

# The effects of elevated dietary vitamins (OVN) combined with Hy•D (25-hydroxyvitamin D<sub>3</sub>) on performance, health and processing yield of broilers

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In this study the effects of a supplementation of broiler chicks with elevated dietary levels of vitamins (OVN<sup>TM</sup>) in combination with Hy•D<sup>®</sup> (25-hydroxyvitamin D<sub>3</sub>) were evaluated. Male broilers were allocated to two dietary treatments: Control and OVN-Hy•D (enriched in vitamins plus Hy•D<sup>®</sup>). In the starter period (days 0-21) chickens fed OVN-Hy•D gained more weight than those receiving the control feed (P<0.01) and showed a more favorable feed efficiency (P<0.01). In the grower period (days 21-40) no differences in performance between the two treatments were observed. The utilization of the OVN-Hy•D premix increased breast weight (P<0.01) and breast meat yield (P<0.01) in relation to the control premix. Tibia breaking strength was numerically improved in the OVN-Hy•D group. In the meat from OVN-Hy•D a clear reduction of the TBARS values after 7 days of storage was recorded, when compared to the control meat (P<0.001), indicating protection from oxidative deterioration of the lipids. The present results suggest that the use of an enriched OVN<sup>TM</sup> vitamin premix in combination with Hy•D<sup>®</sup> exhibited beneficial effects on performance of broilers in the starter period, improved breast meat yield at slaughter and increased the oxidative stability of the meat.

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**Keywords:** 25-hydroxyvitamin D<sub>3</sub>; vitamins; broiler performance; intestinal health; processing yield.

## Introduction

An optimum level of vitamins in the feed is essential to allow chickens to express their full genetic growth potential and to enhance health, welfare and as a consequence, productivity. Furthermore, the concentrations of vitamins in poultry meat, which are important for its nutritional value, are directly dependent on the respective levels in the feed of the birds. The dietary supplementation, recommended for Optimum Vitamin Nutrition (OVN<sup>TM</sup>), generally exceeds the basic requirements, necessary to prevent clinical vitamin deficiency, as they compensate for stress factors on the animals and on the feed as well. OVN<sup>TM</sup> levels ensure that the vitamin intake does neither limit performance nor compromise health of farm animals under commercial conditions (Svendsen and Weber, 2001).

In a recent study, chickens fed a diet formulated according to OVN<sup>TM</sup> achieved a statistically better performance than those fed a control diet supplemented with average vitamin levels, which are currently used by the Spanish feed industry (SIL) (Hernandez et al., 2002). Furthermore it was found that the nutritive value of poultry meat from OVN<sup>TM</sup> broilers was superior to that of regular meat (Pérez-Vendrell et al., 2003).

Vitamin D<sub>3</sub> is needed for proper absorption of calcium and influences the uptake of phosphorus as well (Fritts and Waldroup, 2005). Vitamin D<sub>3</sub> is typically supplied to broilers in the form of cholecalciferol, which subsequent to absorption is transformed in the liver to 25-hydroxyvitamin D<sub>3</sub> (25-OH-D<sub>3</sub>). Upon demand, this intermediate vitamin D metabolite is further hydroxylated in the

kidney to 1,25-dihydroxycholecalciferol, which is considered to be the active hormonal form of vitamin D (Collins and Norman, 1991). Since recently, 25-OH-D<sub>3</sub> (Hy•D<sup>®</sup>), is commercially available and is being used by the poultry industry around the globe. Hy•D<sup>®</sup> supports the homeostatic function of vitamin D<sub>3</sub>, which is important to provide sufficient minerals for incorporation into the bone matrix and to avoid bone disorders of various origins. Moreover, it has been suggested that Hy•D<sup>®</sup> modulates the immune response and thus has positive effects on health and performance of poultry. In fact, under field conditions Hy•D<sup>®</sup> has shown improvements in body weight gain, feed efficiency, bone strength and breast meat yield, when compared with equivalent levels of vitamin D<sub>3</sub>.

The objective of this trial was to evaluate the effects of a supplementation of broiler chicks with elevated dietary levels of vitamins (OVN<sup>™</sup>) in combination with Hy•D<sup>®</sup> (25-hydroxyvitamin D<sub>3</sub>) on performance, health and processing yield of broilers.

