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The role of exogenous melatonin and photoperiod on productive and reproductive performance of Ossimi sheep

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ABSTRACT

To determine effect of the administration of exogenous melatonin and photoperiod on initiating the lambing season and improving reproductive efficiency of sheep, a total of thirty-four multiparous, non-pregnant Ossimi ewes aged 3-5 years with average body weight 55.94±1.80 kg were used. After weaning and the starting of the breeding season, the ewes were divided into four groups; the 1st group (7 ewes) was exposed to natural daylight (NL) and severed as a control group, the 2nd group (9 ewes) was exposed to 16-hour artificial lighting (AL), the 3rd group (10 ewes) was exposed to natural daylight+18-mg/h melatonin (NL+MEL), while the 4th group (8 ewes) was exposed to 16-hour artificial lighting+18-mg/h melatonin (AL+MEL). The treatment of the ewes continued throughout the mating season and for three consecutive estrus cycles (60 days). Ewes were weighed before mating and after parturition. Reproductive traits were recorded after parturition. Results revealed that exogenous melatonin (induced by either natural daylight or artificial photoperiod) exhibited significantly ($P\leq0.05$) higher body weights (6.20±1.711 and 4.14±1.91kg for NL+MAL and AL+MEL groups more than the control group). Both of the melatonin treatment and the use of artificial light for 16 h insignificantly influenced reproductive parameters (percentages of fertility, conception rate, scanning, lambing rate, and fecundity rate of Ossimi ewes. Fertility and conception rates tended to be higher in (NL+MEL) and (AL+MEL) groups, while SP percentage, lambing and fecundity rates were higher in treated groups than control. The percentage of the number of services per conception (NSC) and abortion rate were insignificantly reduced in treated ewes as compared with the control. Both weaning rate and the survival rate was elevated ($P\geq0.05$) in treated ewes than untreated ones. Lambing interval and days open were significantly lower ($P\leq0.05$) in AL+MEL group than AL and NL+MEL groups. The lambs' weight at birth, weaning, net gain, and average daily gain tended to be higher in (NL+MET) and (AL+MEL) groups than other groups with insignificant differences. It can be concluded that, stimulation of melatonin (induced by natural daylight and artificial photoperiod manipulation) might be a useful tool in improving reproductive performance and lamb production in Ossimi sheep.

Keywords: Melatonin, photoperiod, productive and reproductive performance, Ossimi ewes.

INTRODUCTION

Seasonal breeding in animals is influenced by some exogenous (photoperiod, climate, nutrition, and management) in addition to endogenous (hormones, genotype) factors (Michael *et al*., 2020). Productivity in various species of farm animals, especially sheep, is limited by seasonality. Seasonality is clearly reflected in detectable changes in behaviour, gametogenesis and hormone secretion (Egerszegi *et al.*, 2014). Melatonin is an indoleamine, which is synthesized from the essential amino acid, tryptophan (Reiter *et al.*, 2013). Its production is dependent on ambient illumination, with the release being suppressed by light. The suprachiasmatic nucleus which is the major circadian oscillator that receives light input from the retina through the retinohypothalamic tract is the one that regulates the circadian melatonin production (Berson *et al.,* 2002). The pineal gland secretes melatonin hormone which has a controlling role on breeding season of ewes.

Seasonal anestrus reduces reproductive efficiency and hinders productivity. In adult ewes, melatonin implantation have been traditionally inserted around the time of the summer solstice in order to advance the breeding season (Haresign *et al.,* 1990). It has been demonstrated that melatonin given by injection, oral administration or as vaginal or subcutaneous implantation can advance the breeding season in ewes. Melatonin also affects the ovaries through a luteotrophic action both in vitro (Egerszegi *et al.,* 2014) and in vivo (Abecia *et al.,* 2007). It enhances the ovulation rate by decreasing the atresia of medium and large follicles (Forcada *et al.,* 2002a). Unlike Northern European sheep breeds, Mediterranean breeds have a short seasonal anestrus, especially when social (ram effects) or nutritional factors are appropriately managed (Lindsay, 1996). Mediterranean sheep breeds show an earlier onset of the breeding season, compared to genotypes located at higher latitudes, even when both are subjected to the same photoperiodic treatment (Martin *et al.,* 1999). Therefore, melatonin implantation in commercial Mediterranean flocks are usually inserted at approximately the time of the spring equinox (Forcada *et al.,* 1999).

