SINAI Journal of Applied Sciences 12 (4) 2023 627-638

Available online at www.sinjas.journals.ekb.eg

SCREENED BY SINAI Journal of Applied Sciences

iThenticate Professional Plagiarism Prevention

Print ISSN 2314-6079
Online ISSN 2682-3527

ARU-EGYPT SJAS TrustScience | ItCreates

EFFECT OF ARTIFICIAL GROWTH PROMOTER ON PRODUCTIVE PERFORMANCE OF QUAIL UNDER NORTH SINAI CONDITIONS, EGYPT

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ARTICLE INFO

Article history:
Received: 23/06/2023
Revised: 30/07/2023
Accepted: 02/08/2023

Keywords:
Tylosin,
quail,
economic efficiency and
growth performance.

Check for updates

ABSTRACT

The aim of this study was to investigate the impact of using tylosin antibiotic as growth promoter on growth performance of quail from one day to 42 day of age. Initially, 120 one-day-old quail chicks were fed a basal diet containing 24% protein and 2800 Kcal ME/kg diet for one week. At seven day of age, the chicks were randomly assigned to four groups, each consisting of 30 quail chicks, with three replications of 10 chicks each. The quail chicks were then fed four different levels of antibiotic, namely zero (control), 0.1, 0.2, 0r 0.3 g/kg. The study revealed that feeding birds with diets containing 0.1 g/kg of tylosin led to a significant increase in their average weight gain, while those fed on zero, 0.2, or 0.3 g/kg had the lowest weight gain without significant differences among them. Birds given 0.3 g/kg of tylosin had the best feed conversion ratio (FCR) compared to other treatments. The addition of antibiotic resulted in a reduction in serum total protein and albumin levels in comparison to the control group which had the highest values. Birds that were fed diets containing tylosin also had lower levels of serum cholesterol compared to those without antibiotic supplementation. In conclusion, appropriate use of tylosin antibiotics can enhance the growth performance and economic efficiency of quail in the unique environmental conditions of North Sinai.

INTRODUCTION

The Quail (*Coturnix coturnix*) farming industry in Egypt holds great promise as there is a significant market demand for both quail meat and eggs (**Eidrisha *et al.*, 2022)**. Nevertheless, this industry is confronted with various obstacles, such as diseases and substandard growth rates that impede its growth (**Yousha *et al.*, 2014; Yousha *et al.*, 2020 a & b)**.

Antibiotics, which are produced by microorganisms, are natural substances used to prevent the growth of harmful microorganisms. Their use in animal and poultry feeds has been a common practice for many years. Besides their antimicrobial properties, antibiotics are also utilized as growth enhancers and to prevent or treat infectious diseases, which can lead to overall physiological improvements **(Ashraf *et al.*, 2019)**.

The use of antibiotics in poultry feed has significantly contributed to the growth and success of the poultry industry by promoting growth, improving growth performance, reducing mortality rates and improving the overall health of poultry flocks **(Sahu, 2016)**.

Antibiotics are added to poultry feed at low doses, which are believed to be sub-therapeutic, to control bacterial infections and promote growth. These sub-therapeutic doses of antibiotics have been shown to enhance the growth and feed efficiency of poultry, resulting in increase production and profitability for farmer **(Mehdi *et al.*, 2018)**. Additionally, the use of antibiotics

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https://doi.org/ 10.21608/sinjas.2023.212636.1209

in poultry feed has been found to reduce the prevalence of certain diseases in poultry flocks, such as necrotic enteritis and coccidiosis **(Gilani *et al*., 2018)**. As a result, antibiotics have played a crucial role in ensuring a stable and abundant supply of affordable poultry products for consumers **(Mousavi *et al*., 2012; Hayden *et al*., 2020)**.

In addition to promoting growth and preventing diseases, the use of antibiotics in poultry feed have also been shown to enhance the characteristics and safety of poultry outputs (**Sahu, 2016)**. Antibiotics can reduce the levels of harmful bacteria in poultry products, which can cause foodborne illnesses in humans. This is particularly important given that poultry products are a significant source of protein in many countries and can contribute to food security **(Aust *et al*., 2008; Gao *et al*., 2012)**.

Tylosin is frequently employed in the production of poultry, including quail farming, owing to its efficacy in combating a range of bacterial pathogens. This antibiotic is derived from Streptomyces fradiae and is considered one of the most potent antimicrobial agents against several species of mycoplasma, exhibiting superior activity against mycoplasma as compared to bacteria, as reported by **Kowalski *et al*. (2002)**.

The use of antibiotics in animal production has given rise to concerns regarding antibiotic resistance and its potential implications for human health. Furthermore, the impact of tylosin on the growth performance, blood parameters, and economic efficiency of quail in Egypt, has not been extensively investigated **(Shah *et al*., 2022).**

The primary objective of this study was to investigate how the inclusion of tylosin antibiotic, as a growth enhancer, in the diets of quail could affect their performance, certain blood parameters, and economic efficiency in the unique environmental conditions of North Sinai.

MATERIALS AND METHODS

This study was conducted at the farm of the Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences, Arish University, El Arish, North Sinai, Egypt.

Experimental Birds and Procedure

A total of 120, seven-day-old quail chicks with comparable live body weights were randomly divided into four groups, each containing 30 birds, using a completely randomized design with three replications. The control group was provided with a basal diet that did not contain tylosin, whereas the other three groups were given tylosin-supplemented diets at levels of 0.1, 0.2, or 0.3 g/kg.

Managements

During the whole trial, the birds were kept in battery cages with unlimited access to food and water under the same environmental and management conditions. the chicks were randomly assigned to four groups, each consisting of 30 quail chicks, with three replications of 10 chicks each. Throughout the whole trial, artificial light was available 24 hours a day. In order to maintain the necessary brood temperature, which was 34-36 ^{o}C for the first week and 4^{o}C lower each week for the following 4 weeks, electric heaters (equipped with thermostats) were utilized. During the fifth and sixth week temperature was maintained at 22-24^{o}C.

The quail battery cages are smaller than those designated for chickens and are multi-storey and consist of cages. It has a total height of 2 meters and a width of 1 meter and 20 cm. With a capacity of 5 roles. The feeders and drinkers required for quail breeding are similar to chickens. A feeder of 1 m is allocated for each 30 birds, and an automatic drinker for each battery with multiple roles.

Table 1. Composition and calculated analysis of starter and grower diets

Ingredient (%)	Starter period (7-21 day of age)	Grower period (22-42 day of age)
Yellow corn	54	59.7
Soybean (44%)	37.5	32
Wheat bran	1.9	1.6
Protein concentration 45 % CP*	5	5
Calcium Carbonate	1.5	1.5
Salt (Nacl)	0.1	0.2
Total	100	100
	Calculated analysis	
Metabolizable energy (ME Kcal / kg diet)	2800	2870
Crude protein (%)	23.8	21.8
Calcium (%)	0.92	0.9
Available phosphorus (%)	0.41	0.41
Methionine (%)	0.47	0.44
Lysine (%)	1.44	1.28
Methionine +Cystine (%)	0.86	0.80
Crude fiber (%)	2.95	2.83

* Each 1 kg contains the following: 120000 UI Vitamin. A, 20000 UI Vitamin. D3, 100 mg Vitamin. E, 10 mg Vitamin. K3, 10 mg Vitamin. B1, 50 mg Vitamin. B2, 15 mg Vitamin. B6, 100 µg Vitamin. B12, 300 mg niacin, 500 µg biotin, 10 mg folic acid, 100 mg pantothenic acid, 2500 mg choline, 500 mg zinc, 600 mg manganese, 40 mg copper, 300 mg iron, 5 mg iodine, 1 mg cobalt, 1 mg selenium.

Methods of Interpreting Results

Growth performance

Biweekly recordings of body weight and feed consumption were conducted, and the average body weight gain and feed conversion ratio were calculated **(Hussain *et al.*, 2021).**

Blood biochemical

Nine birds from each treatment (three birds from each replication) were selected randomly and deprived of feed for eight hours, weighed, and then slaughtered in the end.