## Materials and methods

The experiment was conducted in a poultry pen house of the experimental farm of IRTA. The house was provided with artificial programmable lights, automated gas heating and forced ventilation by depression. 720 day-old male broiler chickens of the Ross 308 breed were purchased from a local supplier, bulk weighed at arrival to the farm and randomly allocated to 12 pens, housing 60 chicks each. The growth trial lasted 40 days. There were 2 dietary treatments, replicated with 6 groups each, which differed in the supplementation levels of vitamins: Control (basal vitamin supplementation, according to regular Spanish industry levels [SIL]) and OVN-Hy•D (elevated vitamin levels, according to OVN<sup>™</sup> and supplemented with 62.5 µg 25-OH-D<sub>3</sub> [ROVIMIX<sup>®</sup> Hy•D<sup>®</sup> 1.25%] per kg of feed). Two diets (starter and grower), based on maize and soybean were prepared in pelleted form. The composition of the basal diet as well as the vitamin inclusion levels of the two different premixes, used in this study, is presented in Table 1. Both feed and water were provided *ad libitum*.

**Table 1 Composition and calculated nutritive value of the diets and the vitamin premixes**

Diets			Premixes		
Ingredients (%)	Starter	Grower	Vitamins <sup>2</sup>	SIL	OVN-Hy•D
Maize	55.70	60.27	A (IU/kg)	13000	13000
Soya meal (47.5%)	35.95	32.15	D <sub>3</sub> (IU/kg)	2600	2500
Fat	4.13	4.07	Hy•D (µg/kg)	0	62.5
Dicalcium phosphate	1.85	1.55	E (mg/kg)	18.90	225
Calcium carbonate	1.13	0.95	K <sub>3</sub> (mg/kg)	2.20	4.00
Salt	0.47	0.35	B <sub>1</sub> (mg/kg)	1.40	3.00
Amino acids	0.36	0.26	B <sub>2</sub> (mg/kg)	6.20	9.00
Minerals <sup>1</sup> & vitamins <sup>2</sup>	0.40	0.40	B <sub>6</sub> (mg/kg)	3.00	6.00
<b>Calculated nutritive value</b>			B <sub>12</sub> (µg/kg)	21.2	40.00
ME (kcal/kg)	3000	3050	PP (B <sub>3</sub> ) (mg/kg)	33.00	60.00
Crude protein (%)	22.00	20.50	PA (B <sub>5</sub> ) (mg/kg)	10.40	15.00
Methionine + cystine (%)	0.87	0.81	FA (M) (mg/kg)	0.68	2.00
Calcium	1.00	0.85	Biotin (mg/kg)	0.07	0.25
Non phytate P	0.45	0.39	C (mg/kg)	0	100

<sup>1</sup>One kg of feed contains: Mn: 60 mg; Zn: 40 mg; I: 0.33 mg; Fe: 80 mg; Cu: 8 mg; Se: 0.15 mg; Co: 0.20 mg; Ethoxyquin: 150 mg.

Broiler performance (body weight gain, feed intake and feed to gain ratio) was evaluated in the starter (days 0 to 21), in the grower (days 21 to 40) as well as in the overall period (days 0 to 40). On day 21, two chicks per pen were euthanized and their intestinal contents were analyzed for the presence of Lactobacilli, Clostridium, Coliforms and Enterococcus. Two days after the end of the

experiment (day 42), the broilers were slaughtered and six randomly selected chickens from each pen were individually weighed and after cooling (24 hours later) evaluated for carcass yield and breast meat yield. Samples of the left breast from 12 animals per treatment were used to determine TBARS (Thiobarbituric acid reactive substances) values as an indicator of lipid oxidation at 0 and 7 days of storage at 4° C. The left tibia of the selected broilers were taken to measure bone breaking strength, using a MTS Alliance RT/5 material testing system. All data were evaluated as by treatment using the General Linear Model (GLM) procedure of SAS. Significance was based on a 5% probability level.

