

**EFFECT OF INDUCTION OF PARTURITION
BY USING PROSTAGLANDIN ANALOGUE
ON REPRODUCTIVE AND PRODUCTIVE
PERFORMANCE IN SUPEROVULATED
RABBIT DOES**
(With 2 Tables)

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**تأثير أحداث الولادة باستخدام البروستاجلاندين على الأداء التناسلي والإنتاجي
لإناث الأرانب التي تم إثارة التبويض لها**

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تم استخدام ٢٤ أنثى بوسكات غير مرضعة لدراسة تأثير أحداث الولادة باستخدام البروستاجلاندين على الأداء التناسلي والإنتاجي. تم عمل آثاره للتبويض لهذه الإناث باستخدام ٦٠ ميكروجرام من الهرمون المشيمي الخيلي (حقنت بمعدل ١٥ ميكروجرام يوميًا لمدة أربع أيام متتالية). بعد التزاوج مباشرة تم حقن الإناث بـ ٥٠ وحدة دولية من الهرمون الحاث للغدة المنسلية. وعند عمر ٢٩ يوم من الحمل تم تقسيم الإناث عشوائيًا إلى مجموعتين. المجموعة الأولى (عددنا ١٢ أنثى) تم حقنها تحت الجلد بالمحلول الملحي (٩٠% كلوريد صوديوم) وتم استخدامها كمجموعة ضابطة. أما المجموعة الثانية (عددنا ١٢ أنثى) فقد تم حقنها تحت الجلد بـ ٥٠ ميكروجرام من البروستاجلاندين $F_{2\alpha}$ (البرين) في الساعة العاشرة صباحًا. الصفات التي تم دراستها هي: عدد الإناث التي حدث لها استجابة للتزاوج ، عدد مرات التلقيح للحصول على حمل ، طول الفترة بين الولادات ، معدل الحمل (%) ، طول فترة الحمل (يوم)، عدد الإناث التي حدث لها ولادة ، حجم الخلفة ، وزن الخلفة ، الزيادة في وزن الخلفة ، نسبة النفوق خلال الفترة قبل الفطام. ولقد أوضحت النتائج مايلي: ١ - أن معدل الحمل في المجموعة المعاملة باستخدام ٥٠ ميكروجرام من البروستاجلاندين عند اليوم ٢٩ (٩١.٧) كان أعلى من المجموعة الضابطة (٨٣.٣) . ٢ - كانت فترة الحمل في المجموعة المعاملة أقصر معنويًا من المجموعة الضابطة. ٣ - كانت الفترة بين الولادات للمجموعة المعاملة (٤٥.٣ ± ٤.٠ يوم) أقصر معنويًا من المجموعة الضابطة (٤٩.٠ ± ٦.٠ يوم). ٤ - كانت عدد الخلفة عند الولادة للمجموعة

المعاملة 8.3 ± 0.2 وكانت القيمة المقابلة للمجموعة الضابطة 7.6 ± 0.1 ٥ - كانت نسبة النفوق عند الولادة في المجموعة المعاملة أقل معنوياً من المجموعة الضابطة بحوالي ٣٨.٩% ٦ - لم يلاحظ أي فروق معنوية بين المجموعتين المعاملة والمجموعة الضابطة في القبول للتزاوج ، حجم الخلفة عند عمر ٢١ أو ٣٠ يوم من العمر ، وزن الخلفة ، معدل الزيادة في وزن الخلفة ، نسبة النفوق خلال الفترة قبل القطام . وقد أوضحت النتائج أن حقن ٥٠ ميكروجرام من البروستاجلاندين $F_{2\alpha}$ (السيرين) في أنثى اليوسكات التي تم إثارة التبويض لها يكون فعال في أحداث الولادة وليس له آثار جانبية. كما أن استخدام هذه الطريقة يؤدي إلى اختصار الفترة بين الولادات وكذلك نسبة النفوق للخلفات أثناء عملية الولادة مما يؤدي إلى زيادة عدد الخلفة المتحصل عليها.

