Research Article

Role of Adding Apricot Seed Powder, Oil, and Nano-Powder to Broiler Chicken (Ross 308) Feed in Improving Production Performance

Nihad Mohammed Nafel[1*], Fadhil Rasool Abbas Al-Khafaji[2]

[1]Department of Animal Production, Al-Qasim Green University, Iraq; [2]Department of Animal Production, Al-Qasim Green University, Iraq.

Abstract | The evaluation of food industry by-products has recently attracted considerable attention due to their nutritional value. Apricot seeds, in particular, can be utilized to produce compounds such as antioxidants and feed enhancers. Therefore, this study was conducted to investigate the effects of apricot kernel powder, oil, and nano-powder supplementation in broiler diets on selected production traits. A total of 420 one-day-old, unsexed Ross 308 broiler chicks were randomly distributed into seven treatments with three replicates per treatment and 20 chicks per replicate in a completely randomized design (CRD). The dietary treatments were as follows: T1 (control) without supplementation; T2 and T3 supplemented with apricot kernel powder at 10 and 20 g/kg feed, respectively; T4 and T5 supplemented with apricot kernel oil at 2.5 and 5 ml/kg feed, respectively; and T6 and T7 supplemented with nano apricot kernel powder at 1 and 3 mg/kg feed, respectively. The results showed that treatments T5 and T6 had a highly significant increase ($p \leq 0.01$) in live body weight compared to all other treatments. Total weight gain was also significantly higher ($p \leq 0.01$) in T6 compared to the other groups. Treatment T5 did not differ significantly from T6 or the control group in total weight gain. A significant reduction ($p \leq 0.01$) in total feed intake was observed in all supplemented groups compared to the control. Furthermore, feed conversion ratio improved significantly ($p \leq 0.01$) in all supplementation treatments relative to the control group, with T3 showing the greatest improvement among the treatments. In conclusion, addition of apricot seed powder, oil, and nano-powder in feed improved growth performance and feed efficiency in Ross 308 broilers, with nano-powder showing the most pronounced effect.

Keywords | Apricot seed powder, Apricot seed oil, Nano- supplementation, Productive performance, Broiler

Received | January 21, 2026; **Accepted** | February 23, 2026; **Published** | June 12, 2026
***Correspondence** | Nihad Mohammed Nafel, Department of Animal Production, Al-Qasim Green University, Iraq; **Email:** nihad.m@uokerbala.edu.iq
Citation | Nafel NM, Al-Khafaji FRA (2026). Role of adding apricot seed powder, oil, and nano-powder to broiler chicken (Ross 308) feed in improving production performance. J. Anim. Health Prod. 14(3): 797-804.
DOI | https://dx.doi.org/10.17582/journal.jahp/2026/14.3.797.804
ISSN (Online) | 2308-2801

INTRODUCTION

Recently, increasing attention has been directed toward the utilization of food processing by-products and waste materials to reduce environmental pollution and enhance sustainability (Soheir and Afaf, 2014; Al-Saeedi *et al*., 2022). Fruit residues, including seeds, are inexpensive, readily available, and rich in biologically active compounds; therefore, many studies have explored their potential as natural antioxidant sources (Ibrahim *et al*., 2017; Jideani *et al*., 2021; Salman *et al*., 2025).

Apricot (*Prunus armeniaca* L.) is a stone fruit belonging to the Rosaceae family and is widely cultivated in the Mediterranean region, Russia, and the United States (Hussain *et al*., 2011; Al-Saeedi *et al*., 2023). It is commonly processed into juice or dried products, leaving the seeds as a by-product. Apricot kernels are a valuable source of edible oil and contain high levels of unsaturated fatty acids, particularly oleic and linoleic acids, as well as palmitic acid (Konchok *et al.*, 2011). In addition, apricot seeds contain various biologically active compounds, including tocopherols, phenolic compounds, carotenoids, and phytosterols, which exhibit antioxidant and antimicrobial properties. These compounds may promote the growth of beneficial gut microflora and contribute to maintaining digestive health (Salem *et al.*, 2016; Soltan *et al.*, 2021).

Natic *et al.* (2020) reported that fruit seed extracts, including apricot, are frequently used as dietary supplements in animal production, including poultry, due to their antioxidant and antibacterial effects, which can enhance growth performance. Arbouche *et al.* (2012) found that including apricot kernel powder as a partial soybean substitute at levels of 20%, 40%, and 60% increased feed intake but had no significant effect on live body weight or body weight gain in broilers. However, higher inclusion levels (100, 150, 200, 300, 400, and 800 g/kg feed) significantly affected total mortality rates.

Due to the limited number of local studies investigating the use of apricot seeds and their supplementation in broiler diets, this study aimed to evaluate the effects of adding apricot seed powder, oil, and nano-powder at different levels on selected production traits in broiler chickens.

