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Presencia de *Salmonella* en Productos Avícolas

Manejo y Almacenamiento del Huevo Fértil en Aves Previo a su Incubación

Naturaleza de los Virus de Influenza Aviar

Efficacy of Viusid-Vet liquid* in production and immunology variables for broilers in a commercial poultry farm in the state of Aguascalientes (Mexico)

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1.0. Introduction

Intensive broiler production nowadays requires a certain number of procedures to be carried out all together to obtain the maximum production possible in the shortest amount of time. Some of these measures involve establishing good biosafety programmes, balanced diets, suitable vaccination programmes, using growth enhancers and products that boost the immune system (immunomodulators).

Accordingly, **Viusid-Vet Liquid®** is a product developed by Catalysis to improve production parameters and optimize the broilers' immune system.

Viusid-Vet Liquid® is a nutritional preparation that contains antioxidants, vitamins, trace elements and the main active ingredient, which is liquorice root extract (glycyrrhizinic acid), with potential antiviral properties whose activity in vitro and in vivo stops the replication of both the DNA and RNA viruses.[1, 21, 12, 10] It also stops the virion leaving its capsid and then penetrating the cells.[16, 18] These effects have been associated with the selective inhibitor, whose dosage depends on the phosphorylation of the Kinase-P.[7, 8]. **Viusid-Vet Liquid®** can also stimulate production of interferon gamma in the T and B lymphocytes by activating these, thus boosting the immune system.[11, 15]

The molecular activation of its active substances stimulates their biological functions (antiviral and antioxidant effect), without modifying their molecular structure, which means that the organism's defences are reinforced considerably.

2.0. Objetive

This clinical trial is intended to prove the effectiveness of **Viusid-Vet Liquid®** in broilers by evaluating its effect on the productive parameters and its immunological effect on the humoral immune response.

3.0. Material and methods

3.1. ANIMALS AND TREATMENT

The clinical trial was carried out in the Caracol 1 commercial poultry farm owned by Bachoco, S.A. de C.V., located in the state of Aguascalientes (Mexico). 226,679 one-day-old birds from the Ross x Ross strain were divided into two groups: Group A with 115,165 birds, and Group B with 111,514 birds. The four sheds assigned to Group B were treated with **Viusid-Vet Liquid®** in the ratio of 0.1 ml of the product/1 Kg of live weight, added to the drinking water for the first 3 weeks of the fattening period. The four sheds assigned to Group A were used for the control group, where the birds received no treatment of any kind.

The birds are of the Gallus gallus species, Ross x Ross strain, light rotisserie females, housed in sheds with a capacity of 16 birds per m^2.

The sheds measure 138 m long by 13 m wide. Health management of the brood was as normal for this type of commercial poultry farm. The broilers were reared under controlled conditions in sheds that were fitted out with an automatic feed system and nipple drinkers with cup. The diet was based on the farm's own-brand of pellet feed for pre-starters, starters, growers, finishers and withdrawal.

3.2. GROUP A - CONTROL GROUP

All the birds were given feed and water ad libitum. They were vaccinated according to the schedules established on the farm.

3.3. GROUP B - TREATMENT GROUP

All the birds were given feed and water ad libitum. They were vaccinated according to the schedules established on the farm and they were given **Viusid-Vet Liquid®** in a ratio of 0.1 ml/Kg of live weight, added to their drinking water daily for the first 3 weeks of the fattening period.

3.4. EVALUATED PRODUCTIVE PARAMETERS

To calculate the viability percentage at 35 days, the weight of all the birds, their weekly feed conversion, cumulative feed conversion at 35 days, the amount of feed consumed every week and cumulative feed consumed were all recorded. Finally, the productivity rate and number of kilograms of meat per square metre were determined.

3.5. HUMORAL IMMUNE RESPONSE

To prove the immunostimulatory effect of **Viusid-Vet Liquid®** on the organs, blood samples were taken when the broilers were 21 and 35 days old (18 samples/replica). Serum was obtained and frozen at -20°'a1 C, so that the titres of the specific serum antibodies for Newcastle disease could be determined using the haemagglutination-inhibition test.

3.6. HISTOLOGY

10 chickens from each treatment group were slaughtered when they were 21 and 35 days old. Samples of the bursa of Fabricius, spleen and thymus were taken and put in a 10% buffered formalin for processing, setting up on glass slides and dyeing with H&E stain before being analysed and assessed under the microscope.

4. Results

The values of the productive variables obtained during the fattening period are as follows:

4.1.0. PRODUCTION PARAMETERS

Table 4.1.1 Production parameters for birds treated with **Viusid-Vet Liquid®** (B) vs. control (A)

WEIGHT (gr) (P<0.05)*					CONVERSION (P<0.05)*				MORTALITY (P<0.05)*		
Wk.	Control A	**Viusid B**	dif g	%	Control A	**Viusid B**	dif g	%	Control A	**Viusid B**	Dif %
1	155.0	156.8	1.8	1.1%	1.3406	1.3604	19.8	1.5%	1.04%	1.01%	0.03%
2	376.3	393.3	17.0	4.5%	1.0636	1.0496	-14.0	-1.3%	2.49%	2.34%	-0.15%
3	689.3	735.3	46.0	6.7%	1.2676	1.2272	-40.4	-3.2%	3.37%	3.17%	-0.20%
4	1161.8	1230.0	68.3	5.9%	1.3527	1.3192	-33.5	-2.5%	3.90%	3.73%	-0.17%
5	1559.5	1653.3	93.8	6.0%	1.6042	1.5635	-40.8	-2.5%	4.24%	4.29%	0.05%

*The weight of **B** was significantly higher than A at 5 weeks' old, with a probability (P< 0.05) in comparison with ***Student's t-distribution of least squares.***

The use of **Viusid-Vet Liquid®** (B) tended to lead to improvement.

A large difference was observed in weight (93.8 g) and food conversion (40.8 g). Mortality was 0.15%, 0.20% and 0.17 % less at weeks 2, 3 and 4.

