Efficacy of the simultaneous injection of vitamin A and gonadotropins in sows

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The number of sows served and farrowing rate are the main components of breeding herd efficiency for achieving a constant flow of piglets to the nursery. The relative importance of the number of sows served per batch, mainly by week, is around 60%, accounting for 30% of the farrowing rate. Piglets born alive (PBA) and mortality accounts for 5% each.

The interval between weaning and oestrus (WEI) is one of the components of the empty days of the sow and after the first weaning this interval is longer than in older parities. Sows managed in warm climates and in summer when sunlight declines, have longer WEI and less homogeneous number of PBA.

Many different alternatives to decrease WEI after weaning in second parity are made by managers and technicians. However, one of the most known alternatives is the pharmaceutical approach using gonadotropins, 400 IU equine chorionic gonadotropin (ecG) and 200 IU human chorionic gonadotropin (hcG) after weaning.

To increase PBA different approaches have been tried. Injections of vitamin A has been one of them. Lindemann et al. (2007), in a trial involving 443 litters in five experimental stations, showed that it is possible to increase the litter size when vitamin A is injected mainly in second parity.

The aim of this study is to evaluate the effect of gonadotropin use at weaning concomitant with vitamin A injection at weaning and serving date with the aim of reducing WEI and increasing PBA.

	Hipravit-AD3E Forte + Gestavet	Gestavet	Control
Total included sows	56	41	42
1st weaning, parity 2	22	21	21
2nd weaning, parity 3	34	20	21

Table 1. Number of sows included in each treatment group.

Materials and methods

The study involved 139 adult Landrace x Large White sows, 64 sows after first weaning and 75 after second weaning. It was conducted during July 2009 in one sow farm located in North East Spain. The number of sows allotted to each treatment is given in Table 1. The farm was located in Ejea de los Caballeros, Zaragoza, Spain. It is a 2,500 farrow to wean sow farm managed in weekly batches (piglets are sold at approximately 18kg). The farm meets all the 2013 welfare requirements.

Commercial gestation diet and lactation diet were used. The daily quantity of feed provided per sow was not registered, following the normal management of the farm, but basically sows were fed ad libitum during lactation and during the interval between weaning to be served and in a restricted electronic feeding system in gestation.

The total amount of feed per sow per year was 1184 kg per sow. Nutritional requirements of both diets were equal or higher to FEDNA requirements. The level of vitamin A of both diets was 10,000 IU per kg.

Water was provided ad libitum in the troughs where sows drunk at a constant water level. No extra light was provided during gestation. Lighting during lactation was provided to light the farrowing rooms 16 hours a day.

The experimental products were:

- Gestavet, Hipra. The product contain 400 IU ecG and 200 IU of hcG in water suspension. One dose is 5ml of the reconstituted suspension.
- Hipravit-AD3E Forte, Hipra (Hipravit). The composition per ml is:
  - Vitamin A: 500,000 IU
  - Colecalciferol: 75,000 IU
  - α-tocoferol acetate: 50mg

The dosage of Hipravit-AD3E Forte was 1ml. Both products were registered in Spain and after the experiment all the sows and piglets were kept in the farm following the normal management of the farms.

The experiment consisted of three treatment groups:

- Hipravit + Gestavet group. Sows assigned to this group received one intramuscular dose of Gestavet (5ml) at weaning and two intramuscular doses of Hipravit-AD3E Forte of 1ml, the first one at the same time than Gestavet and the second one at breeding time.
- Gestavet group. Sows assigned to this group received one intramuscular dose of Gestavet (5ml) at weaning.
- Control. Sows assigned to this group received 5ml of saline serum at weaning.

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Table 2. Treatment to first oestrus interval (ITC) (LSM in days).

	Hipravit + Gestavet	Gestavet	Control
ITC Overall	4.0	4.5	4.5
Parity 2	4.0	4.6	5.2
Parity 3	3.9	4.3	3.9

Table 3. Treatment to effective oestrus interval (ITEC) (LSM in days).

