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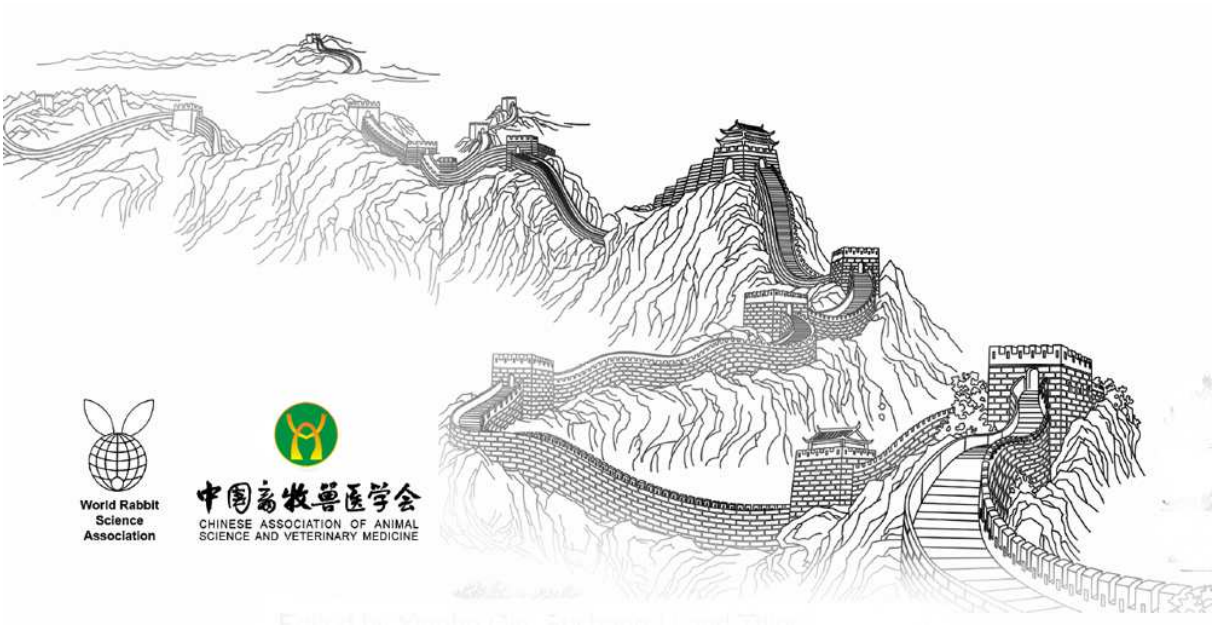

POSSIBLE DELETERIOUS EFFECTS OF EXCESS OF VITAMIN E IN RABBIT PERFORMANCES AND HEALTH BEFORE AND AFTER WEANING

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ABSTRACT

Different researches have demonstrated the interest of the Vitamin E to increase the performances of the rabbit and improve its meat quality but the effects of high levels of this vitamin in the feed has been studied only in few publications. In 5 successive experimentations, 6 555 rabbits corresponding to 763 litters are split between 2 treatments, one with a dosage of vitamin E lightly higher than the one generally used in the rabbit feeds and the other one with additional synthetic or natural vitamin E. Overall, only female fertility is improved by this supplemental vitamin E. Furthermore, the additional intake of vitamin E increases highly significantly the pre-weaning mortality. The fattening mortality is increased too in one of the tests. This supplementary vitamin E significantly decreases the weight performances in all the experimentation, the most affected criteria being the weaning weight. This work demonstrates that when the complete feed contains a sufficient amount of vitamin E, an additional intake is not only unnecessary but has negative effects and suggests the need to establish maximum levels to not to be overpassed in rabbit feeds.

Key words: Rabbit, mortality, Supplementation, Vitamin E, Antioxidant, Fertility.

INTRODUCTION

The enrichment of vitamin E of rabbit feed enables to improve the performances especially for reproduction (Abdelkhalek and al., 2008) and for the quality of the meat by reducing oxidation (Dal Bosco et Castellini, 1998). Two Egyptian publications (Abdelkhalek et al., 2008; Selim et al., 2008) have consisted to increase the rabbit feed vitamin E levels from 40 to 160 ppm and establish that high levels of vitamin E improve the weight gain and feed conversion. The authors did not mention any symptom of toxicity with high levels of vitamin E even if their data show an increase of the mortality before weaning with the highest level of vitamin E. Besides, the number of animals used in these studies is low (7 does per treatment) and the animals have very poor performance due to a hot climate. Consequently, a set of experimentations have been carried out to test the effects of high levels of vitamin E on a big number of animals in the intensive conditions of farming of West France.