4.2.0. PRODUCTIVITY RATE (PR).

According to the formula [(% viability X Kg weight) / (days old X food conversion) X 100)] **Viusid-Vet Liquid®** improved the RP by 23 points compared with the control group.

Group	Age	Weight	FCR*	DWG**	% viability	Productivity rate***
A	35 days	1.559	1.767	44.54	95.76	265.97
B	35 days	1.653	1.740	47.22	95.73	289.16

* FCR = food conversion rate.
**DWG = daily weight gain.
***Productivity Rate= reliable indicator encompassing viability, weight, age and conversion.

4.3.0 KILOGRAMS OF MEAT PRODUCED PER SQUARE METRE

Group A - Control birds

Shed	Weight at 35 days	Birds in sheds	Existence at 35 days	Kg meat at 35 days	M²	Kg meat/M²
1	1.548	29,156	27,929	43,234.09	1,794	24.09
2	1.581	28,698	27,481	43,447.46	1,794	24.21
3	1,566	28,695	27,555	43,151.13	1,794	24.05
4	1.543	28,616	27,314	42,145.50	1,794	23.49
						23.96

Group B - Birds treated with **Viusid-Vet Liquid®**

Shed	Weight at 35 days	Birds in sheds	Existence at 35 days	Kg meat at 35 days	M²	Kg meat/M²
5	1.565	28,747	27,530	43,084.45	1,794	24.01
6	1.797	25,346	24,131	43,363.40	1,794	24.17
7	1.615	28,714	27,559	44,507.78	1,794	24.80
8	1.636	28,707	27,527	45,034.17	1,794	25.10

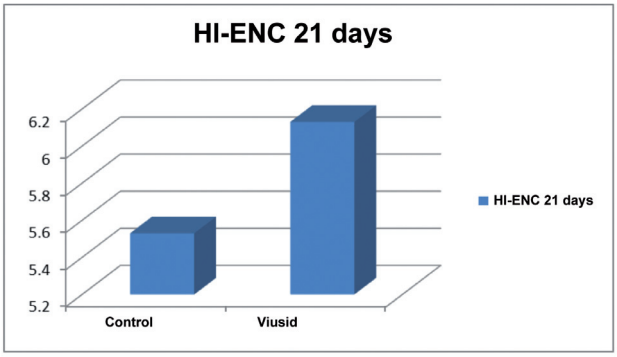
Group B (**Viusid-Vet Liquid®**) improved by 0.560 Kg of meat produced per square metre. 24.52

4.4. HUMORAL IMMUNITY - SEROLOGY RESULTS

4.4.1. RESULTS OF THE HAEMOAGGLUTINATION INHIBITION TEST FOR NEWCASTLE DISEASE

Group	Age	Lowest titre (Log ²)	Highest titre (Log ²)	Average geometric titre (Log ²)
A	21 days	3.0	8.0	5.53
B	21 days	4.0	8.0	6.13
A	35 days	5.0	9.0	7.11
B	35 days	6.0	9.0	7.56

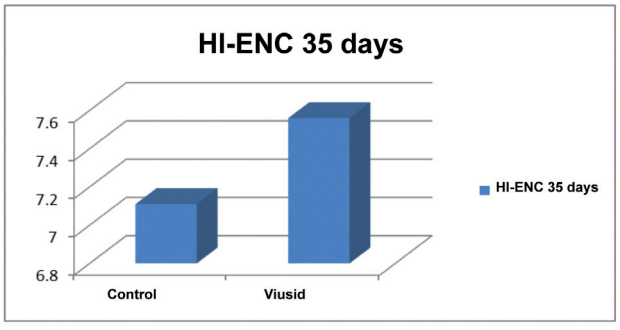
4.4.2. TABLE OF SEROLOGY RESULTS AT 21 DAYS FOR GROUPS A (AVERAGE 5.53 LOG²) AND B (AVERAGE 6.13 LOG²).



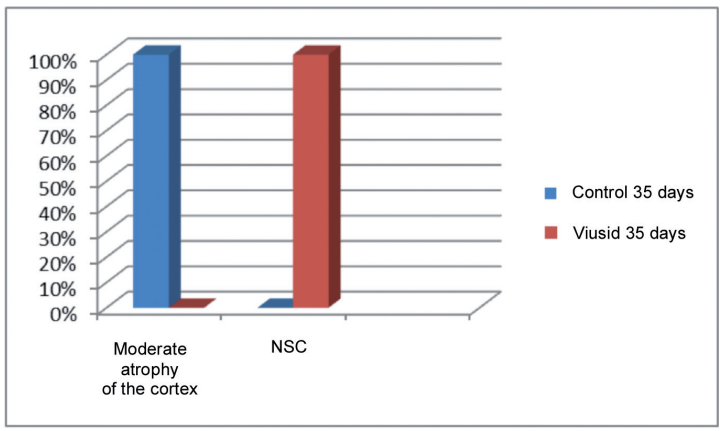
Interpretation - Group B, treated with **Viusid-Vet Liquid®**, mpresented a higher concentration of Newcastle disease antibody titres than in the control group, which means that chickens treated with **Viusid-Vet Liquid®** produced (0.6 log2) more antibodies than the control group.

4.4.3. TABLE SEROLOGY RESULTS TABLE AT 35 DAYS

Interpretation - Group B, treated with **Viusid-Vet Liquid®**, presented a higher concentration of Newcastle disease antibody titres than in the control group, which means that chickens treated with Viusid liquid®'a8 produced (0.45 log2) more antibodies than the control group.



