

# NOTE CONCERNING THE EFFECT OF PMSG STIMULATION ON THE MORTALITY RATE AT BIRTH AND THE DISTRIBUTION OF LITTER SIZE IN ARTIFICIALLY INSEMINATED DOES

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**SUMMARY** : A study of the mortality rate at birth and the distribution of litter size frequencies was performed on 3 consecutive artificial inseminations of 2 groups of rabbit does. In the experimental group the does were treated with 30 IU PMSG about 48 hours before the insemination. The second group was a control without treatment. In total 385 inseminations were performed on multiparous does. The obtained number of litters was 123 in the PMSG group and 142 in the control one. Results showed a significant ( $P < 0.01$ ) increased birth mortality in the PMSG treated does (14.08 %)

compared to the controls (6.23 %). The distribution of the frequencies of the litter size was significantly ( $P < 0.05$ ) different in the PMSG group. Especially litters with more than 12 youngs were more numerous ( $P < 0.01$ ) in the PMSG group, respectively 23.7 and 8.4 %. Also an increased number ( $P < 0.06$ ) of small litters (<5 youngs) was obtained after a PMSG treatment, 18.8 % and 10.5 % respectively. Birth mortality rate after PMSG stimulation was higher in small and large litters but also significantly higher ( $P < 0.001$ ) in litters with 5 to 12 youngs.

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**RÉSUMÉ** : Note concernant l'effet de la stimulation par PMSG sur le taux de mortalité et la distribution des tailles de portées chez la lapine après insémination artificielle.

Une analyse de la taille de la portée et de la distribution des fréquences de taille de portée a été conduite sur 2 groupes de lapines inséminées artificiellement trois fois consécutives, à intervalle de 42 jours. Les lapines du groupe expérimental ont été traitées par 30 UI de PMSG environ 48 heures avant l'insémination. Au total, 385 inséminations ont été réalisées, 123 et 142 portées ont été obtenues pour les groupes PMSG et témoin respectivement. Les résultats montrent une augmentation significative ( $P < 0,01$ ) de la mortalité dans

le groupe des lapines traitées par PMSG (14,8 %) comparé au groupe témoin (6,23 %). La distribution des fréquences de taille de portée était significativement différente ( $P < 0,05$ ) dans le groupe PMSG. On remarque particulièrement le nombre plus élevé de portées ( $P < 0,01$ ) de plus de 12 lapereaux dans le groupe PMSG, respectivement 23,7 % et 8,4 %. De plus, un nombre plus important ( $P < 0,06$ ) de petites portées (<5 lapereaux) a été enregistré après le traitement PMSG, respectivement 18,8 % et 10,5 %. Le taux de mortalité après la stimulation par PMSG était plus élevé dans les petites et les grandes portées mais aussi significativement plus élevé ( $P < 0,001$ ) pour les portées de 5 à 12 lapereaux.

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## INTRODUCTION

Although the rabbit is considered as a mammal with an extreme high reproduction capacity, the irregular alternation of oestrous and anoestrous periods (MORET, 1980) is a disadvantage in view of a regular, synchronized reproduction rhythm. Especially when using artificially insemination in rabbit breeding, groups of females in the same reproductive and physiological stage are likely (COLIN, 1992). However, the receptivity of the doe is largely depending on the

hormonal antagonism between prolactin and gonadotropin (REBOLLAR *et al.*, 1992 ; THEAU & ROUSTAN, 1992).

In order to solve this problem, last years an increasing use of a PMSG treatment 2-3 days before the insemination became widespread (FACCHIN *et al.*, 1992 ; COLIN, 1992 ; MIRABITO *et al.*, 1994). In a lot of experiments PMSG stimulation showed positive response on the receptivity (MAERTENS *et al.*, 1983 ; MANCHISI *et al.*, 1990 ; BONANNO *et al.*, 1991 ; THEAU-CLEMENT & LEBAS, 1994), the conception

rate (KHALIFA *et al.*, 1990) as well as on litter size (MAERTENS *et al.*, 1983 ; BOURDILLON *et al.*, 1992). However, some authors have stressed some disadvantages as the antigenic proprieties (CANALI *et al.*, 1991 ; MC NITT, 1992), a lower conception rate (CR) with nulliparous does (MAERTENS *et al.*, 1983) or a lack of improvement on the CR when control does showed a good fertility rate (CASTELLINI *et al.*, 1991 ; THEAU-CLEMENT & LEBAS, 1994).

Hereafter, our results of PMSG stimulated does were analyzed, with special emphasis on the distribution of the litter size and young's mortality rate at birth.

## MATERIALS AND METHODS

### Animals and husbandry

Multiparous does belonging to the dam line of the Institute (MAERTENS, 1992) were used for this analysis. They were housed in flat-deck cages under controlled illumination (16L:8D) fed and watered *ad libitum*. A minimum inside temperature of 16°C was maintained in winter, using an over-under pressure ventilation system with heated air.