MATERIALS AND METHODS

Experimental protocol

This study took place in a professional rabbit farm non-using antibiotics for more than 10 years and was carried out 2 times:

- A first range of experimentations carried out from October 2008 till July 30th 2009 on 4 following batches of rabbits consisting in testing 2 different levels of vitamin E inside the complete feed: the "control feed" contained 73.5 ppm of synthetic vitamin E and the "vitamin E enriched feed" the same quantity of synthetic vitamin E and a supplementation of 51.1 ppm of natural vitamin E extracted from soybean oil.
- A fifth experimentation carried out from September till December 2014 consisted in distributing a complete feed containing 80 ppm of synthetic vitamin E complemented with a very

appetizing booster containing high levels of amino acids, vitamins and trace minerals distributed during the first 15 days of lactation for a total intake of 300 grams. Two boosters containing respectively 30 and 250 ppm of synthetic vitamin E were allocated to 2 groups of does. This alimentary program represented a level of vitamin E in the total ingested feed of 78 ppm for the control diet and 88 for the Vitamin E one.

Animals
763 litters from 5 batches (1-5) representing 6 555 rabbits were followed from the birth to the slaughtering (70 – 73 days). For these 5 experiences, the animals were split between 2 groups, the "control feed" corresponding to a dosage of vitamin E lightly higher than the usual recommendations (De Blas and Wiseman 2010), and the "vitamin E enriched feed" with additional synthetic or natural vitamin E. The 4 first experimentations represented 682 litters and 5 965 rabbits and the fifth one respectively 81 and 590. The practical conditions of the experimentations in maternity have been described by (Savietto and al., (2015). After weaning, the rabbits were put in the fattening building (Teillet and al., 2012).

Feed
The complete feeds correspond to the formula published by Colin et al (2007). They contain 54 % of cereals and cereals by-products, 22 % of soya, 8 % of milk by-products, 3 % of beet molasses, 1 % of soya oil and 12 % of a concentrate with high levels of minerals, vitamins and amino-acids.

Measured criteria
The numbers of the born and weaned rabbits were registered per litter. The mortality was noted between the 0-8, 8-35, 0- 35 days of lactation and every day after the weaning in order to calculate the mortality for the period 35-56, 56-70 and 35-70 days of age. The weights, the feed distribution and the slaughtering results were measured according to the method already described (Teillet and al,. 2012).

Statistical analyses
The statistical analyses for the weight and the growth were carried out by variance analysis (Anova). The size of litter (number of the born rabbits) was analyzed according to a linear model by considering the effects treatment (Control versus vitamin E enriched) and batches (from 1 to 5). The mortalities were treated according to the statistical design applied by Savietto and al,. (2015).

RESULTS AND DISCUSSION

Maternity
Overall, the increase of the vitamin E tended to improve fertility ($p = 0.10$) in the 4 first experimentations and non-significantly in the fifth one (Table 1) in agreement with the gestation performances reported by Abdelkhalek and al, (2008).

The prolificacy was not affected by the increase of vitamin E in the first 4 experimentations but was lower with the high vitamin E level in the fifth one (Table 1). Abdelkhalek et al., (2008) observed a decrease of the prolificacy when increasing the vitamin E. The reasons of these differences between the experimentation are not clear.

The mortality before weaning increased strongly and on a very regular way (4 experimentations among the 5 ones) with the high vitamin E level (Table 1). Abdelkhalek et al., (2008) observed a similar trend but with a much higher mortality. These results are in opposition with some observations in other species as sheep (Kott et al., 1983).

The weaning weight is very highly significantly lower in 3 of the 4 experimentations where vitamin E is added in the complete feed (Table 1). It is unchanged in the 5th one with the vitamin E added in the booster. This result differs of the ones of Abdelkhalek et al., (2008) reporting an increase of the weaning weight when bringing additional vitamin E (but a diminution when bringing simultaneously

vitamin E and vitamin C) and of the ones of Yousef, (2010) showing that vitamin E supplementation (2 mg / kg in drinking water) during 3 weeks improves the weight gain and the feed efficiency.