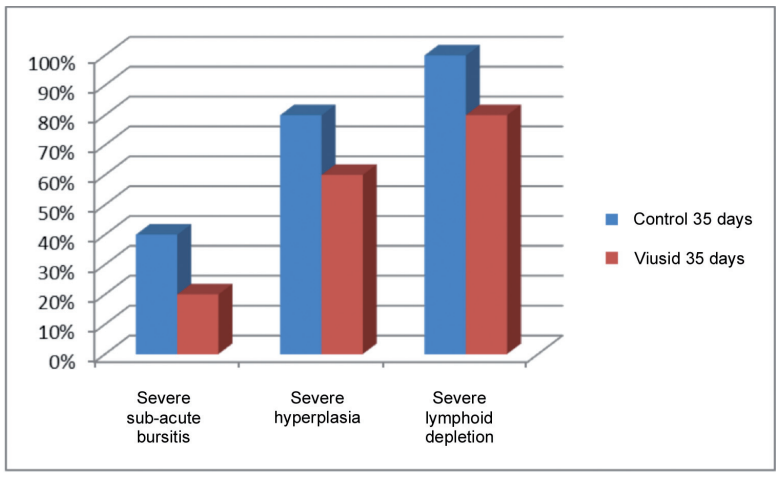
Thymus	Lesion	Control 35 days	Viusid* 35 days
	Moderate atrophy of the cortex	100%	0%
	NSC	0	100%



Absence of atrophy of the cortex cells is an important advantage for Group B (**Viusid-Vet Liquid®**) in thymuses analysed at 35 days.

Bursa of Fabricius	Lesion	Control 35 days	Viusid* 35 days
	Severe sub-acute bursitis	40%	20%
	Severe hyperplasia	80%	60%
	Severe lymphoid hyperplasia	100%	80%

At 35 days, in the cells of the bursa of Fabricius in birds in Group B a protection from the development of lymphatic depletion (20%) was observed.



At 35 days, in the cells of the bursa of Fabricius in birds in Group B a protection from the development of lymphatic depletion was observed.

5.0. Observations

Based on the results obtained here, in broilers at the starter stage (21 and 35 days), **Viusid-Vet Liquid®** is believed to have an immunostimulatory effect, as shown in the better state of health and, therefore, production parameters.

More tests and research work should be done on the product; because the repeatability and reproducibility effect has to be gauged. Moreover, it would be very interesting to clarify which mechanisms of action activate this product according to challenges faced by the flocks, depending on the region of the country and season of year, in order for its use to become more widespread.

6.0. Conclusions

The product can only be applied up to the 4th week, as from then onward it is supposed that the immune system has been stimulated enough to be able to complete the whole production cycle without having any problems caused by infections.

6.1. **Viusid-Vet Liquid®** improves production parameters, such as weekly and accumulated weight, by 93.8 g more at 35 days.

6.2. **Viusid-Vet Liquid®** improves daily weight gain by 2.68 g and accumulated weekly food conversion at 35 days by 40.8 g.

6.3. **Viusid-Vet Liquid®** improves the PR by 23 points and 0.560 Kg meat produced per square metre.

6.4. **Viusid-Vet Liquid®** improves TGM (0.45 Log^2) to combat Newcastle disease in the haemoagglutination inhibition test.

6.5. **Viusid-Vet Liquid®**, based on all the benefits obtained for production parameters and efficacy in preserving and improving the immune response in organs and lymph cells, the hypothesis has been proved and upheld and its immunomodulating effect in commercial broilers is confirmed.

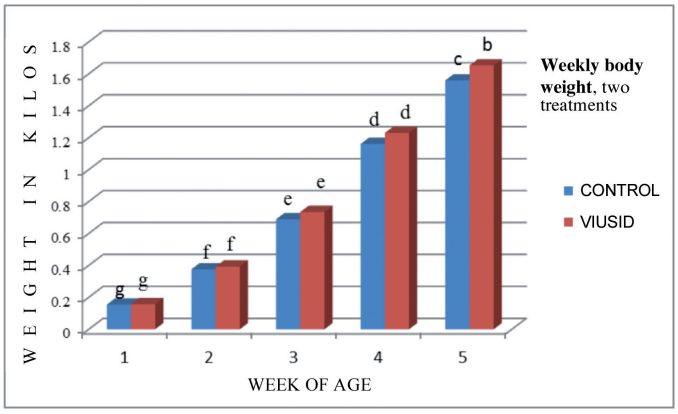
RESULTS OF STATISTICAL ANALYSIS

BODY WEIGHT

Estimators for the body weight (g) of chickens (female) in two treatments over five weeks.

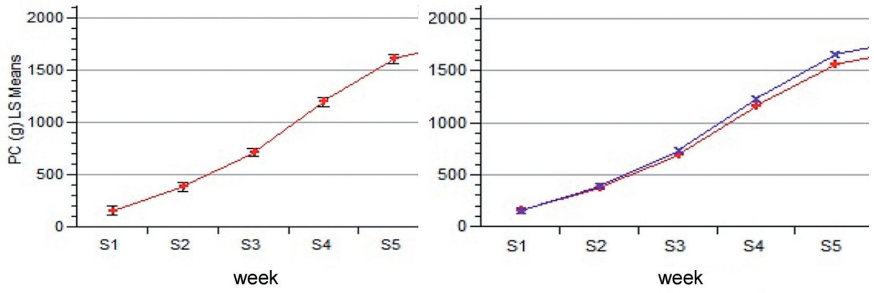
Week	Tx	n[a]	Average*	SD[b]	SME[c]	PR, μ; 95%[d]	Dif[e]	PR μ; 95%[f]	t	P
W1	Tx1	4	155.000[G]	7.78888	3.8944	(142.61, 167.39)	2,000	(-83.45, 87.454)	0.047	0.9624[NS]
	Tx2	4	157.000[G]	9.661	4.8304	(141.627, 172.373)				
W2	Tx1	4	376.250[F]	19.9729	9.986	(344.47, 408.03)	17,000	(- 68.45, 102.454)	0.04035	0.689[NS]
	Tx2	4	393.250[F]	20.3204	10.160	(360.92, 425.58)				
W3	Tx1	4	689.250[E]	19.3628	9.681	(658.44, 720.06)	46,000	(- 39.454, 131.454)	1.0917	0.2822[NS]
	Tx2	4	735.250[E]	43.7140	21.857	(665.69, 804.81)				
W4	Tx1	4	1161.75[D]	22.4704	11.235	(1126.0, 1197.5)	68,250	(- 17,204, 153.704)	1.6197	0.114[NS]
	Tx2	4	1230.00[D]	86.8293	43.415	(1091.8, 1368.2)				
W5	Tx1	4	1559.50[C]	17.407	8.703	(1531.8, 1587.2)	93,750	(8.29644, 179.204)	2.225	0.0324**
	Tx2	4	1653.25[B]	100.354	50.177	(1493.6, 1.812.9)				

