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Effect of Using Different Percentages of Sumac *(Rhus Coriaria L.)* On Broiler Performance

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Abstract

This study is set to find out how broiler's performance was affected by varying dosages of sumac extract. The birds were assigned to four treatments with three replicates, each 10 chicks. The first group was the control (ad libitum feeding) (T1), while the second group (T2) was 5gm Sumac/day, Third group (T3) was 10gm sumac, and fourth group (T4) was 15gm Sumac per day. The chick groups were allocated to 4 treatments with 3 replications, each 10 chicks. The results showed that there was no significant difference in weekly weight gain among the treatments. The second treatment (452.500 gm) gave the highest weight gain and not different significantly than weight gain of these 3 treatments. In the period between 29-35 days, it was found that the chick of T4 gave the best feed convention Ratio. The third treatment (488.221) showed the best production index, while T1 showed the lowest production index. The fourth treatment (1.326) had the highest production index and had significant differences with T4 (232.240). Our findings demonstrate that incorporating Sumac into poultry diets has been shown to promote weight gain, thereby translating to superior production outcomes for poultry farmers.

Keywords: Growth, performance, Broiler, Sumac.

I. Introduction

Poultry meat is beneficial for human health and growth, especially in developing countries (Albashr et al.,2024; Khidhir 2023; Faraj, 2023). The chicken industry uses antibiotics frequently as growth promoters because they increase feed production and growth (Majid et al., 2020a), However, given that society is worried about antibiotic resistance and the potential for utilizing these chicks to spread some of these medications to humans (Hamma et al., 2024), Some restrictions apply when using these growth promoters (Ahmed et al., 2022). Since then, researchers have been looking for substitutes, and one of the greatest ones is herbs, thanks to its motivations (Ivanova, et al., 2024). Utilizing medicinal plants has many benefits, including ease of use, lack of adverse effects, no waste products in the target body, and more. To enhance performance, a variety of substances are used, including probiotics, organic acids, enzymes, and phytogenics (Hashemi et al., 2012). Aromatic plants and the essential oils or extracts they contain have recently drawn attention as possible to growth boosters. Scientists are currently employing beneficial herbs to increase livestock growth rate and feed efficiency (Bunyapraphatsara 2007; Mustafa & Othman 2024). The growing demand for animal protein sources has led to the development of poultry farming worldwide (Mohammadi, et al., 2011). As chicken production grows, there is a greater need for feed ingredients, and poultry diets are altered to maximize feed usage (Majid et al., 2020b). This has led to an increase in the use of growth boosters and feed additives. Antibiotics are one type of growth promoter that alters gut microbiota to improve poultry performance. Due to their adverse effects on consumers, the use of antibiotics has recently been restricted and will soon be discontinued. Prebiotics and probiotics are antibiotic substitutes that don't have any negative effects on users (Mehr, *et al.* 2007). Mohana *et al.* (1996) showed that the addition of protoxin (a probiotic) improved the growth of the broilers, Additionally, it has been shown that protoxin has positive benefits on breast meat, feed conversion ratio, and belly fat reduction (Mohammadi, et.al.2011). Sumac, the dried and ground fruits of the Rhus genus, is a reddish-purple spice used in Arab and Middle Eastern cuisine. It is very popular due to its nutritional, beneficial, medical, and health properties (Alsamri, 2021; Emir et al., 2023). It has