The does were kept in two production groups and inseminated every 6 weeks (11 days *post-partum*) or re-inseminated 42 days after the previous insemination if they were not pregnant. Equipment of IMV was used to inseminate the does with fresh pooled heterospermic semen. Does were induced to ovulate by an I.M. injection of 0.2 ml LHRHa (Receptal, Hoechst).

### Treatment

For each of the 2 groups the study lasted over 3 consecutive insemination during a 4 months period. An ovarian stimulation with PMSG was performed in the first group while the other group was not treated (controls). The intramuscular PMSG injection was given 48 hours prior to the insemination at a dose of 30 IU (Folligon, INTERVET). In total 385 inseminations were carried out on multiparous

does, and data from 265 obtained litters were analyzed. Litter observations were done two times daily in order to judge accurately mortality at birth.

### Statistical analysis

Data were analyzed by a GLM procedure, using the SAS®/STAT version 6 (1990). The model included the main effect of PMSG treatment as follows :

$$Y_{ij} = \mu + \alpha_i + \sum_j$$

where :

$Y_{ij}$  = depending variable ;

$\mu$  = overall mean ;

$\alpha_i$  = fixed effect of PMSG treatment ( $i = 1, 2$ ) ;

$\sum_j$  = random effect of error.

The parameters analyzed were : alive born, total born and mortality at birth. Moreover, the frequency of these parameters divided for litter size ( $LS < 5$ ,  $5 \leq LS \leq 12$ ,  $LS > 12$ ) were analyzed by a  $\chi^2$  procedure.

## RESULTS

Litter size obtained in each group is shown in Table 1. Although not significant, total born young's/litter was somewhat higher in does treated with PMSG. However, the number of young's born alive showed already an inverse trend, 8.27 and 7.91 for controls and PMSG, respectively. Overall the effect of PMSG on mortality at birth was very pronounced ( $P < 0.01$ ). A mortality rate of 14.08 % was observed in litters of PMSG treated does while controls showed only 6.23 % mortality in their litters at birth.

The distribution of the frequencies of the litter size is shown in Figure 1. A significant change ( $P < 0.01$ ) of litter size distribution was observed when does were treated with PMSG. Especially litters with more than 12 young's were more numerous ( $P < 0.001$ ) in the PMSG group, respectively 23.7 and 8.4 % (Table 2). But also a higher ( $P < 0.06$ ) number of small litters ( $< 5$  young's) were obtained after a PMSG treatment, 18.8 % and 10.5 % respectively. The effect was also obvious for alive born young's (Fig. 2).

**Table 1 : Litter size and mortality at birth (LSM  $\pm$  SEM) of artificially inseminated does with and without PMSG treatment.**

	Controls	PMSG	Statistical analysis	
			F-value	P
No. of litters	142	123	-	-
Total born/litter	8.73 $\pm$ 0.30	9.10 $\pm$ 0.33	0.70	NS
Born alive /litter	8.27 $\pm$ 0.32	7.91 $\pm$ 0.35	0.58	NS
Mortality at birth (%)	6.23 $\pm$ 2.01	14.08 $\pm$ 2.16	7.07	0.008

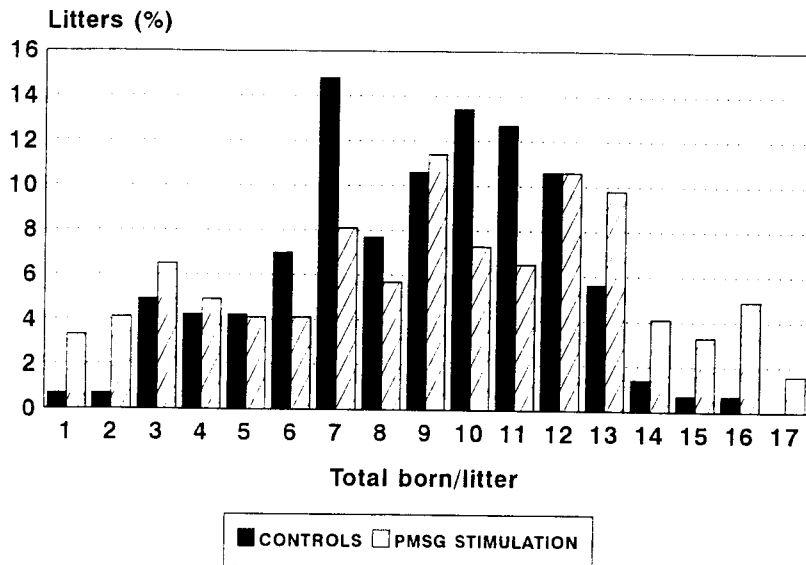
**Table 2 : Effect of a PMSG treatment on the distribution of the litter size (Total born) and relationship with mortality rate at birth.**

Total born/litter	Controls		PMSG		Statistical signification	
	Freq. (%)	Mort. (%)	Freq. (%)	Mort. (%)	Frequency	Mortality
< 5	10.5	16.7	18.8	24.2	0.06	NS
5 - 12	81.1	3.6	57.5	13.4	0.001	0.001
> 12	8.4	11.7	23.7	13.0	0.001	NS