a: Experimental units in the treatment (Tx); b: Standard deviation; c: Standard mean error; d: 95% confidence interval for the treatment average; e: Difference in the treatment averages in the same week; f: 95% confidence interval for the difference between the treatment averages for the same week.
* Averages not connected by the same letter are significantly different (critical t = 2.225; P < 0.05).
** Significant difference (P < 0.05) between the treatment averages for the same week.
NS: No significant difference (P > 0.05) between the treatment averages for the same week.



Averages with different letters are significantly different (P<0.05), the bars represent an average confidence intervals of 95%.

Weekly body weight of chickens (female), in two treatments.



S5	B	1606.3750
S4	C	1195.8750
S3	D	712.2500
S2	E	384.7500
S1	F	156.0000

Tx2,S5	B	1653.2500
Tx1,S5	C	1559.5000
Tx2,S4	D	1230.0000
Tx1,S4	D	1161.7500
Tx2,S3	E	735.2500
Tx1,S3	E	689.2500
Tx2,S2	F	393.2500
Tx1,S2	F	376.2500
Tx2,S1	G	157.0000
Tx1,S1	G	155.0000

DISCUSSION

The left-hand chart shows the average general behaviour fro the whole flock throughout the study and the right-hand chart shows the average behaviour of the treatments for each week of the study. Averages not connected by the same letter are significantly different in the Student t-distribution for minimum squares comparison for the difference between two averages ($t\alpha$, 36 =2.225, $\alpha = 0.05$). Comparison was made among the averages from treatments at each cut-off point (week), also all weeks in the study, and it was observed that the body weight (BW) in treatment Tx2 from the last date (Week 5.0) (BW=1653.25 ± 100.354 g) was significantly higher

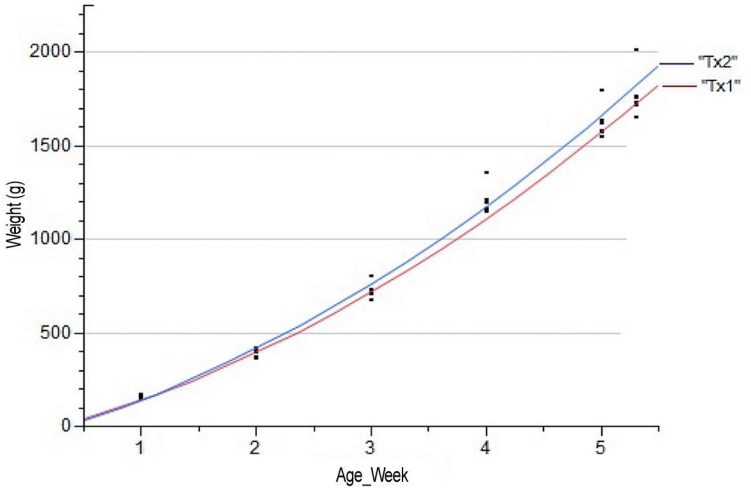
than in treatment Tx1 or any other treatment in previous weeks.

The general behavioural model of body weight (BW) for each treatment displays a growth trend in body weight as the broiler increases in age; all suggest that there will continue to be a weight gain even after the 5th week. The behaviour is similar between the treatments. From the 3rd week, the difference in final weight seems to be in favour of Tx2. Adjusted models are reliable (r2) in predicting the expected body weight from each Tx within five weeks' of age.

The relationship between the average body weight (BW) and the age of the chickens (female) in five weeks of treatment (Tx) between two treatments.

TX1 | Weight (g) = -441.2733 + 384.43818*Age_Week + 34.844044*(Age_Week-3.38333)^2 | r^2 0.996356 | $r^2_{Adjusted}$ 0.996009

TX2 | Weight (g) = -461.4076 + 406.14241*Age_Week + 34.546285*(Age_Week-3.38333)^2 | r^2 0.985495 | $r^2_{Adjusted}$ 0.984113

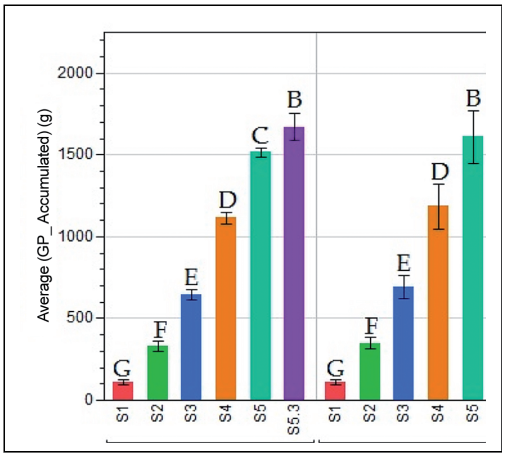


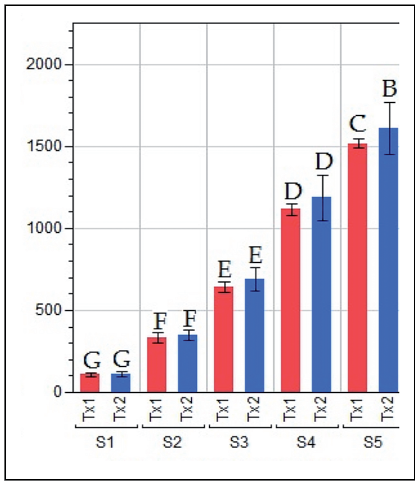
ACCUMULATED WEIGHT GAIN.