MATERIALS AND METHODS

Birds and treatments

This research was carried out at Al-Anwar National Poultry Company in Babil Governorate over a span of 35 days, from 12th September 2024 to 13th January 2025. The aim was to investigate the impact of incorporating apricot seed powder, oil, and nano powder into broiler feed on various productive traits. A total of 420 one-day-old unsexed Ross308 broiler chicks were used, and they were randomly distributed into 7 experimental groups, each consisting of 3 replicates, with 20 chicks per replicate. The data were analysed using a completely randomized design (CRD) to study the effect of the studied treatments on different traits. Apricot kernel powder, oil, and nano-powder were added to the diet from day one as follows:

- T1: Control treatment without supplementation
- T2: 10 g apricot kernel powder/kg feed
- T3: 20 g apricot kernel powder/kg feed
- T4: 2.5 ml apricot kernel oil/kg feed
- T5: 5 ml apricot kernel oil/kg feed
- T6: 1 mg nano apricot kernel powder/kg feed
- T7: 3 mg nano apricot kernel powder/kg feed

Preparation of apricot seed powder, oil, and nano-powder

Apricot seeds were obtained from local markets, manually crushed, and the kernels were ground into powder. The oil was extracted from the kernels using a mechanical press at 168°C for 10 minutes, after which the extracted oil was stored under refrigerated conditions until use. Nutritional value, fatty acid composition ad phenolic acids of apricot kernel has been presented in Tables 1-3. The nano-powder of apricot seed kernels was prepared in the laboratories of the Ministry of Science and Technology. Zinc nanoparticles were synthesized using apricot seed kernel extract according to the Elumalai method with slight modifications, following the steps described below: Ten milliliters of 20% apricot kernel extract were placed in a round-bottom flask and diluted with 1000 mL of distilled water. The solution was heated and continuously stirred at different temperatures. After one minute, zinc sulfate was gradually added while stirring was maintained. The mixture (10 g) was thoroughly mixed and then filtered. Sodium hydroxide was added to neutralize the acidity of the solution (Jefri *et al.*, 2019).

The mixture was subsequently transferred to a glass container and placed in an oven at 200°C for two hours. After filtration, the precipitate was separated from the filtrate, collected, and dried in an oven at 70°C to remove residual moisture. The dried material was then ground into a fine powder. Finally, 10 g of zinc sulfate were gradually added to ensure complete reaction and mixing. The resulting white powder was stored in a tightly sealed container (Munir and Begum, 2019).

Table 1: Nutritional value of apricot kernel powder.

No.	Component	Percentage
1	Protein	24.9
2	Lipid	45.8
3	Ash	2.01
4	Moisture	5.78
5	Fiber	2.44
6	Carbohydrate	19.07

Table 2: Fatty acid composition of apricot kernel oil.

No.	Fatty acid	Percentage
1	Palmatic	4.65
2	a-Lenolinic	6.88
3	Stearic	0.25
4	Arachidonic	0.11
5	Oleic	63.25
6	Linoleic	22.59

Diet

The chicks were initially fed a starter diet containing 23.04% protein and 3021.45 kcal/kg of energy from day one until the third week of their life. From the fourth week until the end of the fifth week, they were switched to a growth diet with 20.06% protein and 3194.92 kcal/kg of energy. The feed was supplemented with apricot seed powder, oil, and nano-powder at the specified concentrations, and both feed and water were provided *ad libitum*. The composition of the feed is detailed in Table 4.

Table 3: Phenolic acids found in apricot kernels.

1	Item (Phenolic acid)	ppm
2	Apigenin	25.4
3	Catechine	66.4
4	Gallic acid	45.9
5	Kaempferol	32.1
6	Rutin	40.8

Table 4: Ingredient composition (%) of the experiment diets used from days 1 to 35.

Feed composition		Ingredients
Finisher feed	Starter feed	
40	30	Yellow corn
24	28.25	Wheat
24.8	31.75	Soybean meal 48%
5	5	Protein concentrate
4.4	2.9	Sunflower oil
0.6	0.9	Limestone
0.9	0.7	Dicalcium phosphate (DCP)
0.2	0.2	Vitamins and minerals mix
0.1	0.3	Salt
100	100	Total
20.06	23.04	Crude Protein (%)
3194.92	3021.45	Calculated metabolic energy (kcal/kg of feed)
1.07	1.27	Lysine %
0.38	0.41	Methionine %
0.30	0.35	Cysteine %
0.78	0.82	Methionine + Cysteine %
0.43	0.41	Phosphorous %
159.77	131.14	C/P Energy Ratio (Protein %)

The protein concentrate used was Brocon-5 Special W, of Chinese origin. Each kilogram contains 40% crude protein, 3.5% fat, 1% fiber, 6% calcium, 3% available phosphorus, 3.25% leucine, 3.90% methionine + cysteine, 2.2% sodium, 2100 kcal/kg of energy, 20,000 IU of vitamin A, 40,000 IU of vitamin D3, 500 mg of vitamin E, 30 mg of vitamin K3, 15 mg of vitamins B1 + B2, 150 mg of vitamin B3, 20 mg of vitamin B6, 300 mcg of vitamin B12, 10 mg of folic acid, 100 mcg of biotin, 1 mg of iron, 100 mg of copper, 1.2 mg of manganese, 800 mg of zinc, 15 mg of iodine, 2 mg of selenium, 6 mg of cobalt, and 900 mg of antioxidant (BHT). The chemical composition of the suspension was determined as per NRC (1994).