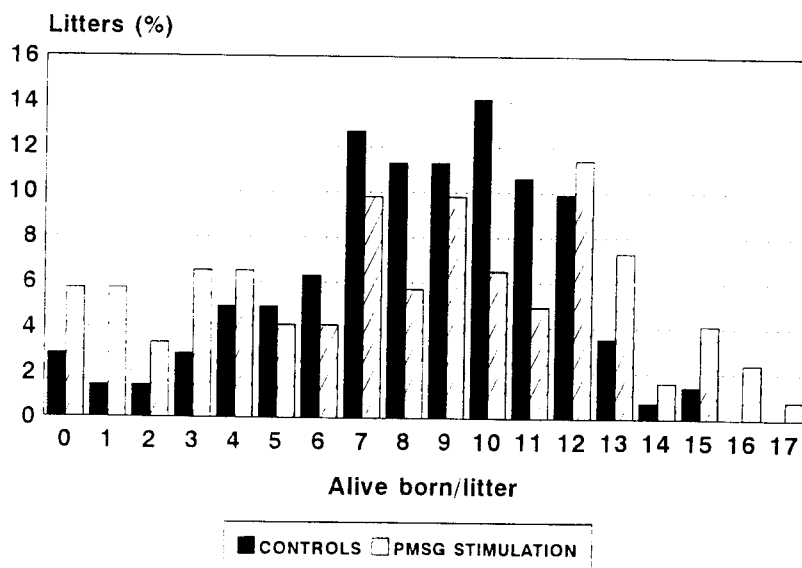
Birth mortality rate after PMSG stimulation was higher in small (24.2 vs 16.7 %) and large litters (13.0 vs 11.7) but only significantly higher (P<0.001) in litters with 5 to 12 youngs (13.4 vs 3.6) (Table 2).

Finally, a higher number of litters without live youngs was observed in the PMSG treated group, respectively seven out of the 123 litters (5.7 %) instead of only 4 out of the 142 litters (2.8 %) in the control group,

**Figure 1 : Distribution of litter size frequencies (total born) in does stimulated or not with PMSG**



**Figure 2 : Distribution of litter size frequencies (alive born) in does stimulated or not with PMSG**



although this difference is not significant.

## DISCUSSION

Although not significant, litter size (total born/litter) was somewhat higher after a PMSG treatment. This effect is already longtime known (MORIN *et al.*, 1976) and confirmed in several experiments (see review THEAU-CLEMENT & ROUSTAN, 1992). However, the significant effect on mortality at birth is much less known. Our results with natural mated, nulliparous does (MAERTENS *et al.*, 1983) showed an increased mortality at birth when a PMSG treatment was used. Recently, ALABISO *et al.* (1994) observed also a significant higher birth mortality when they used a dose of 40 IU PMSG. Mortality reached about 25 % in their experiments while controls or naturally mated does showed only 11 and 8 % young mortality.

The increased birth mortality can only partly be explained by the distribution of the litter size. A higher number of small (<5 young) and very numerous (>12 young) litters were observed in PMSG stimulated does (Fig. 1 & 2). Because mortality in these litter was higher than in normal litters, total rate was negatively influenced in the PMSG group. However, birth mortality rate after PMSG stimulation could not only be related to the changed distribution of litter size, because also in "normal" litters an increased birth mortality was observed.

The difference in distribution of litter size after PMSG treatment agrees well with our previous work (MAERTENS *et al.*, 1983) and recent work of GOSALVEZ *et al.* (1994). These last authors found in one third of their does only one to three *corpora lutea* while 3 out of the 12 does had 16 or more *corpora lutea*. However, they used a dose of 100 IU, which is far above the level normally used in breeding does (20 till 40 IU). At this high dosage, GOSALVEZ *et al.*, (1994) found a negative effect on the quality of growing follicles.

The results of ALABISO *et al.* (1994) suggest further a dose response effect on birth mortality rate. At a dose of 20 IU PMSG, birth mortality was not significantly higher than controls while at 40 IU a three times higher young mortality was observed. The intermediate dosage used in our experiment (30 IU) has led to an increased birth mortality of 125 % compared to the untreated does.

Further experiments are necessary to explain how PMSG treatment acts on the foetal survival and to elucidate if the foetal and uterine structures are different after PMSG treatment.

In conclusion, a PMSG treatment in order to stimulate follicular growth has some negative effects. At a dose of 30 IU, birth mortality was more than doubled. Birth mortality seems to be related to the dose used. Also a significant higher number of small and very numerous litters were obtained with less viability.

Based on these results and other considerations as the lack of improvement in non-lactating does, antibody formation or even animal welfare and the acceptance of the consumers of such induced reproduction, commercial farms has to be advised against a general use of PMSG to synchronize the reproduction cycle of does.

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