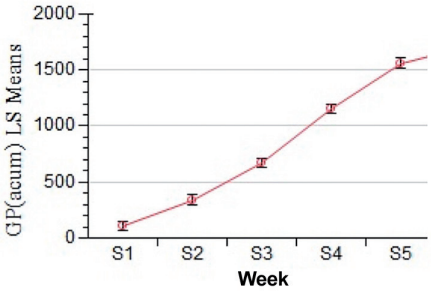
Estimators for the accumulated gain (WG) in body weight (g) of chickens (female) in two treatments over five weeks.

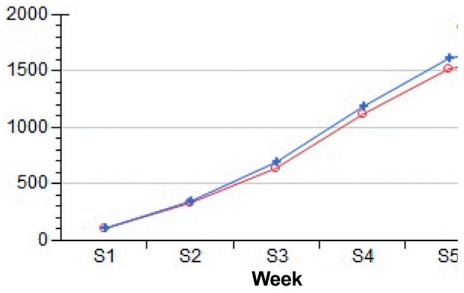
Week	Tx	n[a]	Average*	SD[b]	SME[c]	PR μ; 95%[d]	Dif[e]	PR, μ; 95%[f]	t	P
W1	Tx1	4	110[G]	7.78	3.894	(97.606, 122.394)	3.00	(- 82,454, 88.454)	0.0712	0.9436[NS]
	Tx2	4	113[G]	9.66	4.83	(97.627, 128.372)				
W2	Tx1	4	331.250[F]	19.973	9.986	(299.468, 363.031)	18.00	(- 67.45, 103.45)	0.4272	0.6718[NS]
	Tx2	4	349.25[F]	20.32	10.16	(316.916, 381.584)				
W3	Tx1	4	644.25[E]	19.363	9.681	(613.439, 675.06)	47.00	(- 38.45, 132.45)	1.115	0.272[NS]
	Tx2	4	691.25[E]	43.714	21.857	(621.691, 760.809)				
W4	Tx1	4	1116.75[D]	22.47	11.235	(1080.995,1152.5)	69.25	(- 16.2, 154.7)	1.6435	0.109[NS]
	Tx2	4	1186[D]	86.829	43.415	(1047.835,1324.16)				
W5	Tx1	4	1514.5[C]	17.407	8.703	(1486.802,1542.2)	94.75	(9.296, 180.204)	2.289	0.0307*
	Tx2	4	1609.25[B]	100.354	50.177	(1449.564,1768.93)				

a: Experimental units in the treatment (Tx); b: Standard deviation; c: Standard mean error; d: 95% confidence interval for the treatment average; e: Difference in the treatment averages in the same week; f: 95% confidence interval for the difference between the treatment averages for the same week.
* Averages not connected by the same letter are significantly different (critical t= 2.289; P < 0.05).
** Significant difference (P < 0.05) between the treatment averages for the same week.
NS: No significant difference (P > 0.05) between the treatment averages for the same week.









S5	B	1561.8750
S4	C	1151.3750
S3	D	667.7500
S2	E	340.2500
S1	F	111.5000

LSMeans Differences Student's t

α=0.050 t=2.02809

Tx2,S5	B	1609.2500
Tx1,S5	C	1514.5000
Tx2,S4	D	1186.0000
Tx1,S4	D	1116.7500
Tx2,S3	E	691.2500
Tx1,S3	E	644.2500
Tx2,S2	F	349.2500
Tx1,S2	F	331.2500
Tx2,S1	G	113.0000
Tx1,S1	G	110.0000

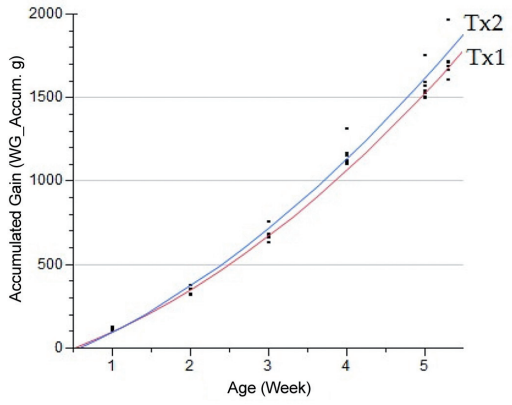
Are significantly different

Tx1: WG(accum) = -486.2733 + 384.43818* Age (Week) + 34.844044*(Age (Week)-3.38333)^2

r^2	0.996356
$r^2_{Adjusted}$	0.996009

Tx2: WG(accum) = -505.6277 + 406.23609* Age (Week) + 34.453935*(Age (Week)-3.38333)^2

r^2	0.985505
$r^2_{Adjusted}$	0.984125



DISCUSSION

The left-hand chart shows the average general behaviour for the whole flock and the right-hand chart shows the treatments for each week of the study. Averages not connected by the same letter are significantly different in the Student t-distribution for minimum squares comparison for the difference between two averages (tα 36 =2.02809, α = 0.05). The maximum WG in the study was obtained from treatment Tx2 in the last week (W5.3) (Tx2= 1609.25 ± 100.354 g), compared with the average for Tx1 in the last week and previous weeks (as was to be expected) (P < 0.05).

The accumulated gain model for body weight (WG) for each treatment shows a tendency toward growth in the WG as the bird ages.

The relationship between accumulated average gain of body weight (WG) and the age of the chickens (female) in five weeks of treatment (Tx) between two treatments.