	Hipravit + Gestavet	Gestavet	Control
ITCE Overall	4.5	6.5	7.3
Parity 2	4.9	7.5	8.4
Parity 3	4.2	5.7	6.4

	Hipravit + Gestavet	Gestavet	Control
Total sows	56	41	42
Parity 2 sows	22	21	21
Parity 3 sows	34	20	21
Sows with anoestrus	0 (0.0%)	4 (9.8%)	2 (4.8%)
Parity 2 anoestrus	0 (0.0%)	3 (14.3%)	2 (4.8%)
Parity 3 anoestrus	0 (0.0%)	1 (5.0%)	0 (0.0%)

Table 4. Number of sows in anoestrus and percentages.

	Hipravit + Gestavet	Gestavet	Control
Total sows	56	41	42
Parity 2 sows	22	21	21
Parity 3 sows	34	20	21
Sows with returns	3 (5.4%)	5 (12.2%)	9 (21.4%)
Parity 2 returns	2 (9.1%)	3 (14.3%)	4 (19.0%)
Parity 3 returns	1 (2.9%)	2 (10.0%)	5 (23.8%)

Table 5. Number of returned sows and percentages.

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The experimental groups were randomised to be not different in the number of piglets weaned in the last productive cycle. Once every sow was assigned to one group, the sow farm number provided in the ear tag was recorded on the appropriate record sheet.

From the weaning day (day 0) sows were kept in individual stalls and were stimulated with boars twice a day. At weaning, sows were assigned to the experimental groups following the randomised list and treated depending on the treatment group products.

Twenty days after weaning, all remaining non in oestrus assigned sows were recorded as anoestrus sows. Returned and aborted sows were recorded and excluded from the experiment. Sows were inseminated 12 hours after the onset of oestrus and 24 hours later.

The registered variables were:

- Treatment to effective oestrus interval (ITEC) defined as the time in days from first treatment (weaning time) or placebo were injected till the last oestrus former to the farrow.
- Treatment to oestrus (ITC) defined as the time in days from first treatment (weaning time) or placebo were injected till the first oestrus.
- Sows with anoestrum (ANO) defined as sows with ITC higher than 20 days.
- Returned sows (RET) as sows showing oestrus during the first 60 days of pregnancy.
- Abortion (ABO) defined as aborted sows.
- Piglets total born (PTB) as the total number of piglets born in the consecutive farrow after treatments.
- Piglets born alive (PBA) as the total number of piglets born alive in the consecutive farrow after treatments.

Results

Three sows were culled during the study, one from the Hipravit + Gestavet group from third parity and two from the control group, one of each parity, for different reasons following the procedures of the normal management of the farm.

Table 2 shows the treatment effect on ITC. For the overall data the Hipravit + Gestavet group was in oestrus sooner (0.5 days; $p<0.05$) than the Gestavet and Control groups. A statistically significant interaction between treatment and parity effects has been detected. So the positive effect of Hipravit + Gestavet group compared with control was only observed for sows from parity 2 but only a tendency to improve ITC was detected when compared with Gestavet group and no differences between groups were detected at parity 3.

Table 3 shows the ITEC results for all treatments and parities. Sows which received the treatment with Gestavet (Hipravit + Gestavet and Gestavet groups) improved ITEC having a shorter non productive time. Even if no interaction between treatment and parity has been found, the group with Hipravit improved ITEC in second parity sows.

Table 4 shows the total number of sows in anoestrus by treatment and by parity and their percentages. We found no difference between treatments or cycles, although at farm level we observed some differences with less anoestrus sows in the group of Hipravit + Gestavet.