Table 1: Results in maternity

Batches	Fertility (%)			Prolificacy			Mortality before weaning (%)			Weight at weaning (grams)		
	Control	Vitamin E	P	Control	Vitamin E	P	Control	Vitamin E	P	Control	Vitamin E	P
1	75,5	83,1	0,194	11,0	11,2	0,771	5,41	7,14	0,219	1 035	962	0,000
2	64,1	76,1	0,080	11,0	10,5	0,358	4,55	11,43	0,014	1 029	964	0,000
3	73,7	67,7	0,370	11,0	11,0	0,996	3,64	7,27	0,048	961	922	0,015
4	53,1	63,0	0,208	11,2	10,6	0,266	3,57	1,89	0,243	969	961	0,826
Average 4 first ones	**67,2**	**72,7**	**0,106**	**11,1**	**10,8**	**0,396**	**4,50**	**7,41**	**0,009**	**997**	**948**	**0,000**
5	68,1	72,7	0,250	12,2	9,4	0,001	5,60	11,70	0,001	917	919	0,843

Mortality in fattening:

The mortality in growing - fattening is unchanged for the 4 experimentations where the vitamin E is added in the complete feed (Table 2). It is highly significantly higher during the weaning - 56 days period in the 5th experimentation where the vitamin E is added in the booster without a clear explanation for this difference.

Table 2: Results of mortality during growing - fattening

Batches	Mortality weaning - 56 days (%)			Mortality 56 - 70 days (%)			Mortality weaning - 70 days (%)		
	Control	Vitamin E	P	Control	Vitamin E	P	Control	Vitamin E	P
1	10,0	4,7	0,033	5,5	4,3	0,307	12,5	9,0	0,242
2	5,3	8,4	0,387	1,1	1,1	1,000	6,3	9,5	0,418
3	4,4	8,4	0,084	2,7	3,1	0,779	7,1	11,6	0,106
4	7,1	6,5	0,871	1,2	1,3	0,951	8,3	7,8	0,900
Average 4 first ones	**6,8**	**6,8**	**0,979**	**2,2**	**3,0**	**0,339**	**8,9**	**9,8**	**0,588**
5	4,1	12,0	<0,001	8,2	10,0	0,370	12,9	22,0	0,100

Weight in growing fattening:

The weights at 56 days and at 70 days remain very highly significantly lower for the vitamin treatment than for the control one (Table 3). The growth is identical. Consequently, even with a lower weaning weight, the vitamin E rabbits have not shown compensatory growth.

Table 3: Results of weight and of growth during growing - fattening

Batches	Weight at 56 days (Grams)			Weight at 70 days (Grams)			ADG weaning - 70 days (Grams / day)		
	Control	Vitamin E	P	Control	Vitamin E	P	Control	Vitamin E	P
1	1 710	1 648	0,012	2 295	2 239	0,073	36,0	36,5	0,530
2	1 834	1 817	0,058	2 388	2 384	0,866	38,8	40,5	0,150
3	1 727	1 669	0,018	2 391	2 280	<0,001	40,8	38,9	0,010
4	1 737	1 669	0,403	2 316	2 260	0,388	38,5	37,2	0,250
Average 4 first one s	**1 739**	**1 687**	**<0,001**	**2 348**	**2 278**	**<0,001**	**38,6**	**38,0**	**0,200**
5	1 700	1 560	0,230	2 206	2 158	0,271	39,1	37,5	0,080

CONCLUSION

When added at higher levels than the ones generally used (50 ppm according to De Blas et Wiseman, 2010), natural and synthetic vitamin E increases the fertility but has negative effects on the mortality

before weaning and on the weaning weight. These results are coherent with the literature except for the weight (Abdelkhalek et al., 2008; Selim et al., 2008). This difference on the weight maybe explained by higher levels of growth in our experimentation (Average weaning weight of 920 grams versus 520 grams for Abdelkhalek et al., 2008). These experiments demonstrate that when the vitamin E level of the complete feed is sufficient, an additional intake of this vitamin is not only unnecessary, but has negative effects as it has already been observed for other liposoluble vitamins as A and D vitamins (De Blas et Wiseman, 2010). These data suggest the need to impose a maximum of vitamin E not to be overpassed in the feed formulation at least for rabbits.

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