Characteristics studied

Live body weight and weight gain (g/bird): The average live body weight for each replicate at the end of each week (from weeks 1 to 5) was determined by weighing all the birds in each replicate. The average live weight of each bird was calculated using the method described earlier (Al-Fayyad and Naji, 1989; Al-Jebory and Ibrahim, 2021).

$$Average\ live\ weight\ \left(\frac{g}{bird}\right) = \frac{Total\ live\ weights\ of\ replicate\ birds\ at\ weekend\ (g)}{Number\ of\ birds\ in\ the\ replicate}$$

The average weekly weight gain (g/replicate) was calculated by subtracting the average live body weight at the beginning of the week (g) from the average live body weight at the end of the week (g) as described earlier (Al-Fayyad and Naji, 1989).

Feed consumption (g/bird)

The weekly feed consumption for the birds in each replicate (weeks 1 to 5) was calculated by subtracting the remaining feed at the end of the week from the total feed provided at the beginning of the week. In cases where there was feed loss in any replicate, the feed consumption was determined using the following equation (Al-Zubaidi, 1986; Arkan *et al*., 2025).

$$Average\ daily\ feed\ consumption\ (g\ /\ bird) = \frac{P}{H \times 7 + x}$$

Where p represents the total feed consumed during the week, H denotes the number of live chicks at the end of the week, and x indicates the number of days the deceased birds were fed.

Feed Conversion ratio (g feed/ g weight gain): The feed conversion ratio was determined using the equation outlined by the study of Al-Zubaidi (1986):

$$Food\ conversion\ rate\ \left(\frac{g\ feed}{g\ weight\ gain}\right) = \frac{The\ average\ amount\ of\ feed\ consumed\ (g)\ during\ the\ week}{Average\ weight\ gain\ (g)\ during\ the\ week}$$

RESULTS

Impact of apricot seed supplements on body weight of broilers

The results presented in Table 5 demonstrate the effect of supplementing broiler feed with apricot seed powder, oil, and nano powder on the average live body weight (g). During the first week, all experimental treatments showed significant improvements over the control group, with a marked increase (p≤0.01) in live body weight for treatment T5 (0.5 liters of apricot kernel oil/100 kg feed). Treatments T7, T4, T3, and T2 displayed similar effects

Table 5: Effect of adding apricot seed powder, oil, and nano powder to the feed of Ross308 broiler chickens on the average live body weight (g/bird) for weeks 1-5 of the bird's life.

Treatments	Starting weight	Average ± standard error				
		Week 1	Week 2	Week 3	Week 4	Week 5
T1	±43.330.33	166.33± 0.67 d	445.00 ± 0.58 e	912.33 ± 2.33 b	1544.33 ± 0.67 c	2196.33 ± 1.20 b
T2	±41.67 0.33	172.00 ± 1.00 b	438.67 ± 0.33 f	891.00 ± 1.00 c	1526.67± 0.88 d	2181.67 ± 0.33 e
T3	42.66 ± 0.33	171.33±0.33 b	454.00 ± 0.57 cd	908.00 ± 1.00 b	1544.67 ± 0.33 b	2194.67 ± 0.33 cd
T4	±42.67 0.33	171.33 ± 0.33 b	454.00 ± 0.57 a	908.00± 1.00 b	1544.67 ±0.33 c	2194.67 ± 0.33 bc
T5	43.67 ± 0.33	174.67 ± 0.33 a	452.00 ± 0.57 b	925.33± 0.33 a	1557.00± 1.00 a	2200.33 ± 0.33 a
T6	43.33 ± 0.33	169.00 ± 0.58 c	447.33 ± 0.33 d	908.00 ± 1.00 b	1543.67 ± 0.67 c	2203.33 ± 2.73 a
T7	42.33 ± 0.33	171.33 ± 0.33 b	449.67± 0.33 c	913.67 ± 0.67 b	1550.33 ± 0.88 b	2190.33 ± 0.33 d
	NS	**	**	**	**	**

** Different letters in the same column denote a significant difference at the (p ≤ 0.01) level. NS: Not significant.

in terms of significance and surpassed treatments T6 and T1. The control treatment (T1) exhibited the lowest live weight values.

In the second week, a significant (p≤0.01) increase in body weight was observed in treatment T4 (0.25 liters of apricot kernel oil/100 kg feed) and all other experimental treatments, with treatment T5 performing better than T7, T6, T3, T1, and T2. Treatment T3 (2 kg apricot kernel powder/100 kg feed) showed no significant difference from T6 (1 g nano apricot kernel powder/100 kg feed) or T7 (3 g nano apricot kernel powder/100 kg feed). Treatment T2 (1 kg apricot kernel powder/100 kg feed) demonstrated a decrease in body weight compared to the control group.