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long been used in traditional medicine in the Middle East, where it is known for its astringent and cooling properties, as well as for preventing symptoms of various digestive, urinary, and respiratory system disorders. Sumac has been traditionally used as a spice in our cuisine. In Turkey, sumac has been used in the preparation of kebab spice, whereas fresh fruit was used in the preparation of syrup. With the increasing interest in Middle Eastern and Mediterranean cuisine, sumac has been gaining more popularity for its specific flavor and bright color (Iram et al., 2020). Sumac, a spice derived from the Rhus genus, boasts a rich nutritional profile that makes it an excellent addition to poultry nutrition. Sumac is notably high in antioxidants, such as polyphenols and flavonoids (Farazandehnia et al.,2024). These compounds play a crucial role in neutralizing free radicals, thus protecting cells from oxidative stress and damage. This antioxidant property is essential for maintaining overall health and preventing various diseases in poultry (Martinelli et al., 2022). The essential oils in sumac contribute to its beneficial properties. These oils, characterized by their antimicrobial and anti-inflammatory effects, help maintain the health of the poultry's digestive tract, thereby promoting better nutrient absorption and overall well-being. Investigating the impact of varying sumac dosages on broiler performance was the aim of this study.

II. Material and Method

Experimental birds:

This investigation was conducted at the animal science department's chicken farm, College of Agricultural Engineering Science, University of Sulaimani. A total of 120-day-old broiler chicks (Ross 308) will be used. The chick groups will be assigned to four treatments with three replicates each 10 chicks. The first group was controlled (*ad libitum* feeding) (T1), while the second group (T2) 5gm Sumac/day, Third group (T3) 10gm Sumac, and fourth group (T4) 15 Sumac/day. Only water is provided *ad* libitum. According to the suggested procedure, all of the birds were fed a typical, conventional diet (NRC, 1994).

Table 1: Composition and nutrient levels of the base diets.

Ingredient, feed base used as %	**Beginning of the diet (1-14 days) %**	**Diet for growth (15-28 days) %**	**Completer diet (36-42days)-%**
Wheat	23.60	23.00	27. 50
Corn	35.50	34.80	39. 70
Meat and bone meal (40%)	3.0	0.6	0. 4
Soybean meal (%44)	29.90	33.04	23.28
Sunflower seed Oil	4	5	5
Dual-calcium phosphate	2.30	1 .94	1.86
Limestone	1.15	1. 16	1.11
Salt	0.25	0. 25	0. 25
Methionine	0.20	0. 11	0.8
*Premix	0.10	0.1	0.1
Total	100	100	100

Study characteristics:

At the end of each week, a delicate scale was used to measure the weight of each chick. The average end live weight of the same period for each chick was subtracted from the average initial live weight of the same period (which was typically weekly) to get the average daily body weight gain. A particular amount of feed was given to the chicks in each duplicate once a week. The residuals were collected at the conclusion of the same week, and the amount of feed consumed was determined by dividing the difference between the feed given to the birds at the start of each week and the feed still present at the

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end of the week. Using Al-Hadme's (1994) approach, the feed intake and feed conversion ratio (FCR) were computed.

Analytical techniques for data:

The trial data was analyzed using the Excel program. There will be parameter calculations for the various treatments. Utilizing XLSTAT (2004), data were analyzed. According to Duncan (1955), at a level of 5%, substantial treatment changes were found.

III. Results

Table 2 results, shows that using sumac effect on the weekly body weight.

It was found after 21 days of experiment, the higher body weight recorded in chicks of treatment 1 (625.000 gm), that is not different significantly with body weight in chicks of treatments 2 and 4. While differ significantly with chicks of treatment T3.

After 28 days of breeding, the highest body weight recorded in chicks of T2 (1197.500 gm), that is not different significantly with body weight in chicks of treatment 1, while different significantly with body weight in chicks of T3 and T4 treatments.

In 35 days, the results showed no significant different among treatments.

In the end of the experiment, after 42 days of breeding, the highest body weight recorded in chicks of Treatment 2 (2257.500 gm), that not different significantly with body weight in chicks of treatment 1 (2177.500 gm), while different significantly with body weight in chicks of T3 and T4 treatments.

Table 2: The effect of using different percentages of sumac on body weight(gm)

Treatment	21 days	28 days	35 days	42 days
T1	625.000 a	1187.500 ab	1765.000 a	2177.500 ab
T2	612.500 ab	1197.500 a	1805.000 a	2257.500 a
T3	585.000 b	1137.500 b	1690.000 a	2090.000 bc
T4	600.000 ab	970.000 c	1660.000 a	1982.500 c

T1 control, T2 (5gm Sumac), T3 (10gm Sumac), T4 (15gm Sumac).

