


Original Article: Effect of Adding Different Levels of Lemon Grass Leaves *Cymbopogon Citratus* to the Diet and Its Extract in Drinking Water on Productive Performance of Broiler Chickens (Ross 308)

Dheyaa Hmazah Yasir*  | Nihad Abdul-Lateef Ali 

Department of Animal Production, College of Agriculture, Al-Qasim Green University, Iraq



Citation D.H. Yasir*, N.A. Ali, Effect of Adding Different Levels of Lemon Grass Leaves *Cymbopogon Citratus* to the Diet and Its Extract in Drinking Water on Productive Performance of Broiler Chickens (Ross 308). *Eurasian J. Sci. Tech.*, 2021, x(x):xx-xx.

 [https://doi.org/ 10.22034/JSTR](https://doi.org/10.22034/JSTR)



Article info:

Received: 06 March 2021

Accepted: 02 May 2021

Available Online: 01 April 2021

ID: JSTR-2103-1003

Checked for Plagiarism:

Peer Reviewers Approved by:

Dr. Amir Samimi

Editor who Approved Publication:

Professor Dr. Mohammad Haghighi

Keywords:

lemon grass , *Cymbopogon citratus*, productive performance, broiler.

ABSTRACT

This experiment was conducted at the poultry farm of the college of Agriculture, Al-Qasim Green University from 18/9/2019 to 23/10/2019. The study aimed to examine the effect of adding different levels of lemongrass leaves (*Cymbopogon citratus*) to the diet and its extract to drinking water on productive performance for broiler chickens (Ross 308). In the experiment, 225 unsexed broiler chicks (Ross), which obtained from Al-Anwar hatchery, were randomly distributed on 15 pens, with 5 experimental treatments, 45 birds for each treatment. Each treatment included three replicates per 15 birds. The treatments of the experiment were as follows: First treatment began with control group free from any addition. In the second treatment, a basic feed was added to 10 g of lemon grass / kg feed, and for the third treatment, a basic feed was added with 20 g of lemon grass / kg feed. The fourth and the fifth treatments involved adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and adding 200 ml of the aqueous extract of the lemongrass liter of drinking water, respectively. The following characteristics were taken into account in the experiments: Average body weight, weight gain, feed consumption, feed conversion ratio, production index and average water consumption.

Significant moral superiority ($p \leq 0.05$) for the fourth and fifth treatment (addition of 100 and 200 ml of aqueous extract of lemon grass / liter of drinking water) in the body weight of the body in the fifth week and the total weight increase were compared with the first treatment (control) and the second treatment, also the two treatments were recorded. Third and fourth treatments showed the best food conversion ratio compared with the first treatment.

Addition treatments for lemon grass, either with fodder or an aqueous extract, were recorded as the best production index scale and with a significant difference ($p \leq 0.05$), compared with the first treatment (control).

Introduction

In recent years, the world's poultry industry has witnessed a great development and expansion, whether in meat or egg production, as its volume of production has increased compared with other animal products, in addition to the volume of the increase in meat production, which was higher than the production of eggs (Windhorst, 2006). This development and expansion in the poultry industry was accompanied by the trend in using multiple factors for the purpose of increasing productivity, such as organic acids, enzymes, medicinal herbs, prebiotics, and probiotics, and their mixtures (synbiotic) as feed additives, including the use of antibiotics as growth promoters, and to protect and treat poultry from pathogenic microbiological infections that increased with increased breeding (Eid et al., 2010; Swiatkiewicz et al., 2015).

Despite the positive role of antibiotics in the development of the poultry industry, it was not without collateral damage to animal health, due to human demand after consuming its products (Dibner & Richards, 2005), the rapid growth of modern strains and the genetic improvement of broiler breeds in order to reach fast-growing, high-quality flocks. The efficiency of a high food conversion has led at the same time to lowering the immunity of these birds, making them more susceptible to disease, and high mortality rates in them, as noted, the characteristics of growth speed and immunity are negatively linked genetically (Eid. et al., 2010). A new food additive using lemon grass *Cymbopogon citratus* has been used. Studies have shown that this plant has many medicinal benefits due to its high content of volatile oil, which contains many compounds, especially the main compound Citral, which ranges between 65-90%, mucin 10-25% and geranol 1-4%, as this plant is used as a disinfectant and analgesic for headaches and rheumatism. It also reduces pressure and is useful in treating ulcers and colitis, as well as cold and influenza diseases (Al-Rawi & Jakarh, 1988).