Light and dark elicit contrasting effects on the secretion of melatonin from the pineal gland, such that the circulating melatonin is virtually absent during light exposure but rapidly increases upon exposure to darkness (Dahl *et al.,* 2000). The Pineal gland is able to measure day length and adjust secretion of melatonin, which inhibits the secretion of gonadotropic hormones, luteinizing hormone (LH), and follicle stimulating hormone (FSH) from the anterior pituitary by inhibiting the release of GnRH from the hypothalamus. The response to photoperiod or the relative duration of light and dark exposure within a day is the most commonly adopted environmental cue that alters the physiological responses as a result to any shift in their physical environment. The melatonin secretion drives differential secretion of other hormones to influence circadian and seasonal processes. Melatonin initiates a series of events resulting in the onset of the breeding season (Rosa and Bryant, 2003), which is mediated by photoperiod, directly influences reproductive function. The physiological reaction of organisms to the length of day or night is known as photoperiodicity (Wankhade et *al.,* 2019). Therefore, the administration of melatonin, either orally (Robinson *et al.,* 1992) or subcutaneously (Forcada *et al.,* 2002), has been used to induce reproductive activity in ewes. There is an accumulation of evidence suggesting that the pattern of melatonin secretion. The present study was conducted to evaluate the effects of exogenous melatonin under different photoperiods on the reproductive responses and some productive traits of female Ossimi ewes under Upper Egypt conditions.

MATERIALS AND METHODS

The study was conducted at the beginning of autumn season (September) of 2018 and continued until the summer (June/July) season 2019 at the research farm of Animal Production Department, Faculty of Agriculture, Al-Azhar University, Assiut Branch, Assiut, Egypt. The aim of the research was designed to know the role of exogenous melatonin and photoperiods on the productive and reproductive traits of Ossimi ewes.

Experimental animals care and feeding

Thirty-four multiparous; non-pregnant Ossimi ewes aged 3-5 years, with average body weight of 55.94 ± 1.80 kg., were shorn, weighed, wormed, hooves trimmed and number paint branded prior to being randomly allotted to the treatments. The animals were clinically healthy and free from reproductive disorders. All animals were housed in individual pens under a natural photoperiodic and thermo-periodic environment and had the same management conditions, throughout the experimental period. Throughout the experiment, the ewes were fed according to their physiological status. Beginning from the preparation of ewes for mating, to the end of the 4th month of pregnancy, all ewes were fed in accordance with NRC (1975), based on the seasonal feeds available, ewes were grazed Egyptian clover (Berseem) during winter and crop residues available besides the green maize (Darawa) during summer plus concentrate feed mixture at the rate of 1.25 kg/h/d which was gradually increased to 1.50 kg/h/d during late pregnancy and lactation periods. The concentrate pelleted diet contained 50 % ground corn, 16 % wheat bran, 17 % undecorticated cotton seed meal, 15% Soybean meal, 1.5% limestone and 0.5% salt (A concentrated feed mixture that provides 16% crude protein and 7.5 MJ net energy to animals). Wheat straw was provided to all ewes' *ad libitum*. Fresh water and mineralized salt blocks were freely available for animals all the time.