Table 3 results revealed that using local sumac effect on weekly weight gain.

In the period between 21-28 days, results showed that no significant different in weekly weight gain among chicks of T1, T2 and T3, while weekly weight gain of these 3 treatments are different significantly at weekly weight gain in chicks of T4.

In the period between 29-35 days, the results showed no significant impact of sumac in weekly weight gain in chicks of all treatments.

In the period between 35-42 days, it was found that the chicks of second treatment (452.500 gm) gave the highest weight gain and not different significantly with the weekly weight gain in chicks of treatment T1 and T3, and had significant differences with weekly weight gain in chicks of treatments T4 (322.500 gm).

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Table 3: The effect of using different percentages of sumac on weight gain (gm).

Treatment	21-28 day	29-35 day	36-42 day
T1	582.685 a	577.500 a	412.500 ab
T2	585.000 a	607.500 a	452.500 a
T3	552.500 a	552.500 a	400.000 ab
T4	370.000 b	590.000 a	322.500 b

T1 control, T2 (5gm Sumac), T3 (10gm Sumac), T4 (15gm Sumac).

Tables 4 results, shows using sumac effect on the feed convention Ratio.

In the period between 21-28 days, results showed that there is no significant difference in feed convention Ratio among chicks of T1, T2 and T3, while feed convention Ratio of these 3 treatments are significantly different with feed convention Ratio in chicks of T4.
In the period between 29-35 days, the results showed no significant impact of sumac in feed convention Ratio in chicks of all treatments.
In the period between 35-42 days, it was found that the chicks of second treatment (1.326) gave the best feed convention Ratio and are not different significantly with the feed convention Ratio in chicks of treatment T1 and T3, and had significant differences with feed convention Ratio in chicks of treatments T4 (2.151).

Table 4: The effect of using different percentages of sumac on feed convention Ratio

Treatment	21-28	29-35	36-42
T1	1.130 b	1.265 a	1.445 b
T2	1.162 b	1.144 a	1.326 b
T3	1.214 b	1.256 a	1.603 ab
T4	1.865 a	1.586 a	2.151 a

T1 control, T2 (5gm Sumac), T3 (10gm Sumac), T4 (15gm Sumac).

Table 5, results revealed that using local sumac effect on Feed Intake.

In the period between 21-28 days, the results showed no significant impact of sumac in feed intake in chicks of all treatments.
In the period between 29-35 days, results shows that higher feed intake recorded in chicks of T4 (749.500 gm) and are not different with feed intake of in chicks of T1, while different significantly in feed intake in chicks of T2 and T3.
In the period between 36-42 days, results shows that higher feed intake recorded in chicks of T4 (664.500 gm) and are not different in feed intake compared to chicks of T3, while different significantly in feed intake compared to chicks of T2 and T1.

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Table 5: The effect of using different percentages of sumac on feed intake (gm).

Treatment	21-28	29—35	36-42
T1	654.500 a	729.500 ab	579.500 b
T2	679.500 a	694.500 bc	599.500 b
T3	669.500 a	689.500 c	639.500 a
T4	684.500 a	749.500 a	664.500 a

T1 control, T2 (5gm Sumac), T3 (10gm Sumac), T4 (15gm Sumac).

Table 6 results, shows that using sumac effect on the production index.

In the period between 21-28 days, results showed that there no significant different in production index among chicks of T1, T2 and T3, while production index in chicks of these 3 treatments differ significantly with production index in chicks of T4 (287.940).
In the period between 29-35 days, the results showed no significant impact of sumac in production index in chicks of all treatments.
In the period between 35-42 days, it was found that the chicks of second treatment (488.221) gave the best production index and not different significantly with the production index in chicks of treatment T1 and T3, and had significant differences with production index in chicks of treatments T4 (232.240).

