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## Emulsifier Supplementation Response in Ross 308 Broilers at 1-10 Days

### ABSTRACT

The study was conducted to check the effect of emulsifier supplementation on growth performance of broiler birds on starter phase, from days 1 to 10. In the current study, a total of twelve hundred twenty-four Ross 308 broiler one day old chicks were used. Ross 308 broiler chicks were divided into two groups in such a way that each group had 12 replicates, and each replicate had 51 birds. The duration of the current trial was of 10 days. Chicks were fed experimental diets with or without emulsifier supplementation. Daily feed intake, body weight, feed conversion ratio and nutrient digestibility were recorded. Mortality was recorded on a daily basis, and feed intake was also corrected for mortality. Data collected from the experiment was interpreted by using analysis of variance method using SPSS under Completely Randomized Design. Results showed that emulsifier supplementation improved ( $p < 0.05$ ) feed intake in broiler birds on the 2<sup>nd</sup>, 6<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> days of the starter phase. Furthermore, emulsifier supplementation ( $p < 0.05$ ) affected the body weight on the 3<sup>rd</sup> and 10<sup>th</sup> day of the trial. Emulsifier supplementation also affected ( $p < 0.05$ ) feed conversion ratio on the 10<sup>th</sup> day of the trial. However, nutrient digestibility was not affected by the supplementation of emulsifier in the diet of broiler chicks. Results showed that emulsifier supplementation should be started on day 10.

### INTRODUCTION

In broiler production the addition of fat is practiced to increase energy density; however, the digestibility of fat is lower during the starter phase. Low fat digestibility in broiler birds is associated with less production of lipases and bile salts during early life (Jackson *et al.*, 1971; Polin *et al.*, 1980). Due to low bile salts secretion and high fat content in the diet of broiler birds, the supplementation of exogenous emulsifier is recommended (Park *et al.*, 2018). Supplementation of emulsifier increases the active surfaces of fats to allow the lipase activity which breakdown the triglyceride molecules into lipid micelles (Guerreiro Neto *et al.*, 2011). During starter phase broilers have lower fat digestibility due to lower production of bile salts and therefore can affect the final weight of birds (Upadhaya *et al.*, 2017). Therefore, the supplementation of emulsifier in the starter diet can influence the weight in the starter phase and finisher phase of the broiler birds.

Several researchers showed that the supplementation of emulsifiers in the diet of broilers increase fat digestibility and growth rate of broiler (Huang *et al.*, 2007; Zhang *et al.*, 2011; Zaefarian *et al.*, 2015). For example, Zhao *et al.* (2015) reported that the addition of emulsifiers in the diet of broilers increase fat digestibility. Tan *et al.* (2016) observed that growth performance increased in broiler supplemented with exogenous emulsifiers in the diet. Bontempo *et al.* (2018) published that body



weight (BW) and feed conversion ratio (FCR) improved in broiler chicks with different levels of emulsifiers in the diet. Similarly, low energy diet supplemented with emulsifier has improved body weight gain (BWG) and FCR in broiler birds (Upadhaya *et al.*, 2017). Likewise, Arif *et al.* (2016) also published that feed intake (FI), FCR, fat digestibility and BW increased in broilers with supplementation of lecithin emulsifier in the diets. However, some researchers reported that the inclusion of emulsifier in broilers diets had no effect on broiler performance (Zhang *et al.*, 2011; Zhao *et al.*, 2015; Upadhaya *et al.*, 2016; Upadhaya *et al.*, 2017). Siyal *et al.* (2017) concluded that emulsifier supplementation (ES) in the diet improved BW and FI but did not show any effect on FCR. Likewise, Serpunja & Kim (2018) revealed that ES in low energy diets did not show any effect on BWG, FI and FCR in the starter and grower as well as in the finisher phase due to less fat in the broiler's diet.

Previous studies were conducted on ES during the whole life (starter, grower, finisher) of the broiler birds with a control diet (Dabbou *et al.*, 2019; Serpunja & Kim, 2019). But to best of our knowledge, no study has been conducted so far to evaluate the effect of ES during 1-10 days (starter phase) only with control diet and daily monitoring of its effect on growth performance of broiler birds. Therefore, a study was planned to determine the effect of exogenous ES in the diet on growth performance during 1-10 days only in broilers.