Table 5 shows the total number of returned sows by treatment and by parity and their percentages. Sows that received the treatment Hipravit + Gestavet had less returns than sows in the control group, 5.4% vs 21.4% ($p<0.05$). This was because third parity sows treated with Hipravit + Gestavet had less returns than sows in the control group, 2.9% vs 23.8% ($p<0.05$).

Only two sows aborted during the experiment: one second parity sow from the con-

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trol group and one from the third parity from the Gestavet group without statistical differences.

Table 6 shows the results of piglets total born and alive by treatments and by parities. No differences were found in PTB or in PBA but there were some important differences at farm level with a increase in the number of piglets born alive in both treatments that included Gestavet versus control group sows in both parities studied.

We found no differences even at farm level when we included Hipravit in the treatment.

Discussion

The results of the experiment agreed with previous studies in terms of shortening the interval between wean to first oestrus and to the effective oestrus when gonadotropins are used after weaning.

Kirkwood found a reduction in the length of this interval in second parity sows. We found even better results when we add Hipravit into the treatment even in third parity sows.

As discussed by Kirkwood, this could be due to different reasons but in warm regions in summer the decrease of the feed intake during first lactation causes a reduction in the reserves of the body of the sow and therefore a reduction in the later performances.

Treatments with hcG plus ecG helps to decrease the number of non-productive days.

We cannot corroborate the data of Kirkwood that found a reduction of percentage of anoestrus when he was using gonadotropins after weaning. It is likely that the good management of the farm staff contributed to this circumstance.

Something interesting that corroborates and reinforces that vitamin A could play an important role in the onset of oestrus is the fact that no sow treated with vitamin A was in anoestrus. If our sample size had been higher it is likely we would statistically detect these differences. More experiments should be done to corroborate this point and understand the role of vitamin A.

We could not replicate the results of Lindemann relating to the increase in litter size in second parity sows when these sows were treated with vitamin A. Brief and Chew, Coffey and Britt and Pusateri also failed to increase litter size through vitamin A injections.

We hypothesised that sows treated with a combination of ecG, hcG and vitamin A could achieve better performances than those not treated with vitamin A.

Lindemann was working with 124 second parity sows in five different stations and we had 139 sows in one farm following the same calculation of the sample size.

In Lindemann's study sows not treated with vitamin A had 9.70 piglets born alive and those treated with 500,000 IU of vitamin A had 12.16 piglets born alive.

The farm used in the present study had high values of PBA in the control group but the increases obtained with the inclusion of Hipravit and Gestavet were relevant despite not being statistically significant.

The mechanisms by which the effects of vitamin A are manifested are not completely understood. Presumably vitamin A or β-carotene may increase reproductive performances exerting positive effects in the oocyte maturation, ovulation, fertilisation and early embryonic survival and development.

Whaley, using a model of high energy diets in gilts, reported that gilts treated with vitamin A (100,000 IU) stimulated an earlier resumption of meiosis and altered development of oocytes before ovulation, resulting in more uniform and advanced oocytes and early embryos,

Conclusion and implications

The interval between weaning and effective oestrus can be shortened in sows after their first and second litter with treatments of vitamin A (Hipravit-AD3E Forte) and ecG and hcG (Gestavet).

This fact decreases the non- productive days of the sow farm and therefore increases the economical results.

Other studies have shown one increase in the litter size of the second parity sows when they are treated with vitamin A at weaning and at mating but we failed in our objective.

However, more studies should be done mainly in sow farms that experience high temperatures in summer time and the feed intake of first parity sows decreases. ■

Table 6. Piglets total born and born alive (LSM±SE) by treatments and by parities.

	Hipravit + Gestavet	Gestavet	Control
Piglets total born			
Parity 2	10.45±0.5	10.61±0.5	10.07±0.5
Parity 3	12.19±0.4	12.18±0.5	11.67±0.5
Piglets born alive			
Parity 2 returns	10.00±0.4	10.28±0.4	9.6±0.5
Parity 3 returns	11.19±0.3	11.24±0.4	10.67±0.5