FOOD CONVERSION

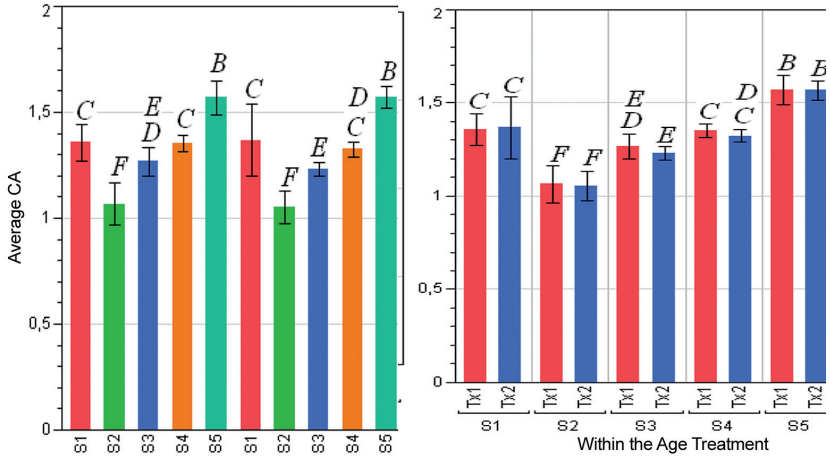
Estimators for the food conversion (FC) of chickens (female) in two treatments over five weeks.

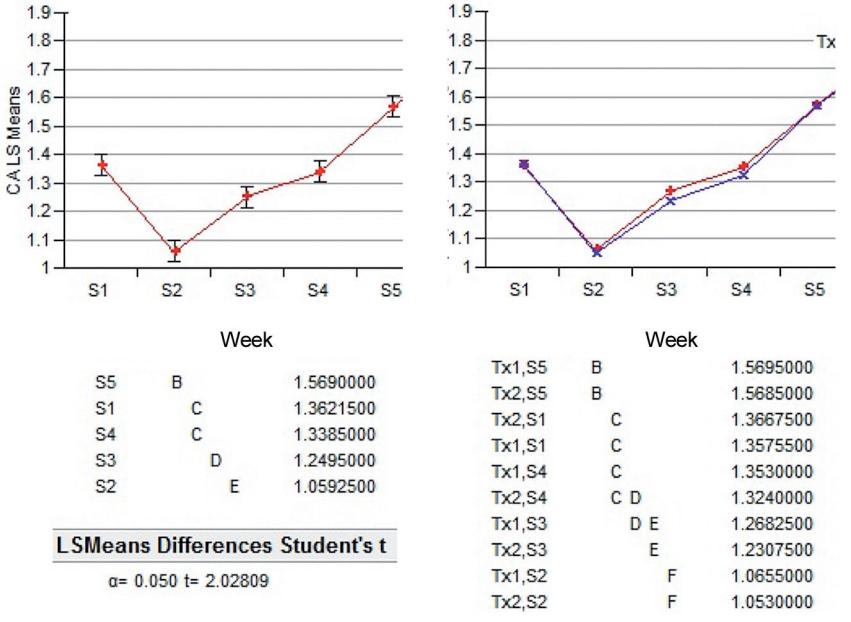
Week	Tx	n[a]	Average*	SD[b]	SME[c]	PR, μ; 95%[d]	Dif[e]	PR, μ; 95%[f]	t	P
W1	Tx1	4	1.3406^{B,C}	0.0538	0.0269	(1.272, 1.443)	0.0198	(- 0.06508, 0.348)	0.2512	0.8031^{NS}
	Tx2	4	1.3604^{B}	0.106268	0.05313	(1.1977, 1.5358)				
W2	Tx1	4	1.0636^{D}	0.06267	0.03087	(0.9657, 1.165)	- 0.014	(- 0.08678, 0.06178)	- 0.3413	0.7349^{NS}
	Tx2	4	1.0496^{D}	0.048696	0.02435	(0.97551, 1.1305)				
W3	Tx1	4	1.2676^{B,C}	0.041987	0.02099	(1.2014, 1.3351)	- 0.0404	(- 0.11178, 0.03678)	- 1.0239	0.3127^{NS}
	Tx2	4	1.2272^{C}	0.021391	0.01070	(1.1967, 1.2648)				
W4	Tx1	4	1.33527^{C}	0.023051	0.01153	(1.3163, 1.3897)	- 0.0335	(- 0.10328, 0.04528)	- 0.7918	0.4336^{NS}
	Tx2	4	1.3192^{B,C}	0.022316	0.01116	(1.2885, 1.3595)				
W5	Tx1	4	1.6042^{A}	0.049883	0.02494	(1.4901, 1.6489)	- 0.0407	(- 0.07528, 0.07328)	- 0.0273	0.9784^{NS}
	Tx2	4	1.5635^{A}	0.032848	0.01642	(1.5162, 1.6208)				

a: Experimental units in the treatment (Tx); b: Standard deviation; c: Standard mean error; d: 95% confidence interval for the treatment average; e: Difference in the treatment averages in the same week; f: 95% confidence interval for the difference between the treatment averages for the same week.
* Averages not connected by the same letter are significantly different (critical t = 2.225; P < 0.05).
** Significant difference (P < 0.05) between the treatment averages for the same week.
NS: No significant difference (P > 0.05) between the treatment averages for the same week.

DISCUSSION

The left-hand chart shows the average general behaviour for the whole flock and the right-hand chart shows the treatments for each week of the study. Averages not connected by the same letter are significantly different in the Student t-distribution for minimum squares comparison for the difference between two averages ($t\alpha$, 36 =2.0809, α = 0.05). The comparison was made between the averages of treatments at each cut-off point (week) of the study, as well as among all the weeks in the study, where the following was observed: The largest (best) FC was obtained in the 2nd week (W2) in both Tx (Tx1: 1.0655 ± 0.06267; Tx2: 1.053 ± 1.0487) respectively (P< 0.05), and the smallest (worst) FC at the end of the study (week W5.0; Tx1: 1.5695 ± 0.0498; Tx2: 1.5685 ± 0.0328) respectively (P < 0.05).