Accordingly, the aim of the present study was to investigate the nutritional value of the powder of the lemon grass plant, its use and determination of the best proportions added to the diet or to drinking water that can be used in poultry diets and its impact on productive performance.

Materials and Methods

This experiment was conducted at the poultry farm of the college of Agriculture, Al-Qasim Green University from 18/9/2019 to 23/10/2019. The study was aimed to survey the effect of adding different levels of lemongrass leaves (*Cymbopogon citratus*) to the diet or its extract to drinking water to on some blood parameters for broiler chickens (Ross 308). In the experiment, 225 unsexed broiler chicks (Ross), obtained from Al-Anwar hatchery, were randomly distributed on 15 pens, with 5 experimental treatments, 45 birds for each treatment. Each treatment included three replicates per 15 birds. The treatments of the experiment were as follows: First treatment began with control group free from any addition. In the second treatment, a basic feed was added to 10 g of lemon grass / kg feed, and for the third treatment, a basic feed was added with 20 g of lemon grass / kg feed. The fourth and the fifth treatments involved adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and adding 200 ml of the aqueous extract of the lemongrass liter of drinking water, respectively. The following characteristics were taken into account in the experiments: Average body weight, weight gain, feed consumption, feed conversion ratio, production index and average water consumption.

The rates of these traits were estimated for each week of the five-week experience. The Completely Randomized Design was used to study the effect of different treatments on the studied traits, the significant differences between the averages were compared with using Duncan's Multiple Range Test (Duncan, 1955) and the SAS (SAS, 2012) was used to analyze the data.

Table 1. Percentage of feed materials included in the composition of the initial diet and final diet used in the experiment with the calculated chemical composition for both diets.

Feed material	Initiator diet (1-21) %	Final diet (22-35 day) %
yellow corn	48.2	58.7
Local wheat	8	7.5
Soybean meal (44% protein)	28.5	20.5
Concentrated Protein*	10	10
Vegetable oil (sunflower)	4	2.5
limestone	1	0.5
Food salt	0.3	0.3
Total	%100	%100
The Calculated Chemical Analysis **		
Metabolized Energy (kcal/kg)	3079.85	3102.6
Crude protein (%)	21.56	18.87
Lysine (%)	1.04	0.85
Methionine + Cysteine (%)	0.455	0.42
Raw fiber (%)	3.54	3.2
Calcium (%)	1.28	1.07
Phosphorus availability (%)	0.42	0.41

*Concentrated protein (Belgian origion), each kilogram contains: 2200 kcal/kg metabolized energy, 40% crude protein, 8% fat, 3.5% fiber, 25% ash, 8% calcium, 3.1 phosphorus availability, 1.2% lysine, 1.2% Methionine, 1.8% Methionine + 70 mg, 30 mg Vitamin B1, 300 mg Vitamin E, 2500 IU D3, Cysteine A, 2% Chlorine, 10,000 IU 12 mg Folic Acid, 250 mg B12, B 120 mg Pantothenic acid, 400 mg niacin, 50 mg vitamin B2, 5000 mg Choline chloride, 450 mg iron, 70 mg copper, 600 mg, C 600 mcg biotin, 1000 mg special vitamin, 750 manganese, 5 mg iodine, 1 g cobalt and antioxidants.

** chemical composition was calculated according to analysis of feed materials mentioned in (NRC, 1994).

Results

It can be observed from Table 2, as for the average live body weight (g) \pm the standard error of experimental treatments, the results of the statistical analysis indicate the effect of adding different levels of lemon leaves to the feed or its extract to drinking water in the average body weight of broiler chickens Ross308 for trial weeks of 5 weeks. There were no significant differences between all treatments in the first and second week of the experiment. As for the third week, we noticed a significant superiority ($P \leq 0.05$) for the third treatment birds adding lemon grass powder (20 g / kg feed) and the fifth treatment on adding the aqueous extract to the lemon grass leaves at a concentration (200 ml / liter drinking water) was compared with the first treatment

