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Effects of dietary inclusion of *Schanginia arbuscula* powder at different levels on growth performance, mortality and liver enzyme in broiler chickens

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Abstract— This study was conducted at Agricultural Research Center / Scientific Research Commission, from 1/7 to 12/8 2025 to investigate the Effects of dietary inclusion of *Schanginia arbuscula* powder at three levels (5, 10 and 15%) on growth performance, mortality and live enzyme in broiler chickens. In the present study, day-old broiler chicks were randomly allocated to four dietary treatments, with three replicates per treatment and 75 birds per replicate. The birds were reared in floor pens within a single hall under identical standard environmental and nutritional conditions, and feed and water were provided ad libitum throughout the experimental period. The evaluated parameters were recorded on a weekly basis. Three inclusion levels of Tartae plant powder (*Schanginia arbuscula*) were incorporated into the diet prior to pelleting as follows: 5% in T2, 10% in T3, and 15% in T4, while T1 remained without supplementation and served as the control treatment. A completely randomized design (CRD) was adopted in the present study to evaluate the effect of four dietary treatments. Statistical analysis of the measured parameters was performed using the SAS software package. The results demonstrated that treatment T2 was superior to T3, T4, and the control (T1) in terms of weekly body weight. Regarding body weight gain, T2 outperformed the other *Schanginia arbuscula* supplemented treatments; however, no significant difference was observed when compared to the control group. With respect to feed conversion efficiency, T2 exhibited the most favorable performance throughout the study period. In contrast, treatment T4 achieved the most favorable outcome in terms of mortality rate, recording the lowest percentage compared with the other treatments, whereas the control group (T1) exhibited the highest mortality. Treatment T4 also showed the most pronounced improvement in liver enzyme activity, as it recorded the lowest serum levels of AST and ALT, followed by T3 and then T2, while the control treatment displayed the highest activity of these enzymes. No statistically significant differences were observed among the treatments with respect to feed intake throughout the experimental periods. Conclusion: This study clearly demonstrates the positive effects of dietary supplementation with *Schanginia arbuscula* plant powder on productive performance. The inclusion of this plant powder in the diet significantly improved growth performance, reduced mortality rates, and enhanced liver enzyme activity, indicating its beneficial role in improving physiological and productive efficiency.

Keywords — *Schanginia arbuscula*, broiler chickens, growth performance, feed conversion ratio, liver enzymes.

INTRODUCTION

Providing feed is considered one of the most important limiting factors in the global poultry industry, as the availability of feed and the variation in its prices from one country to another negatively or positively affect poultry prices in that country. In light of the increasing rise in temperature due to global warming and water scarcity resulting from low rainfall (1), it has become necessary to search for non-traditional plant sources that are tolerant to drought and high temperatures and can be used as poultry feed in a manner that is compatible with these changes, more sustainable, and less costly. One of these plants is *Schanginia arbuscula*, a wild native plant that grows in semi-arid regions, requires no special care, covers wide areas, and is tolerant to drought and salinity (2). It contains a large amount of crude protein, approximately 8-12% depending on the growth stage, in addition to carotene, iron, manganese, zinc and some phenolic compounds (3). The aim of this study is to investigate the use of *Schanginia arbuscula* as a sustainable and drought tolerant alternative feed source to address the challenges of water scarcity and high temperature. Although this plant is widely available in Iraq and the Arab region, it has only been studied to a very limited extent as a forage crop, and this study is the first of its kind in this field in Iraq and the Arab region.

MATERIALS AND MTHODS

This study was conducted in one of the private poultry farms in the Al-Doura area, Baghdad Governorate, Iraq, Ethical approval (UOK. Agri- No.7 2025) starting on 1/7/2025 and continuing for six weeks until 12/8/2025, in order to study the effect of adding three concentrations of the plant *Schanginia arbuscula* (Tartaeeq plant) to the poultry diet. The plant was collected at the maturity stage from the same area of ground and added at levels of 5%, 10%, and 15% to the broiler diet before pelleting. The chicks were randomly distributed into four treatments, with each treatment consisting of three replicates, and each replicate included 5 chicks. The birds were reared in floor pens under the same experimental conditions. Feed and water were offered ad libitum throughout the experimental period. The chicks were fed on standard diets supplemented with the *Schanginia arbuscula* plant as follows:

T1 = Standard diet without addition of *Schanginia arbuscula*

T2 = Standard diet supplemented with 5% of *Schanginia arbuscula*

T3 = Standard diet supplemented with 10% of *Schanginia arbuscula*

T4 = Standard diet supplemented with 15% of *Schanginia arbuscula*

Table 1. Composition of Starter Diet for Broiler Chickens (1–10 days) %

(%) Percentage	Ingredient
43	Yellow corn
10	Barley
34	Soybean meal (44% CP)
4	Wheat bran
4	Vegetable oil
1	Calcium carbonate
1.8	Dicalcium phosphate
0.30	Common salt (NaCl)
0.25	Vitamin–mineral premix
0.30	Methionine
0.35	Lysine
100	Total
Crude protein: 22–23%	Total Crude protein
3000–3050 kcal/kg	Total Metabolizable energy

Table 2. Composition of Grower Diet for Broiler Chickens (11–24 days) %

(%) Percentage	Ingredient
45	Yellow corn
15	Barley
28	Soybean meal (44% CP)
5	Wheat bran
3.5	Vegetable oil
1	Calcium carbonate
1.5	Dicalcium phosphate
0.30	Common salt (NaCl)
0.25	Vitamin–mineral premix
0.20	Methionine
0.25	Lysine
100	Total
Crude protein: 20–21%	Total Crude protein
3100–3050 kcal/kg	Total Metabolizable energy

Table 3. Composition of Finisher Diet for Broiler Chickens (25–42 days) %

(%) Percentage	Ingredient
48	Yellow corn
18	Barley
24	Soybean meal (44% CP)
5	Wheat bran
3	Vegetable oil
0.9	Calcium carbonate
1.2	Dicalcium phosphate
0.30	Common salt (NaCl)
0.25	Vitamin–mineral premix
0.15	Methionine
0.20	Lysine
100	Total
Crude protein: 18–19%	Total Crude protein
3150–3200 kcal/kg	Total Metabolizable energy

Studied parameters: feed consumption, weekly body weight, weekly weight gain, feed conversion ratio, mortality percentage, and the activity of liver enzymes AST and ALT

Feed intake: Weekly feed consumption was recorded for each experimental unit in order to calculate the feed intake per bird according to the following equation:

$$\text{Feed intake g/bird/day} = \frac{\text{Weekly feed consumption by a replicate}}{\text{No. of bird in a replicate during that week}} \times \frac{1}{7}$$

Weekly body weight: Body weight was measured weekly at the end of each week using a sensitive scale.

Weekly weight gain: Weekly weight gain was calculated according to the following equation:

Weekly weight gain = Body weight at the end of the current week − Body weight at the end of the previous week

Feed conversion ratio (FCR): Feed conversion ratio was determined using the following equation:

$$\text{Feed conversion ratio} = \frac{\text{Feed intake (g)}}{\text{Weekly weight gain (g)}}$$

Mortality percentage: The mortality percentage was calculated at the end of each week according to the following equation:

$$\text{Mortality (\%)} = \frac{\text{Number of dead birds}}{\text{Number of total birds}} \times 100$$

Liver enzymes:

Since *Schanginia arbuscula* plant was used for the first time in broiler feeding, it was necessary to measure the liver enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) to ensure that it does not contain toxic compounds that could effect on the birds. Blood samples were collected from the wing vein of five birds per replicate, randomly selected at the end of each week, without feed withdrawal. Blood collection was performed using a 5-mL syringe fitted with a 25-gauge needle, following the method described by Al-Darraji et al. (4). The vein was punctured in the direction of the bird's body, and blood was withdrawn by applying negative pressure. After collection, the needle was removed and the blood was transferred into 5-mL plastic tubes. The samples were then centrifuged at 4,000 rpm to separate the serum from the cellular components. The obtained serum was used for the determination of liver enzyme activities (AST and ALT). The liver enzymes were measured in a private laboratory using commercial kits (Randox Laboratories Ltd., United Kingdom).

A completely randomized design (CRD) was adopted in the present study to evaluate the effect of four dietary treatments. Statistical analysis of the measured parameters was performed using the SAS software package (5). The significance of differences among treatment means was determined using Duncan's multiple range test (6).

The statistical model used is as follows:

$Yij = \mu + Ti + eij$

Where:

Yij = the value of observation of traits

μ = the over all mean of traits

Ti = the effect of treatments, control (T_1), T_2, T_3 and T_4.