In the third week, treatment T5 led all groups with a significant (p≤0.01) increase in live body weight. Treatment T2 showed a reduction in body weight compared to T3, T1, T7, T6, and T4, while no significant differences were observed among the latter treatments. Treatment T5 again significantly (p≤0.01) outperformed all other treatments, followed by T7 and T3, which outperformed T2, T1, and T4. Treatment T4 performed similarly to the control, whereas T2 showed the lowest live weight among the treatments.

In the fourth week, treatment T5 continued to outperform all treatments with significant results (p≤0.01). Treatments T7 and T3 showed better results than T2, T1, and T4, with treatment T4 similar to the control treatment. In the fifth week, a significant (p≤0.01) increase in body weight was observed for treatments T5 and T6 compared to all other treatments. However, treatments T7, T4, T3, and T2 displayed lower body weight values compared to the control. Treatment T4 showed mixed results, being similar to T1 at one point and T3 at another, while no significant difference was found between T7 and T3 regarding live body weight during this week.

Impact of apricot seed supplements on average weekly weight gain of broilers

The results of Table 6 show the effect of adding apricot seed powder, oil and nano powder to broiler feed on the weekly weight gain rate (g) of the studied treatment birds. In the first week of the birds life, a highly significant (p≤ 0.01) superiority in the weight gain rate of treatment T5 was observed over all experimental treatments. All addition treatments increased in weight gain compared to the control treatment, which recorded the lowest rates for this week. The second week witnessed a highly significant (p≤ 0.01) increase for treatment T4 over all studied treatments. As for treatments T7, T6, T5 and T3, they were similar to the control treatment in weight gain but outperformed treatment T2. In the third week, a highly significant (p≤ 0.01) superiority was recorded for the birds of treatment T5 and did not show a significant difference with the control treatment. At the same time, it was observed that treatment T3 was similar to the control treatment on the one hand and to treatment T3 on the other. T7, T6, on the other hand, while T4, T2 recorded the lowest rates of weight gain in this week. As for the fourth week, the statistical analysis showed that weight gain was not significant among the studied treatments.

The statistical analysis showed a highly significant superiority (p≤ 0.01) for treatment T6 over the studied treatments, and treatment T2 was consistent with it in terms of weight gain, while treatment T2 did not show any significant difference with treatments T4, T1, but it was superior to treatment T7, T5, T3, which were identical to each other in terms of weight gain for the fifth week.

As for the total weight gain rate, the weight gain of treatment T6 birds increased at a significant level (p≤ 0.01) compared to treatments T7, T4, T3, T2, T1, but it was similar to treatment T5. At the same time, we find that treatment T5 did not show any significant difference with T4, T1. On the other hand, treatments T4, T3, T1 did not

Table 6: Effect of adding apricot seed powder, oil and nano powder to Ross308 broiler feed on the rate of weight gain (g / bird) for the 1-5 weeks of bird's life.

Treatments	Average ± Standard error					
	Week 1	Week 2	Week 3	Week 4	Week 5	Total weight gain
T1	123.00 ± 0.57 d	278.67 ± 0.33 b	467.33 ± 2.18 ab	632.00 ± 1.73	652.00 ± 1.73 b	2153.00 ± 1.53 bc
T2	130.00 ± 1.15 b	266.67 ± 0.88 c	452.33 ± 0.88 d	635.67 ± 1.85	655.00 ± 0.57 ab	2139.67 ± 0.33 d
T3	128.33 ± 0.33 b	277.00 ± 0.57 b	463.67 ± 3.17 bc	638.00 ± 4.04	645.00 ± 2.31 c	2152.00 ± 2.65 c
T4	129.33 ± 0.33 b	282.67 ± 0.33 a	454.00 ± 0.57 d	636.67 ± 0.67	651.00 ± 0.57 b	2153.67 ± 0.88 bc
T5	132.33 ± 0.33 a	277.33 ± 0.67 b	473.33 ± 0.67 a	631.67 ± 0.88	644.00 ± 0.58 c	2158.67 ± 0.67 ab
T6	125.67 ±0.33 c	278.33 ± 0.66 b	460.67 ± 0.88 c	635.67 ± 0.88	660.00 ± 3.00 a	2160.33 ± 2.85 a
T7	128.33 ± 0.33 b	278.33 ± 0.67 b	460.67 ± 3.84 c	636.0.66 ± 1.45	640.00 ± 1.00 c	2144.00 ± 3.51 d
	**	**	**	NS	**	**

** Different letters within one column indicate a significant difference at (p ≤ 0.01) level. NS: non-significant

Table 7: Effect of adding apricot seed powder, oil, and nano powder to the feed of Ross 308 broiler chickens on the rate of feed consumption (g / bird) for the 1-5 weeks of the bird's life.