SUMMARY

To determine the effect of induction of parturition by the administration of prostaglandin analogue on reproductive and productive performance in rabbit does, a total of 24 non lactating Bouscat rabbit does were superovulated by daily injection of 15 I.U. of Pregnant mare serum gonadotropin (PMSC) for 4 days. Immediately after mating, each doe was injected with 50 I.U. of Human chorionic gonadotropin (hCG). At day 29 of pregnancy, the does were randomly divided into two equal groups (n =12). The first group was subcutaneously injected with saline solution (0.9% NaCL) and used as control. The second group was injected subcutaneous by 50 µg of a synthetic $PGF_{2\alpha}$ (Irelin) at 10.00 a.m. The breeding traits studied were: number of matings / conception for kindling, number of does copulated, receptivity at copulation (R+ or R-), kindling interval (days), conception rate (%), gestation length (days), litter size, litter total weight, litter gain and pre-weaning mortality rate (%). The obtained results indicated that: 1- The conception rate (%) for the treated does with synthetic analogue of $PGF_{2\alpha}$ (91.7) was significantly ($P \leq 0.05$) higher than that of the control does (83.3). 2- The gestation period for the treated group was significantly ($P \leq 0.05$) reduced than that for the control group. 3- The kindling interval for treated group (45.3 ± 0.4 days) was significantly ($P \leq 0.05$) shorter compared with the control group (49.0 ± 0.6 days). 4- The litter size at birth for the group injected with $PGF_{2\alpha}$ was 8.3 ± 0.2 , while the corresponding value for the control group was significantly different (7.6 ± 0.1). 5- The neonatal mortality rate for the group injected with $PGF_{2\alpha}$ was significantly ($P \leq 0.05$) reduced by about 38.9%. 6- No significant difference in acceptance of mating was detected when comparing $PGF_{2\alpha}$ the treated

does with the control ones. 7- No significant effects of $\text{PGF}_{2\alpha}$ treatment were observed on litter size at 21 and 30 days of age, litter body weight, daily litter gain, bunny weight, bunny gain weight and pre-weaning mortality (%). From the above results, it may be concluded that the injection of 50 μg synthetic analogue of $\text{PGF}_{2\alpha}$ at day 29 of pregnancy for superovulated Bouscat rabbit does is effective in induction of parturition without any side effects. The method may also be useful for decreasing the kindling interval and mortality rate at birth and finally increasing the obtained litter.

Key words: Superovulation, Rabbit, Prostaglandin, PMSG, hCG.

INTRODUCTION

Knowledge of the reproductive cycle in domestic animals is fundamental for the development of methods for regulating animal reproduction. Precise control of the time of birth is a valuable aid to animal management. Induction of parturition is now a widely used technique in animal production. The length of gestation period can be controlled and time of parturition synchronized in different animal species by different compounds (Bosc *et al.*, 1977; First *et al.*, 1982; Bazer and First, 1983 and Partridge *et al.*, 1986). These compounds have to be administered during the final stages of pregnancy to avoid deleterious effects on the offspring (Bazer and First, 1983).

Routine birth induction in the commercial rabbit has not been studied thoroughly (Partridge *et al.*, 1986). On a laboratory scale, oxytocin has been used with some success to induce parturition (Morgan, 1974). One distinct disadvantage of using oxytocin routinely is that does can vary markedly in their response to it because of variations in prior hormonal priming of the uterus. Prostaglandin's play a central role in the cascade of hormonal events leading to parturition in both animals and human (Challis and Lye, 1986). Exogenous prostaglandin's appears to be suitable for controlling parturition in the rabbits (Ruffini-Castrovilli and Nordio-Baldissera, 1980; Partridge *et al.*, 1986). Partridge *et al.* (1986), injected 4.38, 8.75 and 17.5 μg Cloprostenol intramuscularly and suggested that the dose of 4.34 μg appeared to be adequate to control the time of parturition with sufficient precision. Ubilla *et al.* (1992) used 50 μg of a synthetic analogue of $\text{PGF}_{2\alpha}$ at 29 of pregnancy for induction of kindling, reported that the conception rate and litter size at birth was

not affected. Whereas, McNitt (1992) stated that the most exciting and potentially useful benefit of induction of parturition with prostaglandin is the reduction in the proportion of kits born dead. Moreover, Pimenta *et al.* (1996) found that the parturition interval was reduced significantly when comparing treated animals with prostaglandin $F_{2\alpha}$ and control groups on day 31 post-coitum.

There are some evidences indicating that the incidence of mortality increased when does superovulated by PMSG (Maertens *et al.*, 1983; Alabiso *et al.*, 1994). Partridge *et al.* (1984) reported that 26% of the kits died at birth. The proportion of pups born dead tended to be lower in prostaglandin treated rabbit does (Partridge *et al.*, 1986). Whereas, Pimenta *et al.* (1996), induced rabbit parturition by administration of a natural prostaglandin $F_{2\alpha}$, and found that the litter size at birth was not affected by natural prostaglandin treatment.