## **MATERIAL AND METHODS**

This study was executed at the Research and Development Farm of Shamim Feed Mills Samma Satta Link Road, Bahawalpur (Pvt. Ltd.).

### **Experimental design, animal husbandry and experimental diets**

The study was carried out in a Completely Randomized Design with or without ES in the starter diet. A total of 1224 day old Ross broiler were used for this experiment. Experimental chicks were procured from a local hatchery. Total birds were divided into two experimental groups in such a way that each group replicated for twelve times with fifty-one birds in each replicate. The duration of the experimental trial was 10 days. Starter diets were formulated with emulsifier (lyso-phospholipids) and without emulsifier. All the ingredients used in the formulation of the experimental diets were provided by a commercial feed mill (Shamim Feed Mills Bahawalpur, Pakistan). The ingredients used

in the diet formulation were taken from the Brazilian table for Poultry and Swine. All diets were formulated on digestible amino acids basis keeping lysine as the reference amino acid as described in a recent study (Abdullah *et al.* 2019). For the experiment, a total of 24 pens were used with the dimensions of 9.2 × 4.2 × 2.5 cubic feet per pen. Rice husk was used as litter material for the bedding of the birds. Light was provided for 24 hours. Automatic nipple drinkers were used for the provision of fresh clean portable water in each pen. All the facilities were the same in each pen. The temperature of the room was 35–33 °C for the first 3 days, and then it declined 3 °C weekly. All birds were provided with feed and water ad libitum throughout the starter period. The diets were corn soybean meal based, and formulated to meet or exceed the feeding standard of chicken (Ross manual) requirements. The experimental procedures complied with the guidelines and code of practice of the University of Agriculture, Faisalabad. The experimental protocol was approved by Synopsis Committee University of Agriculture, Faisalabad. Birds were provided with environment free from thrust, freedom of expression of normal behavior and hunger as previously reported in the research of (Aziz ur Rahman *et al.*, 2017; Rahman *et al.*, 2019).

### **Growth Performance and Nutrient Digestibility**

Feed intake was recorded on the daily basis by subtracting the amount of ort (refusal) from the amount of feed offered. Daily FI was corrected for mortality.

$$\text{Feed intake} = \text{Daily feed intake} - \text{Ort}$$

Body weight was recorded on a daily basis by weighing balance. For that weighing of all birds of one replicate collectively and then dividing it by the number of birds to get average BW of the birds. Blood serum lipid profile was determined following the procedure of previous studies (Dong *et al.* 2019; He *et al.* 2018; Su *et al.* 2013). Feed conversion ratio was calculated on a daily basis by dividing FI to BW of the birds and was corrected for mortality. Feed conversion ratio was calculated by the equation below:

$$\text{Feed conversion ratio} = \frac{\text{Feed intake}}{\text{Body weight}}$$

Nutrient digestibility (dry matter (DM), crude protein (CP) and ether extract (EE)) was calculated. For this purpose celite was used as marker and mixed at the rate of 1 % of feed in the feed from day 7 to day 10 of the trial. For the collection of feces a polythene sheet was spread in each pen. Fecal samples were



**Table 1** – Ingredient and nutrient composition (g/kg) of diets.

Ingredients	Starter	Grower	Finisher
Corn ( <sup>1</sup> CP 7.5%)	51.96	55.64	56.38
Soybean meal (CP 45%)	35.96	26.04	18.41
Canola meal (CP 38%)	5	10	15
Tallow	2.5	3.8	5.4
Mono-dicalcium phosphate	-	1.2	1.1
Dicalcium phosphate	1.5	-	-
Limestone	1.15	1.3	1.2
L-lysine	0.43	0.5	0.74
DL-Methionine	0.41	0.41	0.51
L-Threonine	0.19	0.2	0.32
L-Tryptophan	-	0.01	0.04
NaHCO <sub>3</sub>	0.1	0.1	0.1
Salt	0.3	0.3	0.3
<sup>2</sup> Vitamin premix	0.2	0.2	0.2
<sup>3</sup> Mineral premix	0.2	0.2	0.2
Choline	0.1	0.1	0.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Chemical Composition</b>			
Metabolizable Energy (kcal/kg)	3000	3100	3200
CP (%)	23.76	21.28	19.98
Crude Fat (%)	4.82	6.31	8.02
Lysine (%)	1.5	1.28	1.25
Methionine (%)	0.72	0.66	0.71
Phosphorous (%)	0.45	0.42	0.4
Calcium (%)	0.92	0.84	0.8