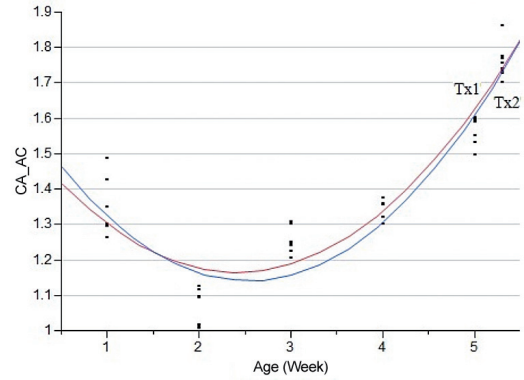




Tx1 | CA_AC = 0.776058 + 0.133844* Age _Week + 0.0691176*Age _Week-3.38333)^2

Tx2 | CA_AC = 0.7532968 + 0.1306844* Age _Week + 0.0775645*Age _Week-3.38333)^2

r^2	0.881093
r^2 Adjusted	0.869769
r^2	0.892972
r^2 Adjusted	0.882779



The model explaining the relationship between food conversion (FC) and age (week) of the chickens between treatments (Tx), in the five weeks of the study shows that the maximum (best) FC is 1.164 with Tx1 at 2.415 weeks, and with Tx2 it is 1.141 at 2.54 weeks, respectively; from then onward, FC decreases as the birds get older.

Tx1

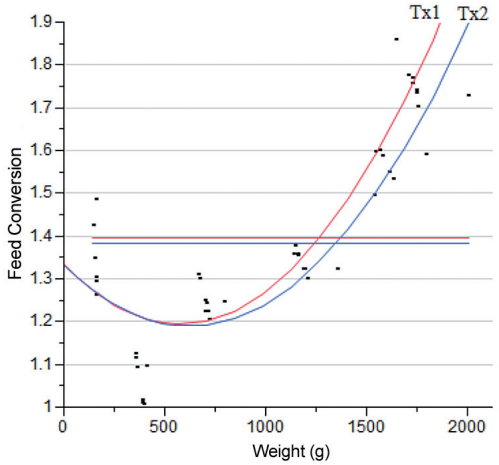
CA_AC = 0.9363712 + 0.0003331* Weight(g) + 4.246e-7*Weight(g)-969.375)^2

r^2	0.83365
r^2 Adjusted	0.817807

Tx2

CA_AC = 0.985038 + 0.0002553* Weight(g) + 3.7064e-7*Weight(g)-969.375)^2

r^2	0.783134
r^2 Adjusted	0.76248



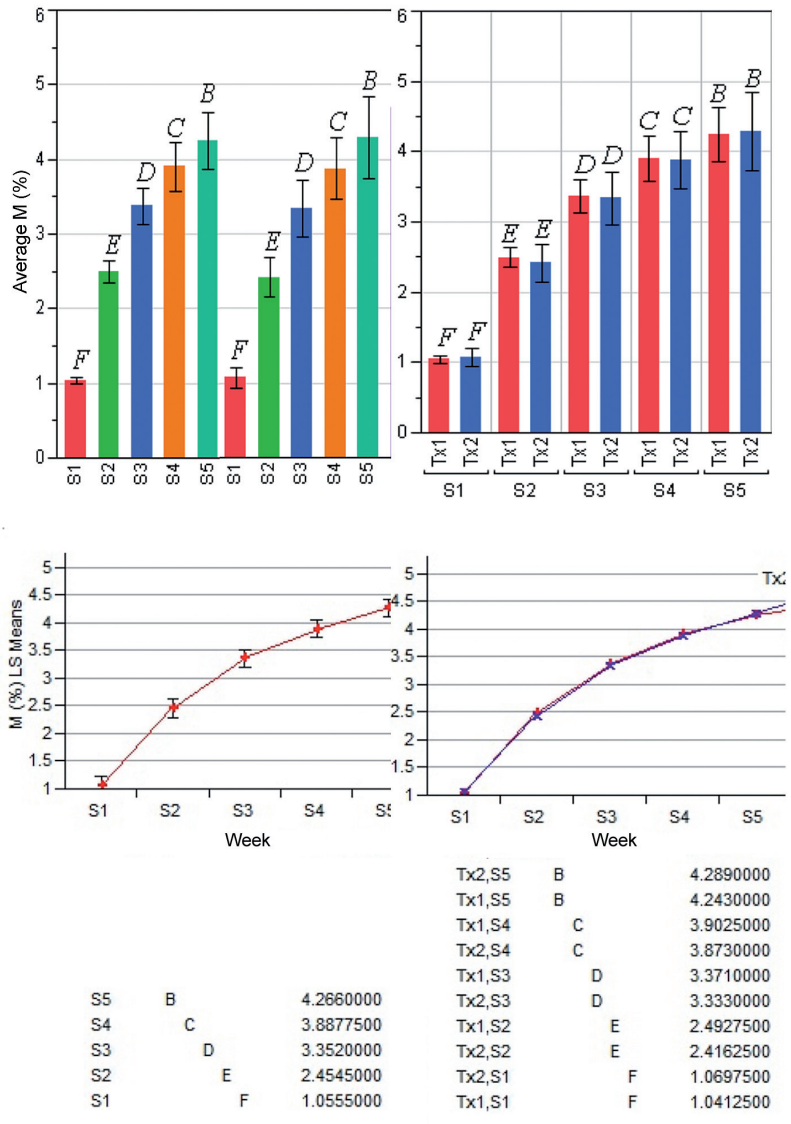
The fitted model for the relationship between food conversion (FC) and body weight (BW) of chickens (female) at five weeks of treatment (Tx) shows that the maximum (best) FC with Tx1 is 1.194, when the BW reaches 577.123 g, and 1.188 with Tx2, when the BW reaches 624.971 g, respectively; from then onward, the FC decreases (lessens) as the birds become heavier.

ACCUMULATED MORTALITY

Estimators for the accumulated mortality (M%) of chickens (female) in two treatments over five weeks.