Although, numerous studies were carried using synthetic prostaglandin analogue $F_{2\alpha}$ for routine birth induction in the commercial animals (Partridge *et al.*, 1986; Cooper, 1992), there are few studies on the effect of this routine birth induction in rabbit (Ubilla and Rodriguez, 1989a; Pimenta *et al.*, 1996). Therefore, the present study was designed to investigate the possible effects of parturition induction by using synthetic prostaglandin analogue $PGF_{2\alpha}$ on reproductive and productive performance in superovulated Bouscat rabbit does under subtropical conditions.

MATERIAL and METHODS

This experiment was conducted at the Rabbit Research Farm, Department of Animal and Poultry Production, Assiut University, Assiut, Egypt, from November 1999 to May 2000.

A total of 24 non-lactating Bouscat rabbit does (aged about one year old, average live body weight of 2.8 Kg and were apparently healthy) were randomly chosen. All does were injected with 60 I.U. of Pregnant mare serum gonadotropin (PMSG) (Folligon, Intervet International B.V. Boxmeer/ Netherlands) for superovulation. This dose was given in four successive injections, 15 I.U. each, administrated at 24 hrs apart. Treatment started at 9:00 a.m. on day -4 before mating. Then, these does were injected with 50 I.U. of Human chorionic gonadotropin (hCG) (Pregnyl, produced by Nile Company for Pharmaccuticals and Chemical Industries, Cairo) after mating either receptive or non-

receptive (forced mating). The PMGS or hCG were subcutaneously injected into the back of the rabbit's neck.

At day 29 of pregnancy, the does were randomly divided into two equal groups. The first group was injected with saline solution (0.9% NaCL) and used as control. The second group was injected with 50 µg of a synthetic analogue of PGF_{2α} (Irelin) (Ubilla *et al.*, 1992) at 10.00 a.m. The injections were carried subcutaneously in the back of the rabbit's neck.

The rabbits were housed individually in galvanized wire cages and kept under the same managerial hygienic and environmental conditions. Food and water were available all the time. Animals were fed standard diet contained 16.3% crude protein and 2284.7 Kcal/Kg ME. Mating was carried out naturally using tested bucks, which have good quality semen. Each doe was transferred to the buck's cage to be mated and returned back to its cage after mating. All does (either untreated or treated) were individually exposed to the proven males for a period of 5 min. to find out whether she displays mating acceptance behavior (lordosis posture). Receptivity was defined by arching of the back and elevation of the rump as described by (Hafez, 1970). Sexual behavior was scored as receptive (R+) or non receptive (R-). Palpation of all dose was carried out 10 days post-mating to detect pregnancy. All kindlings (for first three parities) were left with their dams in the nests for suckling from birth to weaning at 30 days after birth, then they were moved to the growing batteries. The following data were recorded for all does: interval between kindling (days), number of matings / conception for kindling, type of treatment (untreated or treated), number of does copulated, receptivity at copulation (R+ or R-), conception rate (%), number of pregnant does (at Kindling), gestation length (days), litter size, litter weight, litter gain weight, bunny weight, bunny gain weight and pre-weaning mortality (%).

The data were analyzed using analysis of variance (ANOVA) using SAS procedures (SAS, 1988). Differences between means were compared by Duncan's New Multiple Range test as described by Steel and Torri (1960).

RESULTS

The effect of induction of parturition by using synthetic analogue of PGF_{2α} at day 29 of pregnancy on reproductive and productive performance of superovulated Bouscat rabbit does are presented in Table

1. No significant difference in acceptance of mating (receptivity) was detected when comparing $\text{PGI}_{2\alpha}$ treated does to the control does. Significant ($P \leq 0.05$) effect of synthetic analogue of $\text{PGF}_{2\alpha}$ treatment on conception rate, gestation period (days), litter size and mortality rate (%) at birth was observed. The conception rate (%) for the treated does with synthetic analogue of $\text{PGF}_{2\alpha}$ (91.7) was significantly ($P \leq 0.05$) higher than that of the control does (83.3). The gestation period for does treated with synthetic analogue of $\text{PGF}_{2\alpha}$ at 29 day of pregnancy was significantly ($P \leq 0.05$) shorter than control does with no effect on prolificacy. Also, the parturition intervals for does treated with synthetic analogue of $\text{PGF}_{2\alpha}$ (45.3 ± 0.4 days) were significantly ($P \leq 0.05$) shorter compared with the control does (49.0 ± 0.6 days). The litter size at birth for the group injected with synthetic analogue of $\text{PGF}_{2\alpha}$ at 29 day of pregnancy was 8.3 ± 0.1 , while the corresponding value for the control group was 7.6 ± 0.2 . The neonatal mortality rates for group administrated with synthetic analogue of $\text{PGF}_{2\alpha}$ at 29 day of pregnancy were significantly ($P \leq 0.05$) reduced by about 38.9%.