Experimental design

After weaning and at starting of the breeding season, ewes (n = 34) were divided into four groups: The 1st group (7 ewes) was exposed to natural daylight (NL) and severed as a control group, the second one (9 ewes) was exposed to 16-hour artificial lighting (AL), the third group (10 ewes) was exposed to natural daylight + 18 mg/h melatonin (NL+MEL), while the fourth group (8 ewes) was exposed to 16-hour artificial lighting + 18 mg/h melatonin (AL+MEL). Animals were treated with melatonin (Solarbio Life Science®, Beijing, China). The treatment of ewes continued throughout the mating season and for three consecutive estrus cycles (60 days). All ewes were placed upon observation to detect any cases of estrus. Heat detection was performed daily by visual observation and using three fertile rams in good health condition, with an age of 2 to 3 years. Ewe lambs stand firmly to the ram considered to be in heat. Trans-rectal ultrasound scanning was performed to diagnose pregnancy. Ewes were weighed before mating and after parturition. The mating and lambing date for each ewe was recorded. The experiment lasted through mating, pregnancy, parturition, and weaning of lamb from treated ewes. The period of weaning was expanded up to 3 months.

Measures of Ossimi Reproductive Performance

The criteria used in the current study to evaluate the effects of exogenous melatonin under different photoperiods included fertility (number of ewes pregnant /number of ewes mated), scanning percentage (number of fetuses scanned/number of ewes mated), conception rate (number of ewes lambed/number of ewes mated), lambing percentage (number of lambs born/number of ewes mated), fecundity rate (number of lambs born/number of ewes lambed), weaning rate (number of lambs weaned/number of ewes mated), survival rate (number of lambs weaned/ number of lambs born alive), abortion rate (number of aborted ewes/number of ewes pregnant), abortion (defined as the termination of a pregnancy), lambing interval (defined as the number of days occurring between two successive parturition), and days open (defined as the interval from lambing to conception (i.e the number of days between parturition and the insemination that resulted in pregnancy). Reproductive traits were calculated according to Olivier (2014). A number of treated ewes and their offspring are shown in Table 1.

Statistical analysis

The data of the reproductive trials and the productive performance of ewes and their obtained lambs were estimated using the General Linear Models (GLM) procedure for analysis of variance. The model used was:

Table 1. Number of ewes treated with melatonin under different photoperiods and their obtained lambs

Items	Ewes treatments			
	NL	AL	NL+MEL	AL +MEL
No of ewes mated	7	9	10	8
No of pregnant ewes	6	8	9	8
No of ewes lambed	5	8	9	7
No of lambs born	8	14	15	12
No of aborted ewes	1	0	0	1
No of lambs born alive	7	14	15	11
No of lambs died	1	1	1	1
No of lambs weaned	6	13	14	10

NL = Natural daylight (control group), AL = Artificial lighting (16 hour photoperiod), NL+ MEL = Natural daylight + 18 mg/h melatonin, and AL+MEL = Artificial lighting (16 hour photoperiod) + 18 mg/h melatonin.

$Y_{ijk} = \mu + \alpha_i + e_{ij}$, where Y_{ijk} = the trait of study, μ = the overall mean، α_i = the effect of the i^{th} treatment (i = NL, AL, NL+MEL, and AL+MEL) and e_{ij} as the experimental error. Duncan's multiple (1955) range tests were used to detect the differences among the treatments using the SPSS statistical package 22 (SPSS Institute, Chigaco, IL, USA). The data are presented as means ± SE.

RESULTS AND DISCUSSION

Initial ewes' weight at mating, final weight at lambing and body weight changes are illustrated in Table 2. Results revealed that exogenous melatonin (induced by natural day light and artificial photoperiod manipulation) exhibited significantly (*P≤0.05*) higher body weights changing by 6.20±1.711 and 4.14±1.91 for NL+MEL and AL+MEL groups than a control group (Table 2). The elevation of increased ewes' body weight in treated groups may be attributed to a high level of growth hormone in melatonin treatments, where Molik *et al.* (2010) demonstrated that the administration of exogenous melatonin in ewes lambing during shortening photoperiod caused a short term increase in the plasma growth hormone concentration. Interestingly, during this photoperiod, the plasma growth hormone concentration in the control group was almost 60% lower compared to the level recorded during the increasing photoperiod. Current results are in agreement with those of Solinska and Janicki (2004) and Rhind *et al.*, (1991), who reported that melatonin treatment results in decreased growth hormone secretion during periods of long photoperiod. Additionally, Udala and Błaszczyk (1999) demonstrated that the administration of exogenous melatonin in sheep exposed to long day photoperiod decreased the blood GH levels. It can therefore be assumed that there is a very strong relationship between melatonin, prolactin and growth hormone, indicating that photoperiod induces a biochemical signal. Thus melatonin might also be able to modify the concentration of the other hormones involved in milk production in nursing ewes.