Eij = random error assumed to be mean equal to zero and variance is $\sigma^2 e$.

RESULT AND DISCUSSION

Table 4 indicates that there was no significant effect of using the *Schanginia arbuscula* plant on feed intake among the treatments during the experimental period. Likewise, the overall means of the treatments did not show any significant superiority either among themselves or compared with the control treatment, as values of overall means of 741.66, 745.93, 745.98, and 746.48 g/bird/week were recorded for treatments T4, T3, T2, and T1, respectively.

Table 4. Effect of using 5%,10% and 15% of *Schanginia arbuscula* in the diet on feed intake (g/bird/week) (mean ± standard error) of broiler chickens.

Age in week	Treatments				Level of significance
	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	
1	136.22 ±23.22	134.92 ±12.18	135.82 ±13.20	134.88 ±10.97	N. S
2	340.32 ±25.22	335.40 ±13.20	333.4 ±11.5	334.5 ±11.13	N. S
3	615.50 ±22.21	620.28 ±15.23	636.0 ±16.34	625.22 ±13.88	N. S
4	938.22 ±31.26	928.88 ±18.22	935.8 ±18.40	930.2 ±12.11	N. S
5	1148.82 ±23.11	1140.55 ±22.55	1134.6 ±20.99	1139.1 ±13.00	N. S
6	1300.34 ±22.33	1280.90 ±25.22	1300 ±21.55	1286 ±10.81	N. S
Overall mean	746.48 ±33.28	745.98±43.10	745.93 ±33.20	741.66 ±23.50	N. S

N.S Not-significantly different.

Table 5 shows that there was no significant effect of using the *Schanginia arbuscula* plant on body weight among the treatments during the first week of the experiment. However, at 14 days of age, significant differences appeared among the treatments, where treatment T2 achieved a significant superiority ($P < 0.05$) and this superiority continued until the end of the study period. It was followed by the control treatment T1, which was significantly superior ($P < 0.05$) to treatments T3 and T4, which did not differ significantly at 14 days of age. Meanwhile, treatment T3 was significantly superior to treatment T4 during the remaining periods of the study.

Table 5. Effect of using 5%,10% and 15% of *Schanginia arbuscula* in the diet on average body weight (g) (mean ± standard error) of broiler chickens.

Age in week	Treatments				Level of significance
	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15)	
1	140 ±1.40 a	142 ±1.30 a	140 ±1.8 a	141 ±2.4 a	N. S
2	380 ±1.30 b	386 ±1.8 a	375 ±1.90 c	376 ±1.55 c	*
3	810 ±2.40 b	830 ±1.90 a	800 ±1.99 c	790 ±1.90 d	*
4	1410 ±1.45 b	1450 ±2.00 a	1395 ±1.85 c	1350 ±1.79 d	*
5	2080 ±1.50 b	2120 ±2.40 a	2000 ±2.3 c	1900 ±1.88 d	*
6	2680 ±2.43 b	2730 ±1.80 a	2560 ±2.70 c	2250 ±2.00 d	*

Means in same rows with the same superscript were not significantly different, with different superscript were significantly different, * ($P<0.05$), N.S Non-significant.

It is evident from Table 6 that the three *Schanginia arbuscula* plant treatments did not differ significantly ($P<0.05$) from the control treatment during the first week of the experiment. Likewise, no significant differences were recorded among any of the treatments during this week in the trait of weekly weight gain. Treatment T2 of *Schanginia arbuscula* also did not differ significantly ($P<0.05$) from the control treatment T1 throughout the entire duration of the experiment.

Meanwhile, treatment T3 showed a significant superiority over treatment T4 during the fourth, fifth, and sixth weeks, while no significant differences were observed between them during the first three weeks. The overall mean of treatment T2 showed a significant superiority (P<0.05) compared with treatments T3 and T4, while the overall means of treatments T1 and T2 did not differ significantly from each other.

Table 6. Effect of using 5%,10% and 15% of *Schanginia arbuscula* in the diet on weight gain rate (g) (mean ± standard error) of broiler chickens.