## Results and discussion

The full set of results of this trial is shown in Table 2. In the starter period (days 0 to 21), the chicks of the OVN-Hy•D treatment gained significantly more weight than those receiving the control feed ( $P<0.01$ ) and showed statistically a more favorable feed efficiency ( $P<0.01$ ). A similar improvement of performance had already been demonstrated by Hernandez et al. (2002) with a feed, containing OVN<sup>TM</sup> levels of vitamins. As judged by the microbiological analyses, the use of the OVN-Hy•D vitamin premix reduced significantly ( $P<0.05$ ) the presence of *Clostridium perfringens* by 75% as well as numerically the populations of Streptococcus and the Coliforms in the intestinal contents on day 21. These results could be taken as an indication for a better health of the broilers on the OVN-Hy•D feed. In the grower period (days 21 to 40) no differences in performance between the two treatments were found. However, the growth of the birds in this trial was generally lower than expected for this period, probably due to the high outside temperatures. For the overall period (days 0 to 40), no significant differences of performance between the treatments were recorded, although numerically the results for final body weight and daily weight gain with OVN-Hy•D tended to be slightly better.

As observed at slaughter, the utilization of the OVN-Hy•D premix significantly increased breast weight ( $P<0.01$ ) and breast meat yield ( $P<0.01$ ) in comparison to the control premix. This finding indicates that the supplementation of broilers with elevated levels of vitamins and Hy•D<sup>®</sup> might support protein accretion, particularly in the valuable muscles of broiler chicks. Tibia breaking strength was numerically improved in the OVN-Hy•D group, but the difference versus the control was not statistically significant.

After 7 days of storage, TBARS in the breast meat of both treatments were higher than those in fresh meat, indicating an oxidative deterioration of the lipids. However, a clear reduction of the TBARS values in meat from the OVN-Hy•D group was recorded, when compared to the control meat ( $P<0.001$ ). This protection from lipid oxidation in the OVN-Hy•D meat was probably due to the higher levels of the antioxidant vitamins E and C in the test premix.

In conclusion, the results of this growth trial suggest that the use of an enriched OVN<sup>TM</sup> vitamin premix in combination with Hy•D<sup>®</sup> exhibited beneficial effects on performance of broilers in the starter period, improved breast meat yield at slaughter and increased the oxidative stability of the breast meat.

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**Table 2 Results of performance, microbiological analysis of intestinal contents, processing yield and meat quality.**

Parameters evaluated		SIL Premix	OVN-Hy•D premix	St. Err.	Pr > F
<b>Performance</b>					
0-21 d	BW (g)*	742.4 b	789.7 a	8.58	<b>0.01</b>
	ADG (g/d)*	33.2 b	35.4 a	0.41	<b>0.01</b>
	ADC (g/d)*	50.5	51.1	0.50	0.40
	FE (g/g)*	1.52 a	1.44 b	0.01	0.004
<b>Performance</b>					
21-40 d	BW (g)*	2300	2312	66.1	0.84
	ADG (g/d)*	82.0	80.1	3.48	0.79
	ADC (g/d)*	147.4	159.8	6.35	0.38
	FE (g/g)*	1.80	2.00	0.09	0.52
<b>Performance</b>					
0-40 d	BW (g)*	2300	2312	66.1	0.84
	ADG (g/d)*	56.4	56.7	0.94	0.83
	ADC (g/d)*	94.9	99.0	1.73	0.16
	FE (g/g)*	1.68	1.72	0.02	0.29
<b>Microbiological analysis of intestinal contents</b>					
	<i>Streptococcus (log MPN)</i>	5.15	4.45	0.27	0.08
	<i>Coliforms (log MPN)</i>	5.43	4.14	0.44	0.06
	<i>Clostridium perf. (log UFC)</i>	0.87 a	0.22 b	0.21	<b>0.05</b>
	<i>Lactobacillus (log UFC)</i>	4.28	4.38	0.37	0.36
<b>Processing yield</b>					
	BW (g)	2351	2439	36.8	0.07
	Carcass yield (%)	80.4	80.4	0.36	0.95
	Breast weight (g)	335.2 b	367.2 a	7.45	<b>0.003</b>
	Breast yield (%)	14.2 b	15.0 a	0.19	<b>0.006</b>
<b>Bone strength</b>					
	Tibia breaking force (kg)	38.16	40.08	1.57	0.46
	Tibia strength (kg/mm <sup>2</sup> )	12.04	13.77	0.71	0.10
<b>Meat quality</b>					
	TBARS (0 d)	0.68 a	0.50 b	0.07	<b>0.02</b>
	TBARS (7 d)	2.12 a	0.94 b	0.28	<b>0.04</b>

\* BW = body weight; ADG = average daily gain; ADC = average daily consumption; FE = feed efficiency