Treat-ments	Average ± standard error					Total feed consumed
	Week 1	Week 2	Week 3	Week 4	Week 5	
T1	148.67 ± 0.33 c	388.33 ± 0.33 a	655.00 ± 0.57 a	942.00 ± 0.58 a	1252.67 ± 2.96 b	3386.67 ± 2.60 a
T2	154.33 ± 0.33 b	365.33 ± 0.33 c	627.33 ± 0.33 e	909.67± 0.33 c	1166.67 ± 1.20 d	3223.33 ± 0.88 e
T3	146.33 ± 0.66 e	374.67± 1.20 b	633.33 ± 1.33 d	899.67 ± 0.33 e	1162.33 ± 0.67 e	3125.33 ± 1.76 f
T4	146.67 ± 0.33 de	372.00 ± 0.58 b	633.33 ± 1.67 d	914.67 ± 0.33 b	1266.67 ± 0.88 a	3333.33 ± 2.18 b
T5	156.00± 1.00 ab	374.33 ± 0.67 b	642.33 ± 0.33 b	909.33 ± 0.67 c	1146.33 ± 0.88 f	3228.33 ± 1.67 e
T6	148.33 ± 0.67 cd	373.67 ± 0.67 b	638.67 ± 0.33 c	916.00 ± 1.00 b	1181.33 ±1.33 c	3258.00 ± 1.73 c
T7	157.33 ± 0.33 a	373.33 ± 2.84 b	643.00± 0.33 b	904.67 ± 0.33 d	904.67 ± 1.00 e	3237.33 ± 1.86 d
	**	**	**	**	**	**

** Different letters within one column indicate a significant difference at (p ≤ 0.01) level.

show any significant difference among themselves for this trait. Treatment T7, T2 gave the lowest rates in total weight gain. The total weight gain rates were, respectively (2153.00, 2139.67, 2152.00, 2153.67, 2158.67, 2160.33, 2144.00).

Impact of apricot seed supplements on feed consumption of broilers

The data presented in Table 7 illustrate the effect of supplementing broiler feed with apricot seed powder, oil, and nano powder on the feed consumption rate (g) of the birds over a five-week period. During the first week, a highly significant increase (p≤0.01) in feed consumption was observed in treatment T7, which was statistically similar to treatment T5. Conversely, treatments T2 and T5 did not show any significant difference in feed consumption. Treatment T3 exhibited a significant decrease (p≤0.01) in feed consumption compared to all other treatments, though no significant difference was observed between it and treatment T4. Treatment T6 did not differ significantly from the control group or from treatment T4.

In the second week, all supplemented treatments showed a significant decrease (p≤0.01) in feed consumption compared to the control group. Treatment T2 recorded the lowest feed consumption rate during this week.

In the third week, a significant decrease (p≤0.01) in feed consumption was noted for all supplementation treatments when compared to the control (T1). Treatments T5 and T7 outperformed treatments T6, T4, T3, and T2. Treatment T6 was superior to T3, T2, and T4, while treatment T2 exhibited a significant decline (p≤0.01) in feed consumption.

During the fourth week, all supplementation treatments showed a continued significant decrease (p≤0.01) in feed consumption compared to the control treatment. Treatments T6 and T4 were significantly more effective than T7, T5, T3, and T2. Treatments T5 and T2 did not differ significantly, although both outperformed T7 and T3. Treatment T3 recorded the lowest feed consumption rate for this week.

In the fifth week, treatment T4 showed a highly significant increase (p≤0.01) in feed consumption compared to all other treatments, followed by a significant decrease in treatments T7, T6, T5, T3, and T2 relative to the control treatment. Treatment T6 outperformed treatments T7, T5, T3, and T2, while the lowest feed consumption rates for this week were observed in treatment T5.

Regarding total feed consumption, all supplemented treatments showed a significant decrease ($p \leq 0.01$) compared to the control group. Treatment T4 was superior to treatments T7, T6, T5, T3, and T2. Treatment T6 outperformed T5, T3, and T2. Lastly, treatment T3 recorded the lowest total feed consumption during the entire experimental period.

Impact of apricot seed supplements on feed conversion ratio

The results of Table 8 indicate the effect of adding apricot seed powder, oil and nano powder to broiler feed on the feed conversion ratio (g feed/g weight gain). It was shown that in the first week of age, birds in treatment T4 and T3 showed the greatest improvement at ($p \leq 0.01$) in the feed conversion ratio, thus outperforming treatments T7, T6, T5 and T1. Treatment T2 was similar to treatment T4 and T3 once and to treatment T6 and T5 again in the significance of this trait. Treatment T5 showed a significant improvement compared to treatment T7, but it was similar to the control treatment T1. In the second week, all addition treatments improved significantly at ($p \leq 0.01$) in the feed conversion ratio compared to the control treatment, where a highly significant improvement ($p \leq 0.01$) was observed in treatment T7 and T4 on Treatments T6, T5, T3, T2, T1. Treatments T6, T5, T3 were similar in the significance of this trait and showed a significant improvement ($p \leq 0.01$) when compared with treatment T2, T1. In the third week, the results of the statistical analysis showed a highly significant improvement ($p \leq 0.01$) for treatment T5, T3 over treatments T7, T6, T2, T1, and did not show a significant difference with treatment T4, followed by treatment T7, which improved significantly compared to the control treatment, but did not show any significant difference with treatment T6, T2. At the same time, the two last-mentioned treatments were similar in the feed conversion ratio for the third week. The results of the experiment witnessed a highly significant improvement ($p \leq 0.01$) in the feed conversion ratio of birds in the supplementation treatments compared to the control treatment T1. A significant improvement was observed for treatment T7, T3 compared to treatments T6, T5, T4, T2, T1. As for treatments T6, T5, T4, T2, they did not show any significant difference between them, but they outperformed the control treatment. This is what was observed in the fourth week. In the fifth week, a highly significant improvement ($p \leq 0.01$) was observed in the feed conversion ratio of birds in the supplementation treatments compared to the control treatment. Treatment T4 recorded the lowest improvement rates compared to the supplementation treatments, but it was similar to the control treatment in the significance of this trait. As for the total feed conversion rate, a significant improvement was observed at the level ($p \leq 0.01$) for treatment T3 when compared to all the studied treatments, followed by treatment T5, which showed a significant improvement at the level ($p \leq 0.01$) over treatments T7, T6, T4, T2, and T1. At the same time, treatments T7 were significantly similar to treatment T6 once and to treatment T2 again in the total feed conversion rate, and finally, treatment T4 outperformed treatment T1.