Emulsifier Lysoforte Extend (Lyso-phospholipids) @ 500 g/ton

<sup>1</sup>Crude protein, <sup>2</sup>Vitamin mixture MNVT-96 supplies (per kilogram of mixture): 5,600,000 IU vitamin A (acetate), 1,760,000 IU vitamin D3 \ (cholecalciferol), 16,800 IU vitamin E (acetate), 0.7 g menadione dimethyl pyrimidinol bisulfite, 3.2 g riboflavin, 6.4 g d-calcium pantothenate, 36 g niacin, 7.2 mg vitamin B12, 0.7 g folic acid, 2.0 g pyridoxine, and 80 mg biotin, <sup>3</sup>Mineral premix: Mn, 88 mg; Cu, 66 mg; Fe, 8.5 mg; Zn, 88 mg; Se, 0.30 mg/kg.

collected after every 24 hours on the polythene sheets. The samples were placed carefully in sampling bags as described in recent studies (Iamam-ul-Haq *et al.* 2019; Shahzad *et al.* 2019). After sample collection, sample was made free from contaminants such as feathers, down, and scales. Three days samples were mixed and composite sample was obtained for the determination of nutrient digestibility. The sample was dried in the oven at 65 °C and grinded. After grinding the sample was passed through a 0.5 mm sieve and preserved for further analysis as reported by (Hussain *et al.* 2018). Then, the litter material was removed from the sample to avoid the error then this sample was used for the determination of DM, CP, EE, ash and acid insoluble ash present in the feces as well as in the feed sample. Procedures used for the analysis was as described by the AOAC (2000) with some modification as described in literature (Muhammad *et al.* 2016; Niu *et al.* 2017; Xia *et al.* 2018).

Digestibility was calculated from the following equation:

$$\text{Digestibility \%} = 100 - (100 \times \% \text{ marker in feed} \times \% \text{ nutrient in feces}) \times 100 \% \text{ marker in feces} \times \% \text{ nutrient in feed}$$

### Statistical Design

Data were analysed by ANOVA using the General Linear Model procedures of SPSS™ (SPSS v10.0, 1995) under Completely Randomized Design and mean values were compared using Tukey's Test.

## RESULTS

The effect of ES on FI in the diet of broilers during 1-10 days is shown in table 2. The results showed that ES has significant effect on FI. On day 1 there was no effect ( $p>0.05$ ) of ES on FI. On day 2 there was effect ( $p<0.05$ ) of ES on FI. On day 3 FI was not affected ( $p>0.05$ ) by ES. Similarly, on days 4, 5, 8 and 10 of the trial there was no effect ( $p>0.05$ ) of ES on FI. However, numerical values for FI on days 3, 4, 5, 8 and 10 of the trial showed greater values for the diet with ES rather than without supplementation. On day 6, 7 and 9 of the trial ES affects the FI ( $p<0.05$ ).

**Table 2** – Effect of emulsifier on Feed intake of broiler in starter phase.

Days	With Emulsifier	Without Emulsifier	<sup>1</sup> SEM	<sup>2</sup> p Value
Day 1	11.3	10.689	0.28	0.137
Day 2	14.79 <sup>a</sup>	14.25 <sup>b</sup>	0.21	0.018
Day 3	18.52	17.88	0.33	0.189
Day 4	21.16	20.5	0.3	0.133
Day 5	25.18	25.28	0.32	0.825
Day 6	29.77 <sup>a</sup>	29 <sup>b</sup>	0.21	0.017
Day 7	33.67 <sup>a</sup>	32.82 <sup>b</sup>	0.25	0.03
Day 8	37.82	37.3	0.23	0.13
Day 9	42.808 <sup>a</sup>	41.99 <sup>b</sup>	0.28	0.05
Day 10	46.505	46.045	0.37	0.3

<sup>1</sup>Standard error of the mean of 12 replicates; <sup>2</sup>a, b Means with different superscripts within a row differ significantly ( $p<0.05$ ).