(control) where they showed the highest body weight was (977.33 and 1000.67 g / bird), respectively, while the first treatment (control) showed the lowest body weight of (924.33 g / bird). And the second treatment was the addition of lemon grass powder with a concentration of (10 g / kg feed) and treatment. Considering the fourth addition of the aqueous extract of the leaves of lemon grass in a concentration (100 ml / for drinking), there were no significant differences between them and the third and fifth treatment on the one hand and the first treatment on the other hand, where they showed a body weight of (959.00 and 963.00 g / bird), respectively. However, in the fourth week of the experiment, we observed a significant superiority ($P \leq 0.05$) for the fifth treatment birds compared with the first treatment birds and the second treatment where

they showed the highest body weight of 1672.67 (g / bird), while in the first and second treatment, they recorded the lowest body weight of (1559.33 and 1586.67 g / bird). We also noticed the superiority of the third and fourth treatment significantly ($P \leq 0.05$) to the first treatment (control), where they showed a body weight of (1640.67 and 1634.67 g / bird), but in the last (fifth) week of the experiment, we found the continuation of superiority In the fifth treatment, birds showed significant ($P \leq 0.05$)

body weight compared with the first, second and third treatment birds, where they recorded the highest living body weight of 2353.67 (g / bird), while the first treatment recorded the lowest living body weight of (2172.67 g / bird). We noticed from the same Table that the superiority of the third treatment birds and the fourth treatment was significant ($P \leq 0.05$) in comparison to the first treatment (control) birds, where they recorded live body weight of (2278.00 and 2315.33 g / bird), respectively.

Table 2. Effect of adding different levels of lemongrass leaves to Fodder and its extract into drinking water at a live body weight (g) rate of broiler chickens (mean \pm standard error)

Treatments	The weeks				
	The first week	second week	the third week	fourth week	The fifth week
First treatment	162.33 \pm 3.92	478.67 \pm 17.36	924.33 \pm 14.31	1559.33 \pm 38.84	2172.67 \pm 27.16
			b	C	d
Second treatment	166.66 \pm 4.80	491.67 \pm 2.72	959.00 \pm 15.62	1586.67 \pm 19.22	2238.67 \pm 12.86
			ab	Bc	dc
Third treatment	174.00 \pm 3.21	489.00 \pm 10.69	977.33 \pm 22.16	1640.67 \pm 6.56	2278.00 \pm 14.50
			a	Ab	bc
Fourth treatment	170.00 \pm 7.00	501.33 \pm 11.25	963.00 \pm 16.52	1634.67 \pm 20.43	2315.33 \pm 23.68
			ab	Ab	ab
Fifth treatment	170.33 \pm 5.36	494.33 \pm 9.76	1000.67 \pm 4.05	1672.67 \pm 8.83	2353.67 \pm 27.03
			a	A	a
Significant level	NS	NS	*	*	*

First treatment: control group free from any addition. The second treatment: a basic feed added to 10 g of lemon grass / kg feed, the third treatment: a basic feed added with 20 g of lemon grass / kg feed, The fourth treatment: adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and the fifth treatment: adding 200 ml of the aqueous extract of the lemongrass liter of drinking water.

Table 4 indicates the results of the statistical analysis of the effect of adding different levels of lemon grass leaves to the diet or its extract to drinking water in the average feed consumption for broiler for 5 weeks of trial. There were no significant differences between all treatments in the first and second week of experience. As for

the third week, we observed the record of the third and fifth treatment, the highest feed consumption rate, significantly ($P \leq 0.05$) reaching 651.33 and 666.67 g / bird, respectively, compared with the first, second and fourth transactions birds, which recorded the lowest feed consumption rate (620.00 and

619). 33 and 624.67 g / bird), respectively. While in the fourth and fifth week, we noticed that there were no significant differences between all treatments for the experiment. As for total feed consumption, the results indicated that the fifth transaction recorded the highest

total feed consumption rate (3400.67 g / bird) compared with the second treatment that recorded the lowest feed consumption rate (3260.00 g / bird) which in turn did not differ significantly from the treatment birds in the first, third and fourth treatments

Table 4. Effect of adding different levels of lemongrass leaves to Fodder and its extract into drinking water at Consumption of weekly feed (g) (g) rate of broiler chickens (mean \pm standard error)