DISCUSSION

The reason for the improved growth performance, increased nutrient absorption and consequently increased live weight and body weight gain, which was evident in the results of our study for some supplementation treatments (Tables 5 and 6), and in particular the superiority achieved in live body weight and body weight gain in treatment T5

Table 8: Effect of adding apricot seed powder, oil, and nano powder to the feed of Ross308 broiler chickens on the feed conversion rate (g feed consumed / g weight gain) for the 1-5 weeks of the bird's life.

Treat-ments	Average ± Standard error					Average feed conversion rate
	Week 1	Week 2	Week 3	Week 4	Week 5	
T1	1.206 ±0.006 ab	1.393 ± 0.003 a	1.400 ± 0.005 a	1.486 ± 0.003 a	1.920 ± 0.006 a	1.481 ± 0.003 a
T2	1.156 ± 0.018 cd	1.370 ± 0.006 b	1.386 ± 0.003 bc	1.433 ± 0.003 b	1.807 ± 0.031 b	1.431 ± 0.004 c
T3	1.140 ± 0.005 d	1.350 ±0.006 c	1.363 ± 0.003 d	1.406 ± 0.006 c	1.800 ± 0.005 b	1.412 ± 0.005 f
T4	1.133 ±0.003 d	1.316 ±0.003 d	1.393± 0.003 ab	1.436 ± 0.003 b	1.943 ± 0.003 a	1.445 ± 0.003 b
T5	1.180 ±0.010 bc	1.346 ± 0.003 c	1.353± 0.003 d	1.433 ± 0.003 b	1.776 ± 0.003 b	1.418 ± 0.005 e
T6	1.176 ±0.003 c	1.340 ±0.005 c	1.383 ± 0.003 bc	1.436 ± 0.003 b	1.786 ± 0.008 b	1.425 ± 0.005 d
T7	1.223 ± 0.006 a	1.323 ± 0.003 d	1.376 ± 0.003 c	1.416 ± 0.003 c	1.803 ± 0.003 b	1.428 ± 0.006 cd
	**	**	**	**	**	**

** Different letters within one column indicate a significant difference at ($p \leq 0.01$) level.

(apricot kernel oil added at a concentration of 0.50 L/100 kg feed) when compared with the control treatment, may be due to the high content of fatty acids in the composition of apricot kernel oil, which is a good source of energy, as its metabolism produces good amounts of adenosine triphosphate (ATP) (Makrygiannis *et al*., 2023). It has shown an increase in growth rate, increased fat deposition, and a reduction in metabolic disorders and mortality in broiler chickens (Londok and Rompis, 2019).

The effective and clear role of the fatty acids that make up apricot kernel oil, represented by palmitic, arachidonic, oleic, linoleic and others, as palmitic acid is characterized by its stability and ease of absorption compared to some unsaturated acids, which increases the overall absorption efficiency of fats. works to increase digestion and increase fat deposition, while arachidonic acid works to enhance, repair and growth of muscle and skeletal tissues by converting it to prostaglandin and protein synthesis in the muscles (Nur Mahendra *et al*., 2023). Apricot kernel oil contributes to promoting the fat deposition pathway by improving digestion and absorption, increasing the formation of chylomicrons, and raising the activity of the lipoprotein lipase enzyme, in addition to favoring saturated fatty acids, especially palmitic acid, for storage within fat cells instead of oxidation (Nur Mahendra *et al*., 2023). Also, the saturated fatty acids that make up apricot kernel oil may enhance growth by providing a suitable acidic medium in the digestive system, leading to the activation of enzymes that decompose proteins, fats and carbohydrates, and thus increasing the digestion of feed consumed by birds by reducing pathogenic and harmful bacteria and increasing the number of beneficial bacteria (Amer *et al*., 2021; Geng *et al*., 2022; Alsudani *et al*., 2025).

These acids may also increase the size and number of goblet cells. These cells are responsible for the formation of mucin, which is one of the basic components of the mucous membrane lining the intestines. Thus, they work to protect the beneficial bacteria in the intestinal cavity and protect the digestive tract from diseases or maintain the health of the digestive tract, thus achieving high weight rates or within acceptable limits (Oleiwi *et al*., 2023).