Blood samples were taken from the jugular vein of the birds, at the same time of slaughtering. Blood serum were individually separated by centrifugation at 3000 rpm for 10 minutes and stored in vials at –20^{o}C for later analysis. Frozen serum were thawed and assayed to determine, on individual bases, some biochemical parameters by using Atomic Absorption Spectrophotometer and suitable commercial diagnostic kits following the same steps as described by manufactures **(Hussain *et al.* 2021).** Blood samples were collected to determine the serum levels of total protein, albumin, globulin, glucose, total lipids, low-density lipoprotein (LDL), high-density lipoprotein (HDL), cholesterol, serum Aspartate transaminase (AST), and Alanine transaminase (ALT). The globulin value was calculated by subtracting the albumin value from the total protein value, and the (A/G) ratio was calculated based on the albumin and globulin results.

Economic efficiency

Throughout the study, the economic evaluation of the feeds was conducted by determining the net revenue per unit feed cost using component prices prevailing in the market and antibiotic (Tylosin) as described by **Asar *et al.* (2010).**

Statistical Analysis

The collected data was statistically analyzed using the one – way analysis of variance using the general linear model procedure described in the SAS User's Guide (**SAS, 2004**), and the means were compared using Duncan's multiple range test **(Duncan, 1955)** with a significance level of $P \leq 0.05$. The statistical model used was as follow:

$$Yij = \mu + \alpha i + eij$$

Yij=individual observation, μ=overall mean, αi=effect of treatment and eij represents the random error.

RESULTS AND DISCUSSION

Growth Performance

Table 2 presents the impact of using antibiotic (tylosin) on live body weight (g), body weight gain (g), feed intake (g), and feed conversion ratio (g.feed/g.gain) during the experimental period spanning from 7 to 42 day. At the commencement of the experiment, the quail chicks in all treatment groups had similar initial body weights, ranging from 24.51-24.62 g, and there were no significant differences observed among the various treatment groups.

The birds that were given a feed containing 0.1 g/kg tylosin had the greatest live body weight, measuring 193.41 g. The next highest weights were observed in the groups that were fed with 0.2, 0.3 and 0 g/kg of tylosin, with live body weights of 192.64 g, 186.97 g, and 182.98 g, respectively. Despite these differences, the statistical analysis revealed that there was no significant variation ($P>0.05$) in live body weight among the groups. The results showed that the group of birds that were given feed containing 0.1 g tylosin /kg had the highest body weight gain, with an average weight gain of 168.78 g. The second highest weight gain was observed in the group that received 0.2 g tylosin /kg, with an average weight gain of 168.12 g, followed by the group that received 0.3 g tylosin /kg with an average weight gain of 162.30 g, and the control group with an average weight gain of 158.33 g. However, despite these differences, the statistical analysis of the data revealed that there was no significant ($P>0.05$) variation in average weight gain intake among the groups. Similar findings were found in the study done by **Lu *et al.*(2020)**, which discovered that during the 41-day study period, all groups of chicks fed meal-basal diets containing 0.003% avilamycin and 0.0125% protease had similar live body weight and body weight gain with no significant differences ($P > 0.05$).Also, **Nazir *et al*. (2017),** investigated the impact of a commercial feed antibiotic (Lincomycin) on the growth of 200 day-old Hubbard broiler chicks during a 42-day experimental period. The study found no significant difference in live body weight and body weight gain between chicks fed a basal diet with or without Lincomycin. Moreover, **Shittu *et al*. (2022)**, observed that the live body weight and body weight gain of birds that received Polyalthia longifolia as an antibiotic growth promoter at doses of 15 g, 30 g, and 45 g were similar to those of the control group. However, **Shah *et al*. (2022)** found that adding tylosin phosphate at levels of 0.5% and 1% to the basal diet led to significant improvements ($P<0.05$) in weight gain and average daily weight gain of broiler chickens throughout the starter, finisher, and overall rearing periods

Table 2. Growth performance of quail birds fed diets with varying levels of tylosin during the experimental period spanning from day 7 to day 42

Item	Supplementation of tylosin (g/kg)			
	Control	0.1	0.2	0.3
Initial live body weight (g)	24.65^{a}± 0.10	24.62^{a}± 0.07	24.51^{a}± 0.06	24.67^{a}± 0.11
Final live body weight (g)	182.98^{a}±0.008	193.41^{a}±1.44	192.64^{a}±3.53	186.97^{a}±6.11
Body weight gain (g)	158.33^{a}±0.09	168.78^{a}±1.44	168.12^{a}±3.56	162.30^{a}±6.02
Feed intake (g)	497.63^{b}±0.77	519.36^{a}±7.66	510.46^{ab}±3.03	500.49^{b}±2.15
Feed conversion ratio (g. feed/g. gain)	3.14^{a}±0.004	3.07^{a}±0.06	3.03^{a}±0.07	3.09^{a}±0.11

a,b…Means followed by the same letter within each row are not significantly different at 0.05 level of probability

(42 days). Moreover, **El-Sayed *et al.* (2017)** observed that there were significant differences ($P \leq 0.05$) in the average body weight gain of quails, measured in g/bird/ week, due to the application of antibiotics throughout the entire duration of the experiment. In addition, **Cardinal *et al.* (2020)** demonstrated that supplementing the feed of broiler groups with antimicrobial growth promoters had significantly faster growth and higher weight gain ($P<0.05$) in comparison to the control group.

According to the findings, birds that were given either 0 or 0.3 g tylosin /kg of the diet consumed the least amount of feed, with a weight of 497.63 g and 500.49 g respectively, and this difference was statistically significant ($P<0.05$). However, birds that were given 0.1 g tylosin /kg consumed 519.36 g of feed, while those given 0.2 g/kg of tylosin consumed 510.46 g, but there was no significant difference between these two groups. The group that received a diet supplemented with 0.2 g tylosin/kg had the most efficient feed conversion ratio (3.03), with the group given 0.1 g/kg (3.07), 0.3 g/kg (3.09), and the control group (3.14) following in descending order. However, the statistical analysis indicated that there was no significant difference in feed conversion ratio among the various groups. The same results were obtained in a study conducted by **Nazir *et al*. (2017)** they showed no significant differences were found in the feed intake and feed conversion of birds that received antibiotics compared to those in the control group. Also, **Gunal *et al.* (2006)** observed that using antibiotics did not have a significant impact on feed intake or feed conversion during the entire duration of the experiment. Moreover, **Hussein *et al.* (2020)** conducted that adding antimicrobial growth promoters to the feed had no statistically significant effect ($P> 0.01$) on the feed consumption of broiler chickens when compared to the group that did not receive any supplementation (control). On contrary, **Shah *et al*. (2022)** indicated that incorporating tylosin phosphate into the basal diet at levels of 0.5% and 1% led to a notable improvement ($P<0.05$) in the weight gain and average daily weight gain of broiler chickens over the entire rearing period of 42 days. Also, **Shittu *et al.* (2022)** found that inclusion of Polyalthia longifolia as an antibiotic had improvement significant ($P < 0,05$) effect on average total feed intake, daily feed intake and feed conversion ratio compared with the control group.

Blood Constituents

Table 3 shows the statistical analysis of blood components across the different groups. The findings showed that there was no significant effect due to the tylosin levels in Albumin/ Globulin ratio compared with the control group**.** The findings revealed that adding tylosin at levels of 0.1, 0.2, or 0.3 g/kg to the diet of quail chicks led to a significant reduction in the concentrations of serum total protein and albumin, compared to the control group which had the highest values. This confirms the findings of **Rehman *et al*. (2019)**, who found that the blood albumin levels of laying hens were not significantly affected (P>0.05) by the administration of quinolone antibiotics.

The control group had the highest albumin level among all groups. However, According to **Elbaz and El-Sheikh (2020)**, adding antibiotics to broiler chickens' diets caused a significant higher level of blood total protein and albumin when compared to the control group.

The birds that were given diets containing 0.3 g tylosin /kg of the diet had significantly higher serum levels of total globulin and glucose compared to those that were given diets supplemented with 0, 0.1, and 0.2 antibiotics (P>0.05). This is consistent with **Elbaz and El-Sheikh (2020)** who observed that adding antibiotics to broiler chickens' diets caused a substantial rise in the levels of serum total globulin and glucose in comparison to the control group. Also, **Shittu *et al*. (2022)** observed that the broiler chickens that received 45 g Polyalthia longifolia /L of the water as an antibiotic had a considerably higher level of globulin than the control group. However **Al-Saad *et al*. (2014)** found no significant alterations (P>0.05) were observed in the serum blood glucose levels due to the administration of antibiotics, in comparison to the control group.

The inclusion of tylosin in the diets of birds led to a reduction in the serum levels of cholesterol and triglycerides compared to those that did not receive antibiotic supplementation. The birds that were fed a diet supplemented with 0.3 g tylosin /kg of the diet had the lowest levels of total cholesterol, while the birds given a diet supplemented with 0.1 g tylosin /kg had the lowest levels of triglycerides, with the highest levels observed in the control group. This result not agree with **Rehman *et al*. (2019)** who observed that the impact of quinolones on cholesterol levels was observed to be statistically non-significant (P>0.05). However, **Shittu *et al.* (2022),** found that broiler chickens that received 15 g Polyalthia longifolia /L of the water had a significantly higher level of cholesterol compared to the control group.

According to the results, the levels of aspartate aminotransferase (AST) and alanine transaminase (ALT) were notably impacted (P<0.05) by different levels of tylosin when compared to both the positive and negative control groups. In the current study, the birds that were fed diet with 0.3 g/kg exhibited a significant (P > 0.05) increase in the concentrations of (AST) and (ALT) when compared to the other treatments. The findings of this study are consistent with **Elbaz and El-Sheikh (2020)** who observed that the birds received antibiotics had higher levels of AST and ALT compared to the control group. However, A study on the impact of tylosin supplementation in the diet on liver and renal organs was done by **Fitriana *et al*. (2020)** found that there were no significant impacts on ALT and AST on both day 14 and day 28.

When broiler chickens were fed tylosin at levels of 0.1 and 0.3 g/kg as an antibiotic, it led to a significant (P>0.05) reduction in serum HDL compared to the birds that were fed 0 and 0.3 g/kg of tylosin. However, the tylosin levels (0.1, 0.2 or 0.3 g/kg) significantly

Table 3. The impact of the experimental diets with varying levels of tylosin on the blood biochemical constitutes of quail chicks

Item	Supplementation of tylosin (g/kg)			
	Control	0.1	0.2	0.3
Total Protein (g/ dl)	5.18^{a}±0.04	5.05^{b}±0.03	5.06 ^{b}± 0.017	5.08^{b}± 0.03
Albumin (g/ dl)	1.50^{a}± 0.04	1.27^{b}± 0.004	1.24^{bc}± 0.002	1.18^{c}± 0.03
Globulin (g/ dl)	3.86^{b}± 0.02	3.81^{b}± 0.04	3.84^{b}± 0.015	3.98^{a}±0.006
A/G ratio	0.33^{a}± 0.01	0.33^{a}± 0.05	0.32^{a}± 0.04	0.29^{a}± 0.007
Glucose (mg/dl)	305.00^{a}±9.72	361.33^{a}±10.06	353.66^{a}±17.55	292.16^{b}±3.23
Total cholesterol (mg/dL)	280.66^{a}±2.97	265.66^{b}±1.45	263.33^{b}±4.68	262.16^{b}±2.50
Triglycerides (mg/dL)	155.00^{a}± 10.98	92.00^{b}± 2.03	134.00^{b}±0.12	97.50^{b}±0.99
ALT (U/L)	14.00^{b}±0.93	15.50^{b}±0.95	14.33^{b}±0.66	18.50^{a}±0.34
AST (U/L)	309.16^{b}±10.36	267.66^{c}±0.42	314.66^{b}±14.91	352.83^{a}±0.47
HDL (mg/dl)	184.33^{a}±0.66	173.66^{c}±0.61	177.66^{b}±14.91	184.50^{a}±0.99
LDL (mg/dl)	64.66^{b}±4.10	57.50^{b}±1.68	57.66^{b}±2.01	60.16^{b}±1.13

a,b…Means followed by the same letter within each row are not significantly different at 0.05 level of probability

(P>0.05) decreased the serum LDL compared to the control group. Similar findings have been reported by **Elbaz and El-Sheikh (2020)** indicated that the administration of antibiotics to broiler chickens resulted in a significant reduction in serum LDL levels and a notable increase in serum HDL levels compared to the control group.

Economic Efficiency

Table 4 displays the economic outcomes of the experiment's quail chicks in each treatment group. The outcomes showed that the diet containing 0.1g/kg antibiotic (Tylosin) generated the highest net revenue, economic efficiency, and relative economic efficiency throughout the entire experimental period compared to the other groups. These findings are consistent with those of **Nazir *et al.* (2017)**, who discovered that birds fed the antibiotic feed (Lincomycin) had more total income and net profit than the control group. However, the lowest values of net revenue, economic efficiency and relative economic efficiency were recorded for birds fed diet supplemented 0.3 g tylosin /kg whole experimental period (7-42 day).

Conclusion

Our study suggests that including 0.1g tylosin /kg of the basal diet of quail birds as growth promoter can enhance their performance without any apparent negative effects. This supplementation also led to the best economic efficiency.

Table 4. Economic efficiency of chicks as affected by antibiotic supplementation during the experimental period (7 to 42 day)

Item	Supplementation of tylosin (g/kg)			
	Control	0.1	0.2	0.3
Fixed cost (LE)	4.50	4.50	4.50	4.50
Total feed cost (LE)	9.95	9.73	9.63	10.23
Total cost (LE)	14.45	14.23	14.13	14.73
Final LBW (Kg.)	0.183	0.196	0.185	0.184
Total revenue (LE)	21.96	23.56	22.20	22.12
Net revenue (LE)	7.50	9.33	8.06	7.39
Economic efficiency	1.52	1.66	1.57	1.50
Relative economic efficiency (%)	100.00	108.96	103.37	98.84

1- Fixed cost: Bird price + rearing cost.
2- The price was calculated due to the local market the price of one kg/ tylosin.
3- Total revenue: Assuming that the selling price of 1 kg lives body weight is 120 L. E.
4- Net revenue: total revenue – total cost.
5- Economic efficiency (E.E.F): Net revenue per unit total cost.
6- Relative economic efficiency (R.E.E): Assuming that the relative economic efficiency of the control.

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الملخص العربي

تأثير استخدام منشط النمو الصناعي على الأداء الإنتاجي للسمان تحت ظروف شمال سيناء، مصر

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هدفت هذه التجربة إلى دراسة تأثير إضافة المضاد الحيوي (التيلوزين) على نمو السمان خلال المدة من عمر يوم الى 42 يوماً. تم استخدام عدد 120 كتكوت سمان عمر يوم وغذيت الطيور في الأسبوع الأول على عليقة أساسية تحتوي على 24% بروتين و طاقة ممثلة 2800 كيلو كالوري/كجم عليقة. عند عمر 7 أيام قسمت الطيور عشوائيا الى 4 مجموعات تحتوي كل مجموعة على 30 طائراً في ثلاثة مكررات بكل مكررة 10طيور. غذيت الكتاكيت على 4 مستويات من المضاد الحيوي صفر (كنترول)،0.1 ، 0.2 ،0.3 جرام/كجم. أظهرت النتائج وجود زيادة معنوية في متوسط الزيادة في وزن الجسم في الطيور المغداة علي علائق تحتوي علي 0.1 جم التيلوزين/كجم من العليقة بالمقارنة بالطيور المغداة علي صفر و 0.1 و 0.2 جم/ كجم والتي حققت اقل زيادة في وزن الجسم وبدون اختلافات معنويه بالمقارنة بباقي المعاملات. اظهرت الطيور المغذاة علي عليقه تحتوي علي 0.3 جم التيلوزين /كجم من العليقة افضل كفاءة تحويلية بالمقارنة بباقي المعاملات. إضافة المضاد الحيوي نتج عنها نقص في البروتين الكلي ومستوى الألبيومين في الدم مقارنة بمجموعة الكنترول التي لها أعلى مستوى .الطيور المغذاة على عليقة تحتوي على التيلوزين كانت بها نقص في مستوى الكوليسترول مقارنة بالطيور التي غذيت على علائق غير مضاف لها المضاد الحيوي. من خلال هذه الدراسة وجد أن استخدام المضاد الحيوي التيلوزين بمستوى مناسب يمكن ان يحسن الأداء الانتاجي والكفاءة الاقتصادية للسمان تحت ظروف شمال سيناء.

الكلمات الاسترشادية : التيلوزين ، السمان ، الأداء الإنتاجي ، الكفاءة الاقتصادية .

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