The effects of melatonin and artificial light on Ossimi ewes were illustrated in Tables 3,4 and 5. As shown in Table 3, the melatonin treatment and use of artificial light for 16 hours insignificantly influenced the percentages of fertility, conception rate, scanning percentage, lambing rate, and fecundity rate of Ossimi ewes. Fertility and conception rates tended to be numerically higher in (NL+MEL) and (AL+ MEL) groups, while SP percentage, lambing.

Table 2. Effects of melatonin and photoperiod on initial, final and changes of Ossimi ewes body weights.

Ewes treatments	Items		
	Ewes initial weight	Ewes final weight	Body weight change
NL(Control)	56.88 ± 4.13	56.63 ± 2.58	-0.25±2.05[c]
AL	58.11 ± 4.38	64.00 ± 3.68	5.89±1.80[a]
NL+MEL	55.10 ± 2.55	61.30 ± 2.94	6.20±1.71[a]
AL+MEL	53.29 ± 3.77	57.43 ± 3.17	4.14±1.91[ab]
Total mean	55.94 ± 1.80	60.12 ± 1.59	4.18 ± 1.17
Significance	ns	ns	**

NL = Natural daylight (Control group), AL = Artificial lighting (16 hour photoperiod), NL+ MEL = Natural Daylight + 18 mg melatonin, and AL+MEL = Artificial lighting (16 hour photoperiod) + 18 mg melatonin.
[a,b], Means of the same column in each item with different superscripts are significantly different (P<0.05).

and fecundity rates were higher in treated groups than the control

Data in Table 4, illustrates the percentage of the number of services per conception (NSC) were significantly (P<0.05) reduced in treated ewes as compared with a control. The abortion rate was not significantly affected by treatment, weaning rate and the survival rate were elevated (*P≥0.05*) in treated ewes than untreated ones. Lambing interval and days open were significantly (*P≤0.05*) lower in AL+MEL group than in NL, AL and NL+MEL groups. Gestation length did not differ significantly among groups (Table 4). Moreover, as shown in Table (5), Melatonin treatment significantly (*P≤0.05*) influenced the lambing interval and days open with the treatment under natural or artificial lights. However, no significant effects for the treatment of the length of gestation period were found (Table 5). The previous results indicate that melatonin and artificial light seemed to affect some of the reproductive traits in the experimental ewes. These findings are in agreement with those reported by Maria *et al.* (2017) that melatonin able to advance reproductive activity in dairy sheep. Carcangiu *et al.*, (2012) added that melatonin has improved reproductive efficiency in different sheep breeds. There is an accumulation of evidence suggesting that the pattern of melatonin secretion, which is mediated by photoperiod, directly influences reproductive function (Cevik *et al.*, 2017).

Table 3. Effects of melatonin and photoperiod on percentages of fertility, conception rate, Scanning percentage (SP), lambing rate, and fecundity rate of Ossimi ewes.

Ewes treatments	Items				
	Fertility %	Conception rate	SP,%	Lambing rate	Fecundity rate
NL	85.71±0.14	71.43±0.18	128.6±0.18	114.3±0.26	140.0±0.24
AL	88.89±0.11	88.89±0.11	155.6±0.22	155.6 ±0.24	175.6±0.24
NL+MEL	90.00±0.10	90.00±0.10	160.0±0.16	150.0±0.22	150.0±0.17
AL+MEL	100.0±0.00	87.50 ±0.12	150.0±0.19	150.0±0.19	157.1±0.20
Total mean	91.18±0.05	85.29±0.06	150.0±0.01	144.1±0.11	155.7±0.10
Significance	ns	ns	ns	ns	ns

NL= Natural daylight (Control), AL = Artificial lighting (16 hour photoperiod), NL+ MEL = Natural daylight + 18 mg melatonin, and AL+MEL = Artificial lighting (16 hour photoperiod) + 18 mg melatonin.

