st experimental group) and 77.7% (2nd experimental group).

Biological fecundity and twinning also increased in both experimental groups, respectively – 155.5% and 44.4% (1st experimental group) and 150% and 33.2% (2nd experimental group) (Figure 1).

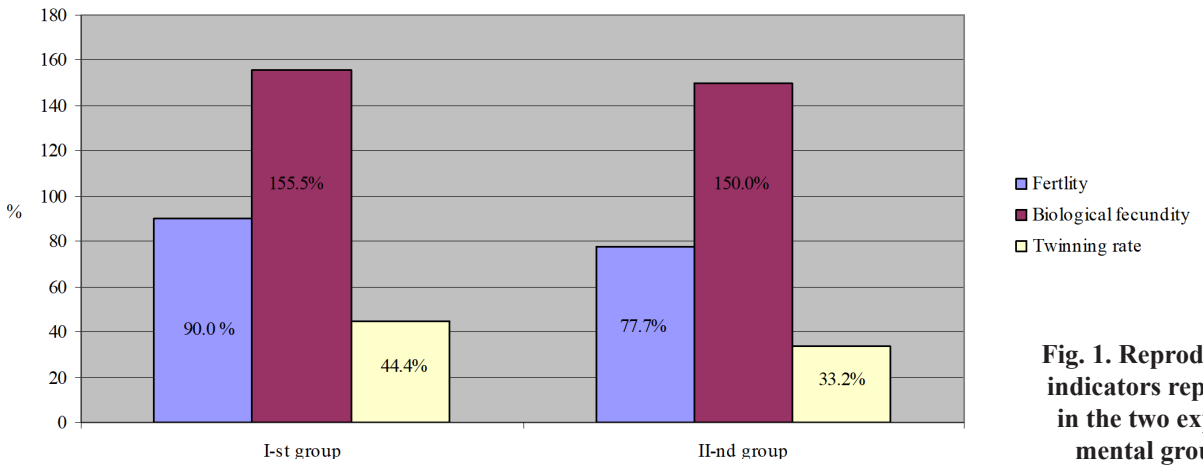

Fig. 1. Reproductive indicators reported in the two experimental groups

In the present study, no significant influence of the dose of gonadotropin on the biological fertility of ewes from the experimental groups was found (Table 1, P > 0.05).

In Chall ewes injected with 550 and 650IU PMSG each in breeding season, Moakhar et al. (2012) recorded lower than our fertility rate (75.0%).

According to Yavuzer (2005), fecundity in ewes increases by 20-50%, after the administration of preparations with gonadotropic action, which corresponds to what we obtained.

Slavova et al. (2013) reported 72.92% fertility and 163.92% biological fecundity in ewes of the Thracian fine fleece breed, inseminated during the anestrous season (m. May) after estrous synchronization with progestagen (12 days) + 500IU PMSG. While in ewes of the same breed, but inseminated in the estrous season (July–August), without estrous synchronization, the authors reported a higher fertility rate (83.58%), but a lower biological fecundity – 119.27%.

In an experiment conducted with 150 Tsigai crossbred ewes in anestrous season (m. April), after synchronized estrous with progestagen (14 days) + 500IU PMSG, Yankov & Hristova (2006) recorded 42.7% fertility and 165.6% biological fecundity.

Ince & Karaca (2009) reported 72–79% fertility and 133–149% fecundity, in 120 Chios × Kivircik (F1) ewes, following the use of 40 mg fluorogestone acetate (FGA) and 400 and 500IU PMSG, during the breeding season.

The results of the present study on the estrous synchronization and fertility correspond with those reported by the authors presented so far. While fecundity and multiple parturition are higher in the present experiment.

The study of preparations with gonadotropic action in many studies has focused on determining the optimal dose. In the present study, no significant influence of the dose of gonadotropin on the biological fecundity of ewes from the experimental groups was found (Table 1, P > 0.05).

Data on the effect of the dose of gonadotropin on the monitored reproductive parameters have been presented in many foreign studies. Timurkan & Yildiz (2005) synchronized estrus in ewes of Hamdani breed, in the estrous season, on the regimen of progestagen + 500, 600 and 700IU of PMSG. The authors report 100% estrous synchronization, fertility – 90.6%, 93.7% 100% and fecundity – 106%, 125% and 140% The most twinning ewes were reported at the 600 IU dose (18%), with three at 750IU (12.5%).