Age in week	**Treatments**				**Level of significance**
	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	
1	103 ±1.30 a	105 ±1.10 a	103 ±1.50 a	104 ±1.70 a	N. S
2	240 ±1.20 a	244 ±1.60 a	235 ±2.33 b	235 ±2.13 b	*
3	430 ±1.80 a	444 ±1.10 a	425 ±2.83 b	414 ±2.53 b	*
4	600 ±1.60 a	590 ±1.90 a	595 ±1.70 a	560 ±2.23 b	*
5	670 ±1.40 a	670 ±1.20 a	605 ±2.63 b	550 ±1.85 c	*
6	600 ±1.50 a	610 ±1.00 a	560 ±2.43 b	350 ±1.65 c	*
Overall mean	440 ±1.50 a	443.83 ±1.9 a	425.5 ±1.43 b	368.83 ±2.03 c	*

Means in same rows with the same superscript were not significantly different, with different superscript were significantly different, * (P<0.05), N.S Non-significant.

Referring to table 7 the treatment T3 exhibited the highest feed conversion efficiency during the first week and was significantly superior (P<0.05) to all other treatments, followed by treatment T2. In contrast, treatments T1 and T4 did not differ significantly during this week, as presented in Table 4. In the second week, treatment T2 recorded the best feed conversion ratio and continued to show significant improvement in this trait until the end of the experiment, except in the second week where it did not differ significantly from the control treatment T1. The control treatment T1 outperformed treatments T3 and T4 in this trait, except during the fourth week, where it showed an equally significant effect to that of treatment T3. In the fifth week, treatments T1 and T2 achieved the best significant results (P<0.05), surpassing treatments T3 and T4, while no significant difference was observed between T1 and T2 in that week. The overall mean of treatment T4 recorded the poorest performance in this trait, whereas treatment T2 achieved the best overall feed conversion efficiency, followed by the overall mean of the control treatment T1, and then that of treatment T3.

Table 7. Effect of using 5%,10% and 15% of Schanginia arbuscula in the diet on feed conversion ratio (FCR) (g feed/g weight) (mean ± standard error) of broiler chickens.

Age in week	**Treatments**				**Level of significance**
	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	
1	1.32 ±0.01 a	1.28 ±0.04 b	1.19 ±0.04 c	1.30 ±0.07 a	*
2	1.37 ±0.03 c	1.36 ±0.05 c	1.42 ±0.04 b	1.42 ±0.01 a	*
3	1.44 ±0.01 c	1.42 ±0.03 c	1.49 ±0.05 b	1.51 ±0.03 a	*
4	1.57 ±0.05 b	1.48 ±0.01 c	1.57 ±0.06 b	1.66 ±0.03 a	*
5	1.71 ±0.02 c	1.70 ±0.05 c	1.87 ±0.02 b	2.07 ±0.01 a	*
6	2.16 ±0.06 c	2.09 ±0.04 d	2.32 ±0.02 b	3.67 ±0.01 a	*
Overall mean	1.595 ±0.05 c	1.555 ±0.04 d	1.643 ±0.04 b	1.938 ±0.01 a	*

Means in same rows with the same superscript were not significantly different, with different superscript were significantly different, * (P<0.05).

According to Table 8, no significant differences (P<0.05) were observed among the *Schanginia arbuscula* plant treatments T2, T3, and T4, either among themselves or in comparison with the control treatment T1 during the first week of the study. Nevertheless, the control treatment T1 consistently recorded the highest mortality rate throughout all experimental periods. In the second week, T1 exhibited the highest mortality rate, followed by T2, whereas treatments T3 and T4 did not differ significantly from each other with this trait. In the third week, the control treatment again showed the highest mortality rate, followed by T2, while treatments T3 and T4 remained statistically similar (P<0.05). During the fourth week, treatments T2 and T4 did not differ significantly from the control treatment T1, whereas treatment T3 recorded the lowest mortality rate. In the fifth week, all three *Schanginia arbuscula* treatments (T2, T3, and T4) exhibited lower mortality rates compared with the control T1, with no significant differences among them. Treatment T4 recorded the lowest mortality rate, followed by T3 and then T2 (P<0.05), while the control treatment T1 showed the highest mortality. The overall mean followed the same pattern: treatment T1 recorded the highest overall mortality rate, followed by T2 and T3, whereas treatment T4 achieved the lowest overall mortality rate at the significance level of (P<0.05).

Table 8. Effect of using 5%,10% and 15% of *Schanginia arbuscula* in the diet on percentage mortality (%) (mean ± standard error) of broiler chickens.