Week	Tx	n[a]	Average*	SD[b]	SME[c]	PR, μ; 95%[d]	Dif[e]	PR, μ; 95%[f]	t	P
W1	Tx1	4	1.0411[F]	0.02872	0.01436	(0.9955,1.087)	- 0.0309	(-0.302,0.359)	0.1748	0.622 [NS]
	Tx2	4	1.0102[F]	0.08452	0.04226	(0.93524,1.204)				
W2	Tx1	4	2.4929[E]	0.08948	0.04474	(2.3504,2.6351)	-0.1485	(-0407,0.254)	- 0.4694	0.6416 [NS]
	Tx2	4	2.3444[E]	0.17023	0.08511	(2.1454,2.6871)				
W3	Tx1	4	3.3708[D]	0.15010	0.07505	(3.1321,3.6099)	-0.2008	(-0.365,0.2925)	- 0.2317	0.8169 [NS]
	Tx2	4	3.1700[D]	0.2364	0.1182	(2.9568,3.7091)				
W4	Tx1	4	3.9022[C]	0.20241	0.10121	(3.5804, 4.2246)	-0.1714	(- 0.36,0.301)	- 0,181	0.574 [NS]
	Tx2	4	3.7308[C]	0.2582	0.1291	(3.462,4.284)				
W5	Tx1	4	4.2426[B]	0.23690	0.11845	(3.866, 4.6200)	0.0474	(-0.284,0.376)	0.2822	0.7794 [NS]
	Tx2	4	4.2900[B]	0.34567	0.17284	(3.7389,4.839)				

a: Experimental units in the treatment (Tx); b: Standard deviation; c: Standard mean error; d: 95% confidence interval for the treatment average; e: Difference in the treatment averages in the same week; f: 95% confidence interval for the difference between the treatment averages for the same week.
* Averages not connected by the same letter are significantly different (critical t = 2.02809; P < 0.05).
** Significant difference (P < 0.05) between the treatment averages for the same week.
NS: No significant difference (P > 0.05) between the treatment averages for the same week.



DISCUSSION

The left-hand chart shows the average general behaviour fro the whole flock and the right-hand chart shows the treatments for each week of the study. Averages not connected by the same letter are significantly different in the Student t-distribution for minimum squares comparison for the difference between two averages ($t\alpha$, 36 =2.02809, α = 0.05). The comparison was made among the treatment averages at each cut-off point (week) of the study, in addition to all the weeks in the study. It was observed that there was no significant difference in accumulated mortality (M%) between treatments at the end of the study (Tx1: 4.243 ± 0.2369% and Tx2: 4.289 ± 0.0328) respectively (P < 0.7794). Neither was there any significant difference in accumulated mortality (M%) between treatments in a single week, in any week during the study (P > 0.05).

The ratio between accumulated mortality (M%) and age (week) of birds (female) at five weeks of treatment (Tx) shows that maximum M% in Tx1 was 4.35% at 5.49 weeks of age, and 4.67% up to 6.39 weeks in Tx2, respectively,

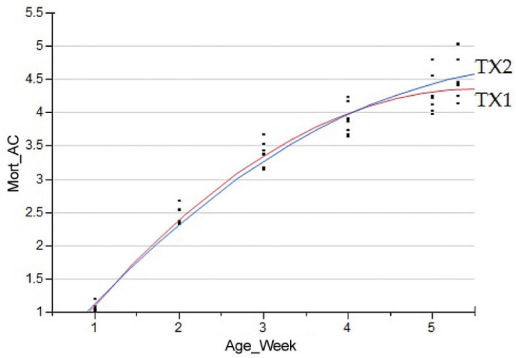
however, these ages were outside the observation limits for the study.

TX1 | Mort_AC = 1.3363518 + 0.6795891* Age_Week - 0.1611755*(Age_Week-3.38333)^2

r^2	0.97779
$r^2_{Adjusted}$	0.975675

TX2 | Mort_AC = 1.0900588 + 0.7333544* Age_Week - 0.1218876*(Age_Week-3.38333)^2

r^2	0.956568
$r^2_{Adjusted}$	0.952432



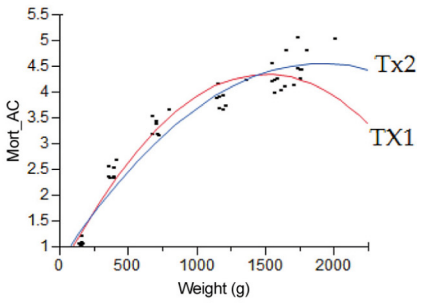
Similar to the above model, the ratio between accumulated mortality (M%) and body weight (BW) of birds during the study period shows that the maximum M% in Tx1 is 4.35%, with a BW of 1497.219 g, and 4.56% in Tx2, when BW reaches 1908.966 g, respectively. On reaching these BWs, M% tends to decrease as BW increases.

TX1 | Mort_AC = 2.1303322 + 0.0018009*Weight(g) - 1.7059e-6*(Weight(g)-969.375)^2

r^2	0.951811
$r^2_{Adjusted}$	0.947222

Tx2 | Mort_AC = 1.7149492 + 0.0019769*Weight(g) - 1.0526e-6*(Weight(g)-969.375)^2

r^2	0.941312
$r^2_{Adjusted}$	0.935723



Ratio between accumulated mortality (M%) and accumulated body weight gain (WG) of chickens (female) in five weeks of treatment (Tx) between two treatments.

DISCUSSION

In the first part of the report (Page 1), the average body weight was stated to be significantly higher in Tx2 (1653.25) than in Tx1 (1559.50) (t = 2.225; P = 0.0324). The difference in final body weight between the two treatments Tx1 and Tx2 is significant (P > 0.05).

Analysis, statistical report and discussion of results drawn up by:
Jaime Alonso Navarro Hernández. MVZ, MSc.
Mexico, D.F., 14 December, 2012.

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