Treatments	The weeks					Total feed consumption
	The first week	second week	the third week	fourth week	The fifth week	
First treatment	147.67 \pm 0.66	407.67 \pm 41.95	620.00 \pm 9.50 b	950.66 \pm 7.31	1177.67 \pm 4.97	3303.67 \pm 46.09 ab
Second treatment	150.67 \pm 18.22	364.00 \pm 28.02	619.33 \pm 4.48 b	947.33 \pm 2.60	1178.67 \pm 35.89	3260.00 \pm 43.15 b
Third treatment	148.00 \pm 19.13	406.33 \pm 11.97	651.33 \pm 3.75 a	936.33 \pm 5.92	1141.67 \pm 42.77	3283.66 \pm 47.32 ab
Fourth treatment	150.67 \pm 4.91	401.33 \pm 8.21	624.67 \pm 5.23 b	932.00 \pm 3.78	1187.67 \pm 22.80	3296.34 \pm 28.81 ab
Fifth treatment	149.67 \pm 2.96	422.00 \pm 22.18	666.67 \pm 11.55 a	952.00 \pm 8.54	1210.33 \pm 10.33	3400.67 \pm 14.84 a
Significant level	NS	NS	*	NS	NS	*

First treatment: control group free from any addition. The second treatment: a basic feed added to 10 g of lemon grass / kg feed, the third treatment: a basic feed added with 20 g of lemon grass / kg feed, The fourth treatment: adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and the fifth treatment: adding 200 ml of the aqueous extract of the lemongrass liter of drinking water.

Table 5 shows the results of the statistical analysis of the effect of adding different levels of lemon grass leaves to the diet or its extract to drinking water in the feed conversion ratio for broiler chickens for 5 weeks in the absence of significant differences between all the treatments of the experiment. As for cumulative nutritional conversion, we observed that the

third and fourth treatment birds recorded the best cumulative nutritional conversion factor (1.448, 1.466 g fodder / gm overweight / bird) and a significant difference ($P \leq 0.05$) on the first treatment birds, which recorded a cumulative nutritional conversion factor that reached (1.548 g forage / overweight / bird).

Table 5. Effect of adding different levels of lemongrass leaves to Fodder and its extract into drinking water at Feed conversion ratio (g / feed g / overweight / bird for broiler) rate of broiler chickens (mean \pm standard error)

Treatments	The weeks					Cumulative Feed conversion ratio
	The first week	second week	the third week	fourth week	The fifth week	
First treatment	1.197 \pm 0.04	1.288 \pm 0.13	1.391 \pm 0.00	1.497 \pm 0.04	1.920 \pm 0.05	1.548 \pm 0.03 a
Second treatment	1.180 \pm 0.11	1.119 \pm 0.08	1.325 \pm 0.04	1.509 \pm 0.05	1.807 \pm 0.08	1.482 \pm 0.02 ab
Third treatment	1.096 \pm 0.12	1.289 \pm 0.01	1.333 \pm 0.04	1.411 \pm 0.04	1.791 \pm 0.03	1.466 \pm 0.02 b
Fourth treatment	1.150 \pm 0.02	1.211 \pm 0.01	1.353 \pm 0.03	1.387 \pm 0.07	1.744 \pm 0.04	1.448 \pm 0.02 b
Fifth treatment	1.139 \pm 0.02	1.302 \pm 0.04	1.316 \pm 0.04	1.417 \pm 0.03	1.777 \pm 0.06	1.469 \pm 0.01 ab
Significant level	NS	NS	NS	NS	NS	*

First treatment: control group free from any addition. The second treatment: a basic feed added to 10 g of lemon grass / kg feed, the third treatment: a basic feed added with 20 g of lemon grass / kg feed, The fourth treatment: adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and the fifth treatment: adding 200 ml of the aqueous extract of the lemongrass liter of drinking water.

Figure 1 shows the effect of adding different levels of lemon grass leaves to the fodder or its extract to drinking water in the broiler index for broiler chickens for the five weeks, where the second, third, fourth and fifth treatments

recorded the highest production index (431.59, 443.96, 456.85 and 457.77, respectively, with a significant difference ($P \leq 0.05$) from the first treatment (control) that recorded the lowest production index of (401.00).