Age week	**Treatments**				**Level of significance**
	T1 (0%)	**T2 (5%)**	**T3 (10 %)**	**T4 (15%)**	
1	a 2.2	a 2.2	1.98 a	a 2.0	N. S

2	10±0.01 1.a	0.5±0.02 b	0.00 ±0.06 c	0.00 ±0.06 c	*
3	1.6±0.01 a	5±0.02 b.0	0.00 ±0.06 c	0.00 ±0.06 c	*
4	0.63±0.01 a	0.66±0.01 a	0.60 ±0.02 b	0.66 ±0.01 a	*
5	0.5 ±0.01 a	0.00±0.02 b	0.00 ±0.02 b	0.00 ±0.06 b	*
6	1.33±0.01 a	0.76±0.04 b	0.77 ±0.02 b	0.55 ±0.06 c	*
Overall mean	0.86 ±0.01 a	0.40 ±0.02 b	0.228 ±0.06 c	0.201 ±0.04 d	*

Means in same rows with the same superscript were not significantly different, with different superscript were significantly different, * (P<0.05), N.S Non-significant.

Lever enzymes AST and ALT

It is evident from Table 9 that there was a significant decrease (P ≤ 0.05) in AST enzyme activity in the blood serum of broiler chickens fed diets containing *Schanginia arbuscula* plant powder, represented by the three treatments T2, T3, and T4, compared with the control treatment T1, and this was observed at all studied ages. Treatment T4 recorded the highest significant decrease compared with the other treatments at all ages, followed by treatment T3, which showed a significant decrease (P ≤ 0.05) compared with treatments T2 and T1. Meanwhile, treatment T2 showed a significant decrease (P ≤ 0.05) compared with the control treatment T1 at all ages. The overall means did not differ much from this trend, as the overall mean of treatment T4 recorded the highest significant decrease, followed by the overall mean of treatment T3 and then T2, while the overall mean of the control treatment exceeded the other treatments significantly (P ≤ 0.05).

Table 9. Effect of using 5%,10% and 15% of *Schanginia arbuscula* in the diet on Activity of aspartate aminotransferase enzyme (AST) (IU /L) (mean ± standard error) in blood serum of broiler chickens.

Age in week	Treatments				Level of significance
	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	
1	212 ±1.15 a	204 ±2.13 b	194 ± 2.20 c	190 ±1.14 d	*
2	213 ±1.52 a	205 ± 1.15 b	197 ±2.30 c	194 ± 2.6 d	*
3	216 ± 1.17 a	205 ±1.11 b	200 ±3.10 c	189 ± 7.7 d	*
4	215 ±1.20 a	202 ±1.17 b	197 ± 1.13 c	190 ±0.98 d	*
5	214 ± 0.87 a	203 ±1.40 b	195 ± 1.89 c	190 ±1.5 d	*
6	215 ± 1.15 a	206 ± 2.13 b	194 ± 2.30 c	191 ±1.15 d	*
Overall mean	214 ±1.52 a	204.2 ±1.15 b	196.2 ± 1.57 c	190.6 ± 2.30 d	*

Means in same rows with the same superscript were not significantly different, with different superscript were significantly different, * (P<0.05).

As for ALT enzyme activity in blood serum, Table 10, which includes the effect of using *Schanginia arbuscula* plant in broiler diets on ALT enzyme activity in blood serum, shows that the three *Schanginia arbuscula* treatments (T4, T3, and T2) recorded a significant decrease (P ≤ 0.05) compared with the control treatment T1 throughout all experimental periods. Treatment T4 also showed a significant decrease compared with treatments T3 and T2, and at the same time treatment T3 recorded a significant decrease compared with treatment T2, while the control treatment T1 recorded the highest ALT enzyme activity at all study periods. The lowest overall mean of ALT activity was recorded by treatment T4, which decreased significantly (P ≤ 0.05) compared with the rest of the treatments, followed by the overall mean of treatment T3 and then T2. It is worth mentioning that all overall means of the *Schanginia arbuscula* treatments recorded a significant decrease (P ≤ 0.05) compared with the overall mean of the control treatment.

Table 10. Effect of using 5%,10% and 15% of *Schanginia arbuscula* in the diet on activity of alanine aminotransferase enzyme (ALT) (IU /L) (mean ± standard error) in blood serum of broiler chickens.