Table 2 shows no significant effects of synthetic analogue $\text{PGF}_{2\alpha}$ treatment on either litter size at 21 and 30 days of age, mortality rate or litter body weight, litter gain weight, bunny weight, bunny gain weight and pre-weaning mortality (%) at different intervals of age.

Table 1: Effect of administration of synthetic analogue of $\text{PGF}_{2\alpha}$ at day 29 of pregnancy on reproductive performance of superovulated Bouscat rabbit does ($\bar{X} \pm \text{S.E}$).

Items	Treated	Control
No. of does	12	12
Acceptance of mating*	11 (91.7%) ^a	11 (91.7%) ^a
No. of animal conceived**	11 (91.7%) ^a	10 (83.3%) ^b
No. of animal kindling	10 (91.7%) ^a	10 (83.3%) ^b
Interval between kindling (day)	45.3 ± 0.4 ^b	49.0 ± 0.6 ^a
Gestation period (day)	30.1 ± 0.1 ^b	31.3 ± 0.1 ^a
<u>No. of Litter size at birth:</u>		
Alive litter	8.3 ± 0.2 ^a	7.6 ± 0.1 ^b
Dead litter	0.5 ± 0.01 ^b	0.8 ± 0.01 ^a
Mortality rate at birth (%)	5.5 ± 0.3 ^b	9.0 ± 0.1 ^a

^{a, b} Means in the same row with different superscripts are significantly different ($P \leq 0.05$).

* % of does mating when presented to the male (receptivity or synchronization rate).

** Diagnosed pregnant at 10 days after mating (conception rate).

Table 2: Effect of administration of synthetic analogue of PGF_{2α} at day 29 of pregnancy on productive performance of superovulated Bouscat rabbit does (X±S.E).

Items	Treated	Control
No. of does (Kindling)	11	10
Litter size:		
- At birth	8.3±.2 ^a	7.6±.1 ^b
- At 21 days of age	7.8±.2 ^a	6.7±.1 ^a
- At 30 days of age	7.7±.2 ^a	6.6±.1 ^a
Mortality rate (%):		
- At birth	5.5±.3 ^b	9.0±.1 ^a
- At 21 days of age	6.0±.1 ^a	11.8±.3 ^a
- At 30 days of age	7.2±.3 ^a	13.2±.4 ^a
Average litter B.W. (g):		
- At birth	425.8±21.8 ^a	444.4±27.6 ^a
- At 21 days of age	3893.7±203.2 ^a	2561.1±120.4 ^a
- At 30 days of age	3927.0±312.0 ^a	3388.9±177.4 ^a
Average bunny B.W. (g):		
- At birth	51.3±1.3 ^a	58.5±1.1 ^a
- At 21 days of age	499.2±4.6 ^a	382.3±6.5 ^a
- At 30 days of age	510.0±14.3 ^a	513.5±13.5 ^a
Daily litter gain (g):		
- From birth to 21 days	165.1±4.5 ^a	100.5±3.5 ^a
- From birth to 30 days	116.7±5.6 ^a	98.1±4.6 ^a
Litter weight gain (g):		
- From birth to 21 days	3468.0±40.5 ^a	2111.1±25.6 ^a
- From birth to 30 days	3501.2±42.5 ^a	2944.4±23.4 ^a

^{a, b} Means in the same row with different superscripts are significantly different (P≤0.05).

DISCUSSION

The conception rate (%) for superovulated Bouscat rabbit does in the present study was significantly (P≤0.05) affected by synthetic analogue of PGF_{2α} treatment, while acceptance of mating (sexual receptivity) was not affected. Pimenta *et al.* (1996) found that the sexual receptivity and conception rate were not affected by prostaglandin treatment. However, Ubilla and Rodriguez, (1989-b) revealed that the receptivity increased on days 6 to 9 post-partum from 43.0% to 70.4%

and conception rate from 66.6% to 82.2% for non treated and treated does, respectively. Rebollar *et al.* (1992) found an indirect positive effect of F_{2x} what is manifested by an increased sexual receptivity by about 20%. Various results show an increase in the conception rate after prostaglandin treatment in does mated 6-9 days post-partum (Ubilla and Rodriguez, 1989-b), suggesting an improvement of follicular growth during this period after the prostaglandin treatment due to the earlier fall in plasma progesterone levels after treatment (Ubilla *et al.*, 1988) and, therefore, a precocious fall in the inhibitory effect of progesterone on gonadotrophin release (Battaglini *et al.*, 1984).