Table 6: The effect of using different percentages of sumac on production index.

Treatment	21-28	29—35	36-42
T1	738.354 a	654.919 a	428.654 ab
T2	719.490 a	759.623 a	488.221 a
T3	651.847 a	637.354 a	358.709 ab
T4	287.940 b	771.342 a	232.240 b

T1 control, T2 (5gm Sumac), T3 (10gm Sumac), T4 (15gm Sumac).

More than 90% of plants in the Anacardiaceae family, including sumac, are rich in flavonols, phenolic acids, anthocyanins, and citric and malic acids (Sakhr and El Khatib, 2020). Sumac seeds are rich in flavones such myricetin, quercetin, and kaempferol, and they also contain significant levels of vitamin C, gallic acid, and benzoic acid (El Ghizzawi et al., 2023). While there are many minerals in sumac, particular microminerals, including calcium, magnesium, potassium, and phosphorus, are much more abundant (Sakhr and El Khatib, 2020). According to the Reda, et al., (2024) findings, Japanese quail breeders' egg quality, digestive enzymes, reproductive and productive performances, and the majority of blood hematological and biochemical parameters improved when they added 1, 2, 3, and 4 grams of sumac powder to their diet, and that may be because of consuming Sumac powder significantly (P <

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0.05) decreased the plasma lipid profile, renal functions (creatinine and urea), and liver enzymes (aspartate aminotransferase and alanine aminotransferase). Additionally, the addition of sumac powder led to a significant rise ($P < 0.05$) in the amylase, lipase, and protease levels. The injection of sumac powder also significantly ($P < 0.05$) increases immunity by raising the levels of IgM, IgG, IgA, and lysozyme in the plasma of quail breeders. However, taking sumac powder as a supplement raised levels of superoxide dismutase, catalase, total antioxidant capacity, and reduced glutathione. The inclusion of sumac in poultry diets yields multiple health benefits, enhancing the birds' overall health and resilience (Shariatmadari & Shariatmadari, 2020). Essential oils and dietary fibers in sumac improve digestive health by promoting the growth of beneficial gut bacteria. These components aid in the digestion and absorption of nutrients, ensuring that the poultry receives the maximum benefit from their feed, leading to improve health and productivity (Fyfe et al., 2020). These results could be attributed to the effect of sumac powder on improving feed utilization probably due to its anti-bacterial effect on gut micro flora (Moghadam et al., 2020). Sumac enhances feed efficiency by improving the digestibility of the feed and nutrient absorption. This means that poultry can derive more nutrients from the same amount of feed, reducing feed costs and increasing production efficiency (Reda et al., 2024). Our findings demonstrate that addition of sumac extract at levels (1%, 2% and 3% of diet) for broiler chicks shad led to significant differences on the feed intake between treatments, incorporating sumac into poultry diets has been shown to promote weight gain. Its high nutrient density provides the necessary building blocks for muscle development and fat deposition, leading to healthier and more weighted birds (Lika et al., 2021, Jahan et al., 2024))

Mansoub (2011) showed that using different levels of sumac had significant effects on food intake, weight improvement, average weight, and feed conversion of broilers ($P<0.05$). The improvement of body weight gain and feed conversion is due to the active materials (cinnamaldehyde and ugenol) found in sumac, causing greater efficiency in the utilization of feed, resulting in enhanced growth, Overall, sumac's myriad of health benefits culminates in optimized growth performance (Mirenayat et al., 2023). The birds show improved vitality, increased weight, and better overall health, translating to superior production outcomes for poultry farmers. The benefits of sumac extend beyond the health and growth of the poultry, significantly impacting the quality of poultry products (Lee et al.,2003). Sumac positively impacts the growth metrics of poultry, making it a valuable dietary supplement (Hasan et al., 2024, Azizi et al., 2020).

IV. Conclusion

We concluded that the use of sumac led to an improvement in the production performance and the excess weight and that a second treatment gave a high and improved conversion efficiency with good production evidence from an economic standpoint.

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