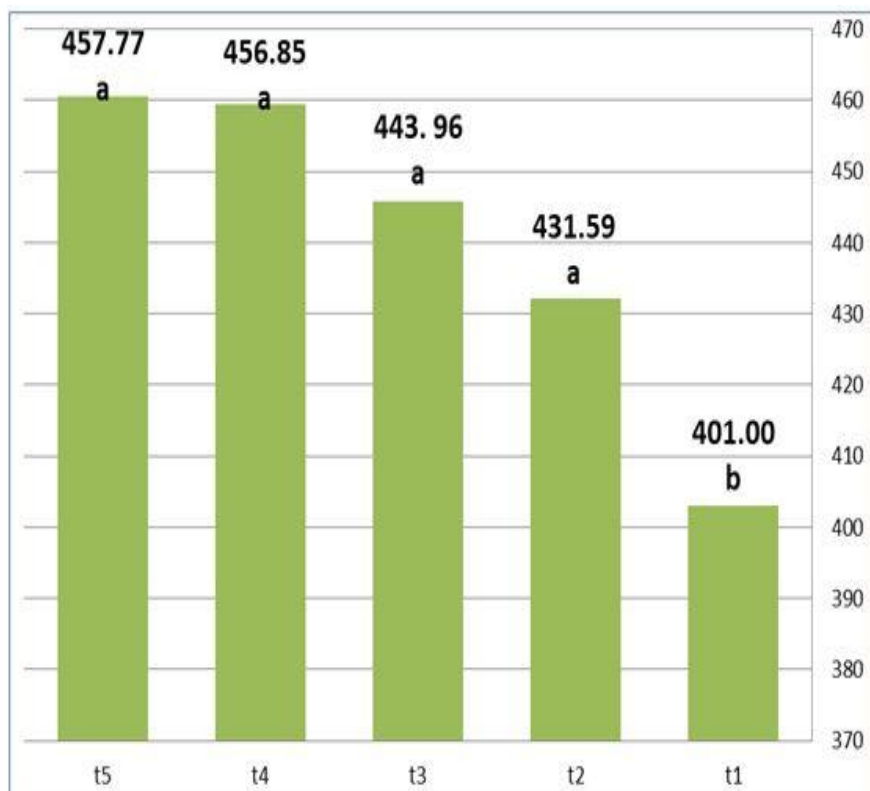


Figure 1. effect of adding different levels of lemon leaves to fodder and its extract to drinking water in the production index of broiler

First treatment: control group free from any addition. The second treatment: a basic feed added to 10 g of lemon grass / kg feed, the third treatment: a basic feed added with 20 g of lemon grass / kg feed, The fourth treatment: adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and the fifth treatment: adding 200 ml of the aqueous extract of the lemongrass liter of drinking water.

Table 6 shows the results of the statistical analysis of the effect of adding different levels of lemon grass to the diet or its extract to drinking water in the rate of water consumption for broiler for the 5-week trial weeks, in the absence of significant differences between all treatments in the first and second week of the experiment. As for the third week, we noticed that the third and fifth treatment birds recorded the highest rate of water consumption (1299.33 and 1332.67 ml / bird), respectively, and with a significant difference ($P \leq 0.05$) for the first, second and fourth transaction birds that recorded the lowest water consumption rate

reached (1240.00, 1239.33 and 1249.33 ml / bird), respectively. While in the fourth and fifth week, we noticed that there were no significant differences between all treatments of the experiment. As for the total water consumption rate, we noticed the registration of the fifth treatment with the highest total water consumption rate (6792.66 ml / bird) and a significant difference ($P \leq 0.05$) from the second treatment birds that were recorded consumption total water was 6508.66 ml / bird, which in turn did not differ significantly from the first, third and fourth treatment birds.