The authors also reported that, the highest sexual receptivity associated with high fertility and conception rates. Zarazaga *et al.*, (2019) illustrated that the values for fertility and productivity were greater in melatonin

Table 4. Effects of melatonin and photoperiod on number of service per conception (NSC), weaning, abortion percentages and survival rates of Ossimi ewes.

	Items			
Ewes treatments	**NSC**	**Weaning rate**	**Abortion rate**	**Survival rate**
NL	1.71±0.18	85.71±0.34[b]	0.166±0.166	85.71±0.14
AL	1.67±0.17	144.4±0.24[a]	————	92.86±0.07
NL+MEL	1.30±0.15	140.0±0.27[a]	————	93.33±0.07
AL+MEL	1.25±0.16	125.0±0.31[a]	0.125±0.125	90.91±0.09
Total mean	1.47±0.087	126.5±0.14	0.064±0.045	91.49±0.04
Significance	*	ns	ns	ns

NL= Natural daylight (Control group), AL = Artificial lighting (16 hour photoperiod), NL+ MEL = Natural daylight + 18 mg melatonin, and AL+MEL = Artificial lighting (16 hour photoperiod) + 18 mg melatonin. NSC= number of service per conception. [a,b],Means of the same column in each item with different superscripts are significantly different (P<0.05).

Table 5: Effects of melatonin and photoperiod on lambing interval, days open and gestation length of Ossimi ewes

Ewes treatments	Items		
	Lambing interval, day	**Days open, day**	**Gestation length, day**
NL	274.67 ± 9.32 [ab]	123.14 ± 7.35[ab]	149.00 ± 2.95
AL	278.13 ± 6.57 [a]	124.44 ± 5.69[a]	151.63 ± 0.56
NL+MEL	277.11 ± 5.18 [a]	125.00 ± 5.37[a]	152.30 ± 2.48
AL+MEL	259.25 ± 3.87 [b]	108.89 ± 3.75[b]	150.38 ± 2.85
Total mean	272.29 ± 3.22[ab]	120.68 ± 2.90	151.00 ± 1.15
Significance	*	*	ns

NL= Natural daylight (Control group), AL = Artificial lighting (16 hour photoperiod), NL+ MEL = Natural daylight + 18 mg melatonin, and AL+MEL = Artificial lighting (16 hour photoperiod) + 18 mg melatonin. [a,b], Means of the same column in each item with different superscripts are significantly different (P<0.05).

groups than in the control group. Mousa and Mohamed, (2011) showed that conception rates were significantly influenced by using light and melatonin treatments.

In addition, a significant effect of time with melatonin treatment on fertility, litter size and fecundity for the three breeds under study (Awassi, Awassi crosses, and Ile de France ewes) were reported by Bonev, (2012). The increase in fertility and litter size resulted from improving luteal function and embryonic survival, probably by inducing a uterine environment that is more conducive to pregnancy (Abecia *et al.*, 2007). The authors explained this by the effect of melatonin on the corpus luteum and its ability to increase progesterone levels during the luteal phase and to support embryo development (Abecia *et al.*, 2007 and Chemineau *et al.,* 2008). Melatonin also affects the ovaries through a luteotrophic action both in vitro (Egerszegi *et al.*, 2014) and in vivo (Abecia *et al.,* 2007). This enhances the ovulation rate by decreasing the atresia of medium and large follicles (Forcada *et al.*, 2002b).