The effect of emulsifier on BW in the diet of broilers during 1-10 days is shown in table 3. Results showed that on day 1 and 2 of the trial there was no effect ( $p>0.05$ ) of ES on BW. However, numerical values showed greater values for diet with ES. On day 3 there was effect ( $p<0.05$ ) of ES on BW. Results showed that ES on day 4, 5, 6, 7, 8 and 9 of the trial has no effect on BW. Numerical values for day 4, 5, 6, 7, 8 and 9 of the trial were greater for the diet with ES. On day 10 of the trial there was effect ( $p<0.05$ ) of ES on BW. The effect of the emulsifier on FCR in the diet during 1-10



**Table 3** – Effect of emulsifier on Body weight of broiler in starter phase.

Days	With Emulsifier	Without Emulsifier	<sup>1</sup> SEM	<sup>2</sup> p Value
Day 1	49.68	48.22	0.35	0.367
Day 2	62.57	62.11	0.62	0.6
Day 3	79.03 <sup>a</sup>	76.87 <sup>b</sup>	0.59	0.017
Day 4	97.39	96.9	0.67	0.18
Day 5	119.1	117.6	1.13	0.35
Day 6	140.64	138.96	1.4	0.404
Day 7	162.98	160.81	1.43	0.3
Day 8	188.74	185.63	1.59	0.18
Day 9	216.5	211.88	1.73	0.07
Day 10	244.86 <sup>a</sup>	238.22 <sup>b</sup>	2.04	0.03

<sup>1</sup>Standard error of the mean of 12 replicates, <sup>2</sup> a, b Means with different superscripts within a row differ significantly ( $p < 0.05$ ).

days is shown in table 4. Table showing that ES has no effect ( $p > 0.05$ ) on FCR on day 1 of the trial. Similarly, on day 2, 3, 4, 5, 6, 7, 8 and 9 of the trial there was no effect of ES on FCR. However, means of replicates on day 1, 2, 3 and 4 of the trial showed improved values of FCR numerically with ES. On day 10 of the trial there was effect ( $p < 0.05$ ) of ES on FCR.

**Table 4** – Effect of emulsifier on Feed conversion ratio of broiler in starter phase.

Days	With Emulsifier	Without Emulsifier	<sup>1</sup> SEM	<sup>2</sup> p Value
Day 1	0.23	0.21	0.006	0.226
Day 2	0.24	0.23	0.004	0.09
Day 3	0.24	0.23	0.005	0.76
Day 4	0.22	0.21	0.004	0.47
Day 5	0.21	0.22	0.003	0.41
Day 6	0.21	0.21	0.002	0.37
Day 7	0.21	0.20	0.002	0.45
Day 8	0.20	0.20	0.002	0.81
Day 9	0.20	0.20	0.002	0.81
Day 10	0.19 <sup>b</sup>	0.19 <sup>a</sup>	0.002	0.02

<sup>1</sup>Standard error of the mean of 12 replicates; <sup>2</sup> a, b Means with different superscripts within a row differ significantly ( $p < 0.05$ ).

The effect of emulsifier on nutrient digestibility in the diet of broilers during 1-10 days is shown in table 5. Results showed that there was no effect ( $p > 0.05$ ) of ES on DM, CP and EE digestibility throughout the starter phase (1-10 days).

**Table 5** – Effect of emulsifier on nutrient digestibility of broiler in starter phase.

Parameters	Without Emulsifier	With Emulsifier	SEM	p Value
% DM Digestibility	58.47	52.72	1.92	0.06
% CP Digestibility	54.38	52.63	2.62	0.61
% Fat Digestibility	69.29	70.32	2.69	0.80

<sup>1</sup>Standard error of the mean of 12 replicates; <sup>2</sup> a, b Means with different superscripts within a row differ significantly ( $p < 0.05$ ).