After treating Kurdi ewes with progestagen and different doses of gonadotropin (300, 400, 500 and 600IU), in the breeding season, Nosrati et al. (2011) recorded 63.7%, 66.1%, 65.8% and 67.9% fertility and 1.11, 1.30, 1.34 and 1.46% fecundity. The dose of 600IU PMSG resulted in the highest number of parturition (58.9%), (P < 0.05).

Lower fertility (37.5 – 44.0%) and fecundity (111.0 – 123.0%) were reported by Kuru et al. (2017) in a study involving the use of 60 mg MAP (for 11 or 14 days) and 500 IU PMSG, in ewes of Pirlak breed, in the anestrous season.

In the same season, Moradi-Kor et al. (2012) found higher reproductive performance in ewes of the multifertile Iranian Kermani breed after administration of 30 mg FGA and 350, 500 and 650IU PMSG.

30 mg FGA и 350, 500 и 650IU PMSG. Fertility and fecundity at different doses are: 350IU – 73.73% and 147.80%, at 500IU – 62.0% and 135.5% at 600IU –79.78% and 169.0%.

In ewes of the MIS breed (crossings of Pirot Pramenka × Merinolandschaf × Ile de France), Maksimović et al. (2020) synchronized estrous according to the scheme 30 mg FGA in combination with 500IU PMSG and natural insemination. The authors report 57.14% fertility, 182% biological fecundity.

The differences between the results obtained in the present study and those of other investigators are probably due to the breed of ewes used and the seasons in which the studies were conducted.

An adequate dose of PMSG was found to improve proliferation, but administration of high doses induced multiple pregnancy, which could lead to increased fetal mortality (Ataman et al., 2006; Maksimović et al., 2015).

In each of the two experimental groups, 1 ewe gave birth to 3 lambs, and there was 1 stillborn, which corresponds to the above. This shows that it is about individual reactivity of the ewe to the dose of the gonadotropic preparation.

Maksimović et al. (2020) reported 15.07% stillborn lambs in MIS ewes and 147.11±0.14 days average gestation length.

In the present study, the average was 146 days (146.33±0.50 – in 1 experimental group and 146.83±0.98 – in 2 experimental groups), with variations from 144 to 151 days. No effect of the dose on the gestation length was found (Table 2, P > 0.05).

Table 1. Effect of Gonadotropin Dose (400 or 500UI PMSG) on biological fecundity

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.01	1	0.01	0.01	0.89	4.67
Within Groups	7.72	13	0.59			
Total	7.73	14				

Table 2. Length of gestation period in ewes treated with 400 or 500UI PMSG

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.9	1	0.9	0.25	0.63	4.67
Within Groups	46.83	13	3.60			
Total	47.73	14				

In Nigerian Balami ewes, Uda and Yankasa, Iyiola-Tunji et al. (2010) reported similar gestation length ranging between 150.3±0.61 days and 153.3±0.60 days, except for purebred Balami ewes, in which a shorter gestation length was registered (137.1±0.81 days).

According to different authors, the duration of the gestation period varies on average from 110.2±1.10 days in the Pakistani breed of Kari ewes (Ahmad, 2008), 140–153 days in the Romanov breed (Toshchev, 2003), 149–155 days in Awassi (Talafha & Ababneh, 2011) , 150–151 days Karayaka (Celik et al., 2021) to 152.34±0.36 days at Akkaraman (Öztürk et al., 2016).

According to a study by Shtugoreva (2021) the average gestation length in Tsigai ewes is 148±1.2 days, and in crossbreeds of Tsigai with Romanov, Texel and Edilbaevska it is, respectively, 150±2.0, 149±1.5 and 147±1.3 days.

Conclusion

100% estrous synchrony was recorded in ewes treated with 400IU PMSG and 90% in animals injected with 500IU.

A higher fertility rate (90%) was reported in the 1st experimental group (400UI PMSG) compared to the 2nd experimental group (77.7%).

155.5% biological fecundity and 44.4% twinning were found in the 400UI PMSG treated group and 150% and 33.3% respectively in the 500UI PMSG treated group.

An average duration of the gestation period of 146 days was found in both experimental groups.

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