Table 6. Effect of adding different levels of lemon grass to fodder and its extract to drinking water on the rate of water consumption of broiler (mean \pm standard error)

Treatments	The weeks					Total water consumption
	The first week	second week	the third week	fourth week	The fifth week	
First treatment	290.33 \pm 0.88	805.33 \pm 93.24	1240.00 \pm 19.00 B	1900.00 \pm 15.27	2354.33 \pm 9.76	6589.99 \pm 103.56 ab
Second treatment	297.33 \pm 37.55	723.00 \pm 56.44	1239.33 \pm 8.51 B	1894.67 \pm 5.20	2354.33 \pm 70.81	6508.66 \pm 83.58 b
Third treatment	292.67 \pm 41.59	804.00 \pm 19.28	1299.33 \pm 10.47 A	1872.67 \pm 11.85	2280.67 \pm 83.79	6549.34 \pm 90.49 ab
Fourth treatment	297.33 \pm 8.96	793.33 \pm 12.01	1249.33 \pm 10.47 B	1870.00 \pm 5.77	2377.67 \pm 44.46	6587.66 \pm 54.54 ab
Fifth treatment	297.00 \pm 7.37	837.33 \pm 46.62	1332.67 \pm 23.13 A	1906.33 \pm 16.04	2419.33 \pm 20.34	6792.66 \pm 35.16 a
Significant level	NS	NS	*	NS	NS	*

First treatment: control group free from any addition. The second treatment: a basic feed added to 10 g of lemon grass / kg feed, the third treatment: a basic feed added with 20 g of lemon grass / kg feed. The fourth treatment: adding 100 ml of the aqueous extract of the lemongrass / liter of drinking water, and the fifth treatment: adding 200 ml of the aqueous extract of the lemongrass liter of drinking water.

Discussion and conclusion

The use of medicinal plants and their extracts as food additives in poultry diets generally improves body weight and overweight (Ahmed et al., 2009). The significant increase in the rate of live body weight and the total weight increase in the treatments of the third, fourth and fifth lemon grass leaves compared with the first (control) treatment was due to the role of the active substances present in the lemon leaves, such as Flavonoids, Linalool and Phenoles as catalysts for the digestive system and improving digestion (Haj Ali, 1995; Hasim; et al., 2015), as it increases the production of digestive enzymes such as the enzyme Chemotrypsin, Lipase, Amylase, and Trypsin in birds (Muthamma et al., 2008). The digestion process also improves and the birds benefit more from the food intake and this is reflected in the growth of birds and the

final return is positive on the rate of weight gain and the final weight of the bird (Lee Et al., 2003; Lee; et al., 2004). There is a positive correlation between the ratio of digestion, body weight, and the amount of feed intake (Abdel Rahman et al., 2013) or the significant improvement in body weight and the overall weight increase of the treatments of lemon grass leaves (third, fourth and fifth) may contain Myrcener, which is considered as an opening of the appetite (Pereira et al., 2004). It is also clear from the results of Table 5 on recording of the third and fourth treatments, the best cumulative food conversion factor is compared with the first treatment (control); this is due to the role of active substances and compounds in lemon grass in improving digestion and the absorption capacity of the digested food as well as increasing the process of food analysis by beneficial microorganisms the creation of

microbial balance inside the intestine (Cabuk et al., 2003). The significant role of active substances in lemon grass lies in improving the physiological efficiency of the digestive system in utilizing feed material that leads to improved production performance and feed conversion ratio (Saad et al., 1988). This improvement in the characteristics of productive performance is all reflected positively on the values of the production guide, which is one of the important indicators in the evaluation of the productive performance of broilers, due to the high value in the transactions of lemon leaves as a result of the high rate of live body weight and the vital percentage. Also, the improvement of the food conversion factor in these transactions, as the scale of the productive guide, is directly proportional to the rate of live body weight and the vital ratio. As for the increase in the rate of water consumption, it is known that the bird's water consumption is estimated to be twice as the amount of feed consumed (Lacy, 2002) and this was in agreement with what Kellems and Church (2002) indicated, in which the bird consumes water about 1.6-2 times higher as much as feed consumed. Lemon leaves may have a role in improving the flavor and taste of feed or drinking water, so that the bird is palatable to it, and then increases the feed or water consumption of lemon grass compared with the first treatment (control).

Acknowledgment

Authors Agreement

We certify that all authors have seen and approved the final version of the manuscript being submitted. They warrant that the article is the authors' original work, hasn't received prior publication and isn't under consideration for publication elsewhere.

Orcid

Dheyaa Hmazah Yasir: <https://doi.org/>

Nihad Abdul-Lateef Ali:

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