## DISCUSSION

Fat sources have been utilized to increase energy density of broilers diet (Summer & Lessons, 2005). Emulsifier supplementation in young age is efficient due to low availability of lipases and bile salts that increase fat utilization and subsequent availability of energy to growing chicks (Jackson *et al.*, 1971; Polin *et al.*, 1980). The current study was executed to check the effect of ES in the diet of broiler chicks on growth performance in starter phase when fat digesting organs are underdeveloped. The results of FI showed that emulsifier supplementation effects FI significantly. The feed intake of the diet supplemented with emulsifier was higher than in the diet without emulsifier supplementation during 1-10 days of the trial. The results of current studies are in agreement with the results of Bontempo *et al.* (2018); Dražbo *et al.* (2019). Park *et al.* (2018) reported increase in FI during the starter phase of broilers with the addition of synthetic emulsifier. The increase in FI is possibly related with better utilization of the diet by improve the mechanism of digestion due to ES that causes more hunger (Bontempo *et al.*, 2018). The results are in contrast to Arif *et al.* (2016); Kaczmarek *et al.* (2015) who stated that emulsifier supplementation had no significant effect on FI. The results are also contrasting to the findings of Imran *et al.* (2016) who reported decrease in FI with supplementation of emulsifier. The current study revealed that FI was improved on day 6, 7 and 9, so it is suggested that feed without ES should be fed to broiler chicks for the first five days of life in the starter phase. The results of BW showed significant ( $p < 0.05$ ) effect of ES at day 3rd and 10th of the starter phase. Emulsifier supplementation improves the digestion of fat at younger ages and increases availability of energy. This increase in energy availability causes energy deposition in the form of body fat and muscle glycogen and better body confirmation, but this was not the case in this study. However, weight gain may be greater due to more FI with ES as shown in table 2. The results of the current study are in agreement with the results of Bontempo *et al.* (2018) who reported increase in BW due to emulsifier supplementation. These results are not in line with the results of Park *et al.* (2018); Serpunja & Kim (2019) who reported no effect of ES on BW of broiler birds. In the same way, Tan *et al.* (2016) reported that ES in the starter phase has no significant effect on BW. The results are also contrasting with the results of Arif *et al.* (2016) who reported decrease of BW with



the supplementation of emulsifier. The results of FCR showed improvement with the supplementation of emulsifier on day 10th of the trial. This improvement in FCR is reflecting increase in weight gain as compared to FI. The results of current studies are in agreement with the results of Dražbo *et al.* (2019); Allahyari-Bake & Jahanian (2017), who reported improvement in FCR with emulsifier supplementation. Contrasting to the findings of current studies Ho Cho *et al.* (2012); Arif *et al.* (2016) showed that ES had no significant effect on FCR. The results of nutrient digestibility showing that ES has no significant effect on digestibility of DM, CP and EE through starter phase (1-10 days). The results of current studies are in agreement to results of Allahyari-Bake & Jahanian (2017), they reported no effect of emulsifier addition on nutrient digestibility except to that of EE. Generally, gut health is considered important for better digestibility and performance in livestock (Qiu *et al.* 2019a; Qiu *et al.* 2019b) and external feed additives are provided to improve the gut health and performance of livestock. However, in the current study, we did not find ES effect on EE digestibility. In contrast, Arif *et al.* (2016) reported improvement in DM, CP and EE digestibility with ES. Similarly, Dražbo *et al.* (2019) reported increase in digestibility of fat with supplementation of emulsifier.

## CONCLUSION

In conclusion, the results of the current study showed that emulsifier supplementation in broiler diets in the starter phase (1-10 days) have positive effect on BW, FI and FCR but had no significant effect on nutrient digestibility. Based on the results, it is suggested that broiler chicks should be fed diet without ES for the first 9 days of the starter phase when there is no effect on BW and FCR. Furthermore, from day 10 ES should be added in broiler chicks diets as there was significant effect on BW and FCR.

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