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EFFECT OF PARTIAL REPLACEMENT OF YELLOW CORN WITH ORANGE PEEL BY-PRODUCT ON PRODUCTIVE PERFORMANCE OF BROILER CHICKS

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ABSTRACT: The current study aimed to assess the impact of replacing yellow corn with orange peel by-product in broiler diets. A total of 500 male day-old Arbor Acres chicks were randomly assigned to four treatment groups, each consisting of 125 chicks (25 chicks per replicate). The first group (control) received a standard diet, while the second, third, and fourth groups were fed diets in which yellow corn was replaced with orange peel by-product at 15% (OP15), 20% (OP20), and 25% (OP25), respectively. The trial lasted for 35 days. The key findings were as follows:

1.Chicks in both the control and OP15 groups showed higher final live weights and better overall feed conversion ratios (FCR) compared to the OP20 and OP25 groups.

2.No treatment had any significant effect on carcass characteristics.

3.All dietary treatments improved the digestibility of ether extract (EE) compared to the control.

4.Blood total cholesterol levels were improved in group of OP20 without significant variations to OP15 and OP25, while control group recorded the highest level.

5.All experimental groups recorded gradual enhancement in economic efficiency comparing to control.

It could be concluded that orange peel by product (OP) could be a good replacement of yellow corn and it's level may be reach 15% replacement of corn without any adverse effect on broilers productive performance.

Keywords: broilers, orange peel, growth performance, replacement.

INTRODUCTION

Nutrition constitutes 70% of the total cost in animal production (Spring, 2013). Corn is the primary cereal grain used in poultry feeds, and rising production and logistical costs have led to higher corn prices, especially during off-season periods (Moura et al., 2010). As a result, incorporating fruit and vegetable waste into animal feeds has been shown to improve diet palatability and increase feed intake (FI), while also reducing feed costs (Alnaimy et al., 2017). Sun-dried orange peel meal and citrus pulp are increasingly being used as alternative sources of calories and protein in broiler (Oluremi et al., 2006) and rabbit (De Bals et al., 2018) diets.

The chemical composition of orange by-products varies across studies. For instance, Suliman et al. (2019) reported the following composition for orange pulp: 87.84% Dry Matter (DM), 88.50% Organic Matter (OM), 10.59% Crude Protein (CP), 15.53% Crude Fiber (CF), 3.87% Ether Extract (EE), 11.5% ash, and 58.52% Nitrogen-Free Extract (NFE). In contrast, Oluremi et al. (2006) found that sweet orange rind contained 89.65% DM, 10.74% CP, 7.86% CF, 12.6% EE, 11.9% ash, 56.9% NFE, 16.66 MJ/kg Metabolizable Energy (ME), and 3.88 mg/100g vitamin C. These findings suggest that orange peel can be a viable substitute for yellow corn in broiler diets. Previous studies have shown that sweet orange peel meal, derived from ground sun-dried peels, can replace up to 20% of dietary maize in broiler chicken diets without negatively affecting performance (Agu, 2006 and Grant, 2007).

In a similar study, Ahaotu et al. (2017) used sweet orange peel to replace wheat offal at various inclusion levels (0.0, 2.5, 5.0%, 7.5%, and 10%) in broiler finisher diets. They concluded that broilers could tolerate up to 7.5% inclusion of sweet orange peel meal (SOPM) without any adverse effects on performance, resulting in cost savings.

Given these findings, the aim of the present study is to evaluate the effects of partial replacing yellow corn with orange peel by-products on the growth performance, blood parameters, and histological characteristics of broiler chicks.

MATERIALS AND METHODS

The experiment was conducted at a private poultry farm in the Menofya Governorate, while laboratory analyses were carried out at the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Dokki, Giza, Egypt.

Preparation and Proximate Analysis of Orange Peel By-Product

Orange peel by-product was sourced from juice factory located in Nobarya city and subjected to proximate analysis according to A.O.A.C. (2000) methods. The results showed the following composition: organic matter (88.00% OM), crude protein (11.20% CP), crude fiber (15.50% CF) , ether extract (4.80% EE), nitrogen-free extract (56.50%NFE) , and ash content 12.00%. Based on these values, the metabolizable energy (ME) of the orange peel was calculated to be 3380 kcal/kg using the equation from Carpenter and Clegg (1956):

$$ME\ (kcal/kg)=53+38\times(CP\%+2.25\times EE\%+1.1\times NFE\%+0.22\times CF\%).$$

The chemical composition of yellow corn was yielding the following values: 98.60% OM , 7.70% CP , 2.30% CF , 3.80% EE , 84.80% NFE , 1.40% ash , and 3350 kcal/kg ME, as per the *Feed Composition for Animal and Poultry Feedstuffs Used in Egypt* (RCFF, 2001).

Experimental Animals, Design, and Management

A total of 500 one-day-old Arbor Acres broiler chicks, with an average weight of 41.3 ± 0.17 g, were randomly assigned to four treatment groups as follows:

- T1 (Control): Basal diet with no replacement.

- T2 (OP15): Basal diet with 15% of yellow corn replaced by orange peel, constituting 8.06% and 8.78% of the total diet during the starter and grower-finisher phases, respectively.
- T3 (OP20): Basal diet with 20% of yellow corn replaced by orange peel, making up 10.72% and 11.70% of the total diet during the starter and grower-finisher phases, respectively.
- T4 (OP25): Basal diet with 25% of yellow corn replaced by orange peel, accounting for 13.43% and 14.63% of the total diet during the starter and grower-finisher phases, respectively.Each group consisted of 125 chicks, divided into five replicates (25 chicks per replicate). The chicks were housed in wire cages under uniform management and hygienic conditions, with *ad libitum* access to fresh water and pelleted feed throughout the experimental period.

Experimental Diets and Measurements

Experimental diets were supplemented with DL-methionine, L-Lysine HCl and mixture of minerals and vitamins according to the catalog recommendations of Arbor Acres broiler strain to agreement the recommended requirements and were formulated to be iso-caloric and iso-nitrogenous. The composition and calculated analysis for the experimental diets are shown in Tables 1 and 2.

The chicks were fed a corn-soybean-based diet formulated to meet the nutritional requirements of the strain over 2 -phase feeding systems. Starter period (1-15 days) and grower- finisher periods (16 - 35 days). At the end of each growth phase, body weight gain (BWG), FI, and feed conversion ratio (FCR) were recorded. At the end of the finisher phase, 20 chicks (5 per treatment) were selected for the determination of nutrient digestibility coefficients. Excreta were collected from the chicks, treated with 1% boric acid to prevent ammonia loss, and then dried at 60°C for 24 hours. The diets and dried excreta were analyzed for CP, EE, crude fiber (CF), OM), and nitrogen-free extract (NFE) using A.O.A.C. (2000) methods at Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

At the end of the 35-day experimental period, five chicks from each treatment, selected based on average body weight, were slaughtered for carcass measurement. Blood samples were collected in heparinized tubes, centrifuged at 3000 rpm for 5 minutes, and the plasma was stored at -20°C for further analysis of total protein, albumin, globulin, total cholesterol (TC) according to Richmond (1973) and triglycerides (TG) as stated by Soloni (1971).

To assess the relative economic efficiency (REE) of meat production, total feed consumption per bird was calculated by multiplying the feed intake by the price of each experimental diet. The total feed cost was estimated based on the local prices at the time of the experiment. Economic efficiency of growth (EEG) was then calculated using the following formula:

EEG=100× [(sale price per total gain – total feed cost)/ total feed cost].

Finally, data were analyzed using SAS (2001) software with the following fixed model:

$Y_{ij} = \mu + T_i + e_{ij}$

Where: Y_{ij} = observed valueThe observation; μ = Overall overall mean; T_i = Effect effect of treatments (i = 1, 2, 3 and 4); and e_{ij} = experimental random error.Random error. Data presented as percentages were transformed using arcsine values (Ewens and Grant, 2005) before statistical analysis. Duncan's new multiple range test (Duncan, 1955) was used to compare means, and results are presented as least square means.

RESULTS AND DISCUSSION

Approximate analysis of orange peel by-product (OP)

The chemical composition of OP was found to be comparable to that of yellow corn, as previously described in the materials section. Specifically, the ME content of OP (3380 kcal/kg) is nearly identical to that of yellow corn (3350 kcal/kg), and the EE content in OP (4.80%) is slightly higher than that of yellow corn (3.80%). Additionally, OP contains significantly higher levels of CP(11.20% vs. 7.70%) and CF (15.50% vs. 2.30%) compared to yellow corn. These results suggest that OP can be considered a viable alternative livestock feed ingredient.

The chemical composition of OP aligns closely with the findings of Oluremi et al. (2006) and Suliman et al. (2019). On the other hand, SOPMdemonstrated nutrient levels similar to yellow corn, with 7.71% CP, 9.58% CF, 2.11% EE, 5.12% ash, 71.24% NFE, and 3752 kcal/kg of metabolizable energy, as reported by Ahaotu et al. (2017).

Effect of Treatments on Broilers Growth Performance

Effect of different dietary treatments on broiler growth performance is summarized in Table 3. The results show that broiler chicks fed the OP15 diet exhibited higher LBW during the starter and finisher phases compared to the control, although the differences were not statistically significant. Similarly, both the control and OP15 groups achieved higher finisher weights than the OP20 group, with no significant difference between them. This trend was also observed for BWG during the starter, finisher, and overall growth periods.

Earlier studies have found that OP serves as a good source of calories and protein, comparable to maize (Aggery, 2013). The peel contains oil sacs, with the oil being composed primarily of d-limonene (91–94%) and a minor amount of β-myrcene being 2.0–2.1% (Florou-Paneri et al., 2001). Citrus peel also contains poly-mentholated flavones, which do not cause negative side effects in animals consuming diets containing these compounds (Florou-Paneri et al., 2001). These findings are in line with those of Oluremi et al. (2006), who concluded that sweet orange rind, when included at 15% in broiler diets, serves as a suitable substitute for maize.

Another theory, citrus peels are recognized as a rich source of various bioactive components, including phenolic compounds, vitamins, minerals, terpenoids, terpenes, dietary fiber, and polysaccharides, which are linked to several significant biological activities such as antioxidant, antimicrobial, antidiabetic, and anticarcinogenic effects (Shehata et al., 2021 and Tomás-Navaro et al., 2014). Additionally, these compounds exhibit anti-allergic, anti-aging, cardioprotective, and neuroprotective properties (Pontifex et al., 2021and Ben Hsouna et al., 2023). Polyphenols, particularly flavonoids, are the most abundant bioactive constituents in orange peel. However, their nature and concentration in extracts are influenced by factors such as environmental conditions, subspecies variety, and the extraction method used (Shehata et al., 2021 and Ben Hsouna et al., 2023).

The absence of significant differences in body weight between the control and OP15 groups may be attributed to the various beneficial mechanisms of orange peel. OP may help reduce pathogen levels in the gastrointestinal tract, promoting better nutrient absorption in the birds (Nannapaneni et al., 2008). Pathogenic microorganisms can stimulate the immune system, diverting nutrients from growth and muscle development to support immune functions (Apata, 2009).

In contrast, Alefzadeh et al. (2016) observed negative effects on broiler growth performance when dried orange peel powder was added at 4 g/kg to the feed.

Table 4 shows that there were no significant differences in FI across the experimental groups during the starter,grower, finisher and overall periods. However, during the finisher phase the OP25 group (T4) recorded the lowest FI (1037.5 g) compared to the other groups, with control (T1), OP15 (T2), and OP20 (T3) groups consuming 1159.5 g, 1179 g, and 1104.5 g, respectively, although the differences were not statistically significant. This reduction in FI in the T4 group may be attributed to the high level of orange peel included in the diet, which contains both soluble and insoluble fibers. Soluble fibers, such as pectins, have a physiological role in delaying gastric emptying and regulating blood glucose levels by increasing gut viscosity and promoting colonic fermentation (Li and Komarek, 2017). On the other hand, the insoluble fibers in orange peel, including cellulose, hemicellulose, and lignin, help shorten bowel transit time, improve laxation due to their bulking effect, and support the growth of beneficial intestinal microflora through fermentation in the large intestine (Li and Komarek, 2017). These findings are consistent with Ahaotu et al. (2017), who reported a decrease in broiler feed intake as the inclusion of SOPM increased.

Regarding FCR, OP20 and OP25 groups exhibited worse FCR values during the starter, finisher, and overall periods compared to the control groups, which showed the best FCR values in these phases (Table 4). The worset FCR in the OP20 and OP25 groups may be linked to the lower weight gain observed in these groups, which can be attributed to the higher fiber content in the diets. Previous studies have noted similar effects, indicating that higher dietary fiber can impair growth performance, as observed by Nicolakakis et al. (1999) and Ahaotu and Ekenyem (2009).

Effect of different treatments on carcass characteristics is presented in Table 5. There were no significant differences observed in any of the carcass measurements, including carcass, liver, gizzard, heart, and total edible parts percentage, across the experimental groups. These findings align with those of Oluremi et al. (2006), who reported that substituting sweet orange rind at levels of 5, 10, 15, and 20% of yellow corn in chick diets did not enhance any carcass parameters. In contrast, Ahaotu et al. (2017) found that increasing the inclusion levels of sweet orange peel (7.50 and 10.00%) in place of wheat offal led to significant ($P < 0.05$) increases in the weights of the gizzard, liver, and heart, compared to the control and lower inclusion levels (2.50% and 5.00%).

As shown in Table 6, the treatments did not significantly affect the digestibility of most nutrients, except for EE. The experimental groups (T2, T3, and T4) demonstrated significantly higher EE digestibility, with values of 67.27, 67.06, and 68.60%, respectively, compared to the control group, which recorded 60.17%. As shown in Table 7, there were no significant differences in the blood parameters (total protein, albumin, globulin, and TG) across the treatment groups. However, significant differences were observed in TC levels. The control group (T1) had the highest TC value (213.33 mg/dl), while the OP20 group (T3) recorded the lowest value (153.83 mg/dl), with no significant differences between the control and the OP15 (T2; 185.67 mg/dl) and OP25 (T4; 190.67 mg/dl) groups. These findings are consistent with Vlaicu et al. (2020), who incorporated 2% orange peel in the diet of Cobb 500 broiler chicks and observed decrease in blood TC compared to the control.

Previous studies have shown that citrus fruits can be effective in lowering blood cholesterol levels (Parmar and Kar, 2008). The ability of orange peel to influence serum biochemical parameters may vary depending on the action of vitamin C and other bioactive compounds in citrus fruits that could affect blood metabolites. Additionally, the beneficial effects observed could be attributed to the reduction in blood cholesterol levels, as citrus fruits are rich in pectin, polyphenols, and flavonoids, which align with the findings of Hong et al. (2012).

As shown in Table 8, economic efficiency improved progressively with higher levels of orange peel substitution. The relative economic efficiency (REE) percentages for the OP15, OP20, and OP25 groups were 121.94%, 125.83%, and 131.43%, respectively, compared to the control group, which had an REE of 100%. These results are consistent with those of Oluremi et al. (2006), who reported improved economic efficiency in broilers fed diets with varying levels (5, 10, 15, and 20%) of sweet orange rind as a replacement for corn. Similarly, Ahaotu et al. (2017) found that the feed cost per kilogram of weight gain decreased significantly (P<0.05) as the inclusion of sweet orange peel meal increased.

CONCLUSION

Orange peel by-product has the potential to serve as an alternative feed ingredient to yellow corn for broiler chickens, due to its high energy content. It can be