Also, melatonin shows a low blood-concentration during daylight and a high concentration during darkness, thus it can be considered as an organic informer of the annual photoperiodic trend (Carcangiu *et al.*, 2013). The differences in fertility rate found among treated and control ewes are mainly mediated by the direct effect of melatonin on the ovary (Yie *et al.*, 1995), as well as by its effect on gonadotropin secretion at pituitary-hypothalamic level (Viguié *et al.*, 1995). Cevik. *et al.*, (2017) showed that all the twinning rate, number of live offspring per ewe, and litter size were significantly higher in melatonin than in control ewes. In addition, the percentages of mated ewes that lambed and twinning rates were significantly higher in the group treated with melatonin than a control group (Bonev, 2012). As reported by Wellace *et al.*, (1988) melatonin increased the progesterone level due to its luteotropic effects and this enhanced embryonic survival. Haresign *et al.*, (1990) claimed that melatonin increases the ovulation rate. The researchers explained this by the effect of melatonin on corpus luteum and it's role on increasing the progesterone level during the luteal phase and supporting embryo development. In addition, studies approaching photoperiod manipulation in rabbits have generally shown a significant improvement in receptivity and fertility of does when the daylight length was artificially increased (Boyd, 1986).

Results in Table (6), show the means and standard errors of the growth performance of lambs for ewes treated with melatonin and artificial lighting. Data revealed that the lamb`s weight at birth, weaning, net weight, and average daily gain tended to be higher in (NL+MET) and (AL+MEL) groups than other groups with insignificant differences. These results are in agreement with those recorded by Mousa and Mohamed, (2011) who reported that the largest kit`s weight at birth and weaning was recorded in kits for does treated by melatonin. Gerencse´r *et al.*, (2008), added that the use of melatonin decreased the pre-weaning mortality level of kits compared to other treatment groups associated with improved nursing behavior for does in treated groups than a control one. Misztal, *et al.*, (2018), observed that sheep lambing during long days produces less milk and has shorter lactation than those naturally lambing during short days. They added that, the extended melatonin treatment in pregnant and lactating sheep causes an additional increase in prolactin which lead to increase in milk production in lactating ewes.

In this context, improved growth performance in lambs for treated ewes can be explained by Mousa and Mohamed, (2011),showed that feed intake and water consumption were significantly lower for rabbits kept under photoperiods 8, 10 and 12 HL than for those treated with melatonin and increased photoperiod (14 and 16 HL). This could be explained by light stimulation to the pineal function leading to increase in cortisol hormone in does expose to long daylight through activation of the hypothalamic-pituitary-adrenal axis and the consequent increase of plasma glucocorticoid concentrations. Other studies showed that, the photoperiod (PP) length is directly associated with the growth of calves and heifers, and also with the mammary tissue growth in case of heifers. The exposure of calves to long day photoperiod during growth phase yields larger, leaner animals at maturity (Wankhade *et al.*, 2019). Varlyakov, (1999) reported that sunlight and ultraviolet radiation are beneficial for the health of large ruminants and increase their productivity. Hansen *et al.*, (1983) added that increased photoperiod enhanced growth until the onset of sexual maturity.

Table 6. Effect of melatonin and photoperiod on growth performance of lambs

Ewes treatments	Items			
	Birth weight (kg)	**Weaning weight (kg)**	**Net gain (kg)**	**Average daily gain (g)**
NL	4.102 ± 0.322	20.90 ± 1.92	16.80 ± 1.78	186.7 ± 19.86
AL	4.078 ± 0.343	20.33 ± 1.36	16.26 ± 1.34	180.6 ± 14.95
NL+MEL	3.973 ± 0.303	21.82 ± 1.83	17.85 ± 1.74	198.3 ± 19.34
AL+MEL	4.370 ± 0.277	22.03 ± 0.90	17.66 ± 0.73	196.3 ± 8.169
Total mean	4.127 ± 0.151	21.32 ± 0.746	17.19 ± 0.70	190.9 ± 7.809
Significance	ns	ns	ns	ns

NL = Natural daylight(Control group), AL= Artificial lighting (16 hour photoperiod), NL+ MEL = Natural daylight + 18 mg melatonin, and AL+MEL = Artificial lighting (16 hour photoperiod) + 18 mg melatonin.

CONCLUSION

It could be concluded from the current results that melatonin (induced by natural daylight and artificial photoperiod manipulation) could be a useful tool to improve ewes' reproductive performance and lamb production of Ossimi sheep.