A significant ($P \leq 0.05$) decrease in parturition intervals, in superovulated Bouscat rabbit does treated with synthetic analogue of $PGF_{2\alpha}$ (Irelin) vs. control, was observed. Partridge *et al.*, (1986) stated that the interval between birth and parturition was significantly reduced in prostaglandin injected does when compared with control does. Also, they added that the length of pregnancy for treated does with prostaglandin (30.1 days) was significantly reduced when compared with untreated controls (31.1 days). Moreover, Ubilla *et al.* (1988), routinely injected 50 μ g prostaglandin (Etiproston) at on day 29 of gestation, stated that the litter interval significant reduced from 49.06 ± 1.68 days to 40.04 ± 0.62 days. Similar results were finding by Ubilla and Rodriguez (1989a-b) and Pimenta *et al.* (1996). In contrast, Alvarino *et al.* (1995) found that synthetic (100-200 μ g) or natural >700 μ g PGS, injected at 28 or 29 of pregnancy induce natural parturition approximately 64 hrs later.

For rabbit production to be profitable, it is necessary that the does produce as many live kits as possible. Partridge *et al.* (1984) suggest that proportionately 0.3-0.5 of deaths before weaning occur prior to or during the birth process. Partridge *et al.* (1983) indicated that improved husbandry techniques such as heated pads in nest boxes or better nestbox insulation can undoubtedly reduce early losses due to chilling and inanition, but still the potentially high losses at parturition remain. The most exciting and potentially useful benefit of induction of parturition with prostaglandin analogues, is the reduction in the proportion of kits born dead (McNitt, 1992). The results in the present study exhibited that injected 50 μ g synthetic analogue of $PGF_{2\alpha}$ at day 29 of pregnancy significantly ($P \leq 0.05$) improved numbers of kits born alive. Ubilla and Rodriguez (1989-b) reported that routine birth induction with 50 μ g synthetic analogue of $PGF_{2\alpha}$ reduced the neonatal mortality by about 50%. Rebollar *et al.*, (1992) injected PGS at 28 or 29 day of pregnancy

reduced the mortality rate at birth without any negative effect on maternal behavior. However, Partridge *et al.* (1986), Ubilla *et al.* (1989-a) and Pimenta *et al.* (1996), injected 800µg and 1200µg of prostaglandin at day 29 of pregnancy, found that litter size at birth was not affected by natural prostaglandin treatment.

The possible improvement in litter size and mortality rate at birth due to synthetic analogue of $\text{PGF}_{2\alpha}$ treatment may be attributed to successful parturition which depends on two mechanical processes: (1) the ability of the uterus to contract and (2) the capacity of the cervix to dilate sufficiently to enable the passage of the fetus (Hafez, 1993). The activity of the uterine muscle is under the influence of progesterone, which ensures an environment conducive to the developing fetus. This hormone influence uterine motility through the release of $\text{PGF}_{2\alpha}$ which interacts with the smooth muscle adenylyl cyclase system to lower cAMP levels and cause myometrial contractions. Also, ripening of the cervix is hormone dependent and may be influenced by factors such as the elevated levels of estrogens, secretion of relaxin and $\text{PGF}_{2\alpha}$ at the onset of parturition (Fitzpatrick and Dobson, 1979; Deis *et al.* 1980 and MacLennan *et al.* (1985). Also, Ubilla *et al.* (1992) suggested that the prostaglandin induction of parturition influences the final stage of pregnancy due to changes in plasma LH levels.

The results in the present study revealed that superovulated rabbit does injected with 50µg $\text{PGF}_{2\alpha}$ showed insignificantly better productive results during the whole experimental period than in the control does. Partridge *et al.* (1986) reported that there was no evidence indicating that the parturition process and subsequent lactational and productive performance was compromised by prostaglandin (Cloprostenol) injections in late pregnancy. Ubilla *et al.* (1992), inducing parturition by the administration of 50µg $\text{PGF}_{2\alpha}$ on day 29 of pregnancy, found that no significant effect of $\text{PGF}_{2\alpha}$ treatment on prolactin concentrations during lactation period. However, Abo Elezz *et al.* (1988), intramuscularly injected rabbit does with 50µg $\text{PGF}_{2\alpha}$ at the time of mating, found an increase in meat production traits. The possible improvement of meat production suggested by Abo Elezz *et al.* (1988) may be due to the dose and the time of PGF injection.

From the above results, it may be concluded that the use of 50µg synthetic analogue of $\text{PGF}_{2\alpha}$ (Irelin) at day 29 of pregnancy for PMSG superovulated Bouscat rabbit does is effective in induction of parturition without any side effects. The method may also be useful for decrease

parturition interval and mortality rate at birth. Moreover, its use could clearly form part of an integrated approach to improvements in husbandry in large-scale commercial rabbit production.

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