Age in week	Treatments				Level of significance
	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	
1	9.0 ±0.11 a	7.2 ±0.02 b	7.1 ±0.14 b	5.2 ±0.10 c	*
2	10.2 ±0.08 a	6.2 ±0.08 b	5.8 ±0.20 b	4.5 ±0.11 c	*
3	10.5± 0.10 a	6.2 ±0.066 b	5.2 ±0.03 c	4.3 ±0.05 d	*
4	12.4 ±0.14 a	6.1 ±0.088 b	5.2 ±0.08 c	4.5 ±0.13 d	*
5	10.60 ±0.3 a	6.31 ±0.25 b	5.79 ±0.36 c	4.5 ±0.14 d	*
6	12.0 ±0.14 a	6.35 ±0.25 b	5.3 ±0.36 c	4.2 ±0.14 d	*
Overall mean	10.7 ±0.14 a	6.39 ±0.25 b	5.28 ±0.36 c	4.53 ± 0.14 d	*

Means in same rows with the same superscript were not significantly different, with different superscript were significantly different, * (P<0.05).

The three inclusion levels of *Schanginia arbuscula* plant powder did not affect feed intake, as no significant differences were recorded among the treatments, as shown in Table 4. In addition, Table 5 indicates that body weight averages were not significantly affected during the first week for all treatments. This can be attributed to the fact that chicks in the first days of life are still adapting to their new environment and learning to use feeders and drinkers. However, significant differences began to appear clearly during the second week, where treatment T2, in which 5% of the *Schanginia arbuscula* plant was included in the diet, showed a significant superiority over the other treatments, including the control group. This improvement is due to improved feed conversion efficiency due to improved digestion and nutrient absorption. This is because tartar powder contains certain compounds that aid digestion and absorption such as saponin (7).

At low concentrations saponins improve the efficiency of the digestive system by increasing the secretion of digestive juices and improving the absorption of nutrients. It also contributes to improving the structure of the intestinal villi thus increasing the absorption surface. This compound has antibacterial and anti-parasitic properties against intestinal microorganisms reducing the competition for nutrients in the intestine. Seriously It helps reduce inflammation and improves the microbial balance in the digestive system (8)

In contrast, the same effect was not observed in treatments T3 and T4, in which 10% and 15% of *Schanginia arbuscula* powder were used, respectively. This is likely due to the fact that these higher inclusion levels reduced the dietary concentrations of energy and protein, which consequently affected body weight gain.

Furthermore, Table8 shows a significant reduction in mortality rate in treatments T2, T3, and T4 compared to the control treatment. This may be attributed to the positive effects of *Schanginia arbuscula* powder on improving physiological functions in the body. In addition, the inclusion of *Schanginia arbuscula* powder reduced the dietary levels of energy and protein, which led to a lower incidence of ascites, as well as a reduction in the occurrence of sudden death syndrome (9).

The three inclusion levels of *Schanginia arbuscula* plant powder did not affect feed intake, as no significant differences were recorded among the treatments, as shown in Table 4. In addition, Table 5 indicates that body weight averages were not significantly affected during the first week for all treatments. This can be attributed to the fact that chicks in the first days of life are still adapting to their new environment and learning to use feeders and drinkers. However, significant differences began to appear clearly during the second week, where treatment T2, in which 5% of *Schanginia arbuscula* plant was included in the diet, showed a significant superiority over the other treatments, including the control group.

This improvement can be attributed to a better feed conversion efficiency, resulting from enhanced digestion and absorption of nutrients. This is due to the fact that *Schanginia arbuscula* powder contains certain compounds that aid in digestion and absorption, such as saponins (7). At low concentrations, saponins improve digestive efficiency by enhancing the secretion of digestive juices and improving nutrient absorption. They also contribute to improving the structure of intestinal villi, thereby increasing the absorptive surface area. Moreover, this compound possesses antibacterial and anti-parasitic properties against intestinal microorganisms, reducing competition for nutrients within the intestine. It also helps reduce inflammation and improve microbial balance in the digestive tract (8)

Furthermore, Table 8 shows a significant reduction in mortality in the T2, T3 and T4 treatments compared to the control treatment. This can be attributed to the positive effect of *Schanginia arbuscula* powder on improving the body's physiological functions. In addition, the use of *Schanginia arbuscula* powder reduced energy and dietary protein levels, resulting in a reduction in the incidence of ascites and sudden death syndrome (9).

In contrast, the same effect was not observed in treatments T3 and T4, where 10% and 15% Schanginia arbuscula powder were used, respectively. This is likely due to the fact that these high intake levels reduced dietary energy and protein concentration, that consequently affected body weight gain.

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