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دور الميلاتونين الخارجي وفترة الإضاءة على الأداء الإنتاجي والتناسلي للأغنام الأوسيمي

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أجريت هذه الدراسة بمحطة الانتاج الحيواني التابعة لقسم الانتاج الحيواني كلية الزراعة جامعة الازهر فرع اسيوط. وتهدف الدراسة إلى معرفة تأثير الميلاتونين وفترة الاضاءة على الاداء الإنتاجي والتناسلي للنعاج الأوسيمي ومواليدها. حيث استخدم في الدراسة عدد ٣٤ نعجة أوسيمي متعددة الولادات وغير عشار تتراوح اعمارها بين ٣-٥ سنوات وبمتوسط وزن جسم ٥٥,٩٤ ± ١,٨٠ كجم عقب الولادة والفطام قسمت النعاج عشوائيا الى اربعة مجاميع. وقد عرضت المجموعة الاولى (٧ نعاج)/ لضوء النهار العادي واستخدمت كمجموعة ضابطة دون أي معاملة، أما المجموعة الثانية (٩ نعاج) فقد عرضت فيها النعاج لإضاءة صناعية لمدة ١٦ ساعة يوميا، كما عوملت المجموعة الثالثة (١٠ نعاج) بالميلاتونين بمعدل ١٨ مجم/للراس مع ضوء النهار الطبيعي بينما عرضت المجموعة الرابعة (٨ نعاج) للإضاءة الصناعية لمدة ١٦ ساعة بالإضافة الى المعاملة بالميلاتونين بمعدل ١٨ ملجم/للراس. وقد إستمرت التجربة من بداية موسم التزاوج حتى الولادة والفطام، هذا وقد سجلت أوزان الجسم للنعاج عند بداية التجربة وبعد الولادة لمعرفة التغير في وزن الجسم كما سجلت اوزان الحملان بعد الولادة مرة كل اسبوعين. كما أنه تم تسجيل تاريخ التلقيح والاجهاض والولادة لكل نعجة وعدد النعاج التي لقحت والتي ولدت وتم حساب جميع الصفات التناسلية للنعاج.

وقد أظهرت النتائج أن التغير فى وزن الجسم للنعاج التى عوملت بالميلاتونين مع ضوء النهار الطبيعي او الصناعي كان أعلى معنويا (*P≤0.05*) مقارنة بالمجموعة الضابطة. ولم تظهر المعاملة بالميلاتونين أو الاضاءة أى تأثير معنوي على صفات الخصوبة، ومعدل الحمل، وعدد الاجنة الممسوحة، ومعدل الولادات فى النعاج الاوسيمى. على الرغم من عدم وجود تأثير معنوي للمعاملة الا أن تلك الصفات كانت أعلى رقميا فى المجموعات المعاملة مقارنة مع مجموعة الكنترول. هذا بالإضافة إلى أن عدد التلقيحات اللازمة للاخصاب كانت معنويا (*P≤0.05*) أقل فى النعاج المعاملة بالميلاتونين والاضاءة عن النعاج الغير معاملة كما ان معدل الاجهاض كان أقل ولكن لم يظهر اى فروق معنوية بين المعاملات. وقد إتضح أن معدل الفطام كان أعلى (*P≤0.05*) معنويا كما كان معدل البقاء مرتفعا (*P≥0.05*) في النعاج المعاملة مقارنة بالمجموعة الضابطة. الفترة بين ولادتين وعدد الايام المفتوحة كان معنويا (*P≤0.05*) اقل في المجموعة المعاملة بالإضاءة الصناعية مع الميلاتونين عن المجموعة التي عوملت بالإضاءة الصناعية او الميلاتونين فقط. ولم تتأثر فترة الحمل بالمعاملة, أيضا فإن أوزان الميلاد والفطام ومعدل النمو اليومي فى الحملان لم تتأثر بالمعاملة.

مما سبق يمكن استنتاج أن المعاملة بالميلاتونين فى ضوء النهار الطبيعي أو مع الإضاءة الصناعية يمكن أن يكون أحد العوامل الهامة لتحسين الأداء التناسلي للنعاج وإنتاج الضأن في الأغنام الأوسيمي.