The improvement in productive performance in terms of live body weight and weight gain in treatment T6 (adding nano-apricot kernel powder at a concentration of 1 g/100 kg feed) may be due to the ability of nanoparticles, which exhibit multiple properties, including large surface area, high surface activity, and high absorption capacity (Abd Al-Ghany, 2019; Michalak *et al*., 2022). Particle size affects the permeability and absorption of apricot kernel powder, which has a high nutritional value, as shown in Table 1, in terms of the high protein content (24.9%) and its direct association with proteins inside the body, causing an increase in body mass. The reason may also be the compounds with antioxidant properties that make up apricot kernel powder, which work to reduce fat oxidation, i.e., improve the metabolism process inside the bird's body, leading to an improvement in live weight and weight gain. The increase in body weight in the supplement groups may be due to the presence of biologically active molecules such as (kaempferol, gallic acid, and catechine) in apricot kernel powder, which can stimulate increased digestion and metabolism of nutrients and improve digestion of fats and increased absorption, leading to higher efficiency in feed consumption and thus improving the feed conversion ratio (Biswas *et al*., 2023; Xiong *et al*., 2024).

CONCLUSION

The addition of apricot kernel powder, oil, and nano powder had a clear and significant impact on improving the productive performance of broiler chickens. This is probably due to the high nutritional value of apricot kernels and their balanced blend of highly concentrated fatty acids that protect the digestive tract from diseases and maintain high or acceptable weight gain rates. Furthermore, the presence of biologically active molecules in apricot kernel powder can stimulate increased digestion and nutrient metabolism, leading to higher feed efficiency, i.e., enhanced growth in chickens and improved feed conversion ratio.

ACKNOWLEDGEMENT

The authors extend their thanks and appreciation to Al Anwar Poultry Company and to the Faculty of Agriculture/Al Qasim Green University

NOVELTY STATEMENT

This study is unique in that it is the first to use nano-apricot seed powder for broiler.

AUTHOR'S CONTRIBUTION

Al-Khafaji prepared the study proposal and oversaw the fieldwork, while Nafal collected and analyzed the data and wrote the manuscript.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

REFERENCES

Abd El-Ghany W (2019). Nanotechnology and its considerations in poultry field: An overview. J. Hellenic Vet. Med. Soc., 70(3): 1611–1616. https://doi.org/10.12681/jhvms.21783

Al-Fayyad H, Naji S (1989). Poultry product technology. Higher Education Press, University of Baghdad

Al-Jebory HH, And Ibrahim MK (2021). Effect of adding bee propolis to diet on productive performance of broiler chickens. Indian J. Ecol., 48(15): 203-207.

Al-Saeedi MKI, Al-Jebory HH, Ajafar M (2023). Effect of in ova injection with nano-copper in productive performance of Japanese quail exposed to pathological and environmental challenge: Annals of Agri-Bio Res., 28(2): 361-366.

Al-Saeedi MKI, Al-Jebory HH, Abood MH (2022). Progress phenotypic traits of hatched chicks and growth indicators of broiler chicks fed embryonically with zinc methionine: Arch. Razi Inst., 77(6): 2139-2145.

Alsudani AA, Al-Jebory HH, Al-Saeedi MKI (2025). Effects of *in-ovo* injection of zinc-methionine on some microbial and parameters of immunology of broiler: Punjab Univ. J. Zool., 40(1): 01-07. https://doi.org/10.17582/journal.pujz/2025/40.1.1.7

Al-Zubaidi SSA (1986). Poultry Management. Basra University Press - Al-Basr

Amer SA, A-Nasser A, Al-Khalaifah HS, Alsadek DMM, Abdel Fattah DM, Roushdy EM, Sherief WRIA, Farag MFM, Altohamy DE, Abdel-Wareth AAA, Metwally AE (2021). Effect of dietary medium-chain α-monoglycerides on the growth performance, intestinal histomorphology, amino acid digestibility, and broiler chickens. Blood Biochem. Paramet. Anim., 11(1): 57. https://doi.org/10.3390/ani11010057

Arbouche R, Arbouche F, Arbouche HS, Arbouche Y (2012). Effects on growth performance of the incorporation of apricot kernel meal in the broiler ration. Rev. Méd. Vét., 163(10): 475–479.

Arkan NB, Al-Jebory HH, Al-Khafaji FRA (2025). Impact of nano-encapsulated of anti-bacterial peptide on broiler growth performance under oxidative stress condition. Adv. Anim. Vet. Sci., 13(6): 1169-1179. https://doi.org/10.17582/journal.aavs/2025/13.6.1169.1179

Biswas S, Cho SB, Kim IH (2023). An evaluation of gallic acid supplementation to corn-soybean-gluten meal-based diet in broilers. Poult. Sci., 102(7): 102738. https://doi.org/10.1016/j.psj.2023.102738

Geng S, Zhang Y, Cao A, Liu Y, Di Y, Li J, Lou Q, Zhang L (2022). Effects of fat type and exogenous bile acids on growth performance, nutrient digestibility, lipid metabolism and breast muscle fatty acid composition in broiler chickens. Animals, 12: 1258. https://doi.org/10.3390/ani12101258

Hussain I, Gulzar S, Shakir I (2011). Physico-chemical properties of bitter and sweet apricot kernel flour and oil from north of Pakistan. Int. J. Food Saf., (13): 11-15.

Ibrahim UK, Kamarrudin N, Suzihaque MUH, Abd Hashib S (2017). Local fruit wastes as a potential source of natural antioxidant: An overview. IOP Conf. Ser. Mater. Sci. Eng., 206(1): 012040. https://doi.org/10.1088/1757-899X/206/1/012040

Jefri SNS, Abdullah AH, Muhamad EN (2019). Response surface methodology: Photodegradation of methyl orange by Cuo/Zno under UV light irradiation. Asian J. Greenchem., 3: 271.

Jideani AI, Silungwe H, Takalani T, Omolola AO, Udeh HO, Anyasi TA (2021). Antioxidant-rich natural fruit and vegetable products and human health. Int. J. Food Prop., 24(1): 41-67. https://doi.org/10.1080/10942912.2020.1866597

Konchok T, Tsering S, Ashish Y, Shashi BS (2011). Extraction of apricot kernel oil in cold desert Ladakh, India. Indian J. Tradit. Knowl., 10(2): 304-306.

Londok J, Rompis JEG (2019). Supplementation of lauric acid and feed fiber to optimize the performance of broiler. IOP Conf. Ser. Earth Environ. Sci., 387(1): 012082. https://doi.org/10.1088/1755-1315/387/1/012082

Makrygiannis J, Athanasiadis V, Chatzimitakos T, Bozinou E, Mantzourani C, Chatzilazarou A, Makris DP, Lalas SI (2023). Exploring the chemical composition and antioxidant properties of apricot kernel oil. 332. https://doi.org/10.3390/separations10060332

Michalak I, Dziergowska K, Alagawany M, Farag MR, El-Shall NA, Tuli HS, Emran TB, Dhama K (2022). The effect of metal-containing nanoparticles on the health, performance and production of livestock animals and poultry. Vet. Quart., 42(1): 68-94. https://doi.org/10.1080/01652176.2022.2073399

Munir S, Begum M (2019). Computational investigations of a novel photoactive material for potential application in dye sensitized solar cells. Asian J. Green Chem., 3: 91.

Nati CM, Zagorac DD, Ciri CI, Meland M, Rabrenovi CB, Akši CM (2020). Cold pressed oils from genus Prunus. In: Cold Pressed Oils; Academic Press: Cambridge, MA, USA, pp. 637–658. https://doi.org/10.1016/B978-0-12-818188-1.00056-6

NRC (1994). Nutrient requirements of poultry, 9th Revised Edition. Nutrient requirements of domestic animals. Nat. Res. Coun. Washington, DC: USA, National Academy Press. https://doi.org/10.1155/2023/3220344

Nur Mahendra MY, Kamaludeen J, Pertiwi H (2023). Omega-6: Its pharmacology, effect on the broiler production, and health. Vet. Med. Int., 3220344, 10 Pages.

Oleiwi GH, Nafel NM, Al-Khafaji FRA, Naser IH (2023). Effect of adding different concentrations of mix-oil solution to drinking water of broiler chickens ross 308 and breeders at elevated temperatures on productive performance. Adv. Life Sci., 10(3): 418-425. https://doi.org/10.62940/als.v10i3.1832

Salem MZM, Zayed MZ, Ali HM, El-Kareem MSMA (2016). Chemical composition, antioxidant and antibacterial activities of extracts from *Schinus molle* wood branch growing in Egypt. J. Wood Sci., 62: 548–561. https://doi.org/10.1007/s10086-016-1583-2

Salman KAA, Al-Saeedi MKI, Al-Jebory HH (2025). Effect of adding manganese sulfate for diet on the hormonal and histological response of aged roosters exposed to heat stress. Kufa J. Agric. Sci., 17(1): 131-141. https://doi.org/10.36077/kjas/2025/v17i1.12455

Soheir EM, Afaf MY (2014). Utilization of apricot kernels. J. Home Econ. 24(1): ISSN 1110-2578.

Soltan Y, Adibe Filho AA, Abdalla A, Berenchtein B, Schiavinatto P, Costa C (2021). Replacing maize with low tannin sorghum grains: Lamb growth performance, microbial protein synthesis and enteric methane production. Anim. Prod. Sci., 61: 1348–1355. https://doi.org/10.1071/AN20605

Xiong T, Chen Z, Hassan M, Zhu C, Wang J, Tan S, Ding F, Cheng Z, Ye J, Fan Q, Xu D, Jiang S, Ruan D, (2024). Effects of dietary gallic acid supplementation on growth performance, meat quality, antioxidant capacity, and muscle fiber gene expression in broiler chickens. Animals, 14(24): 3670. https://doi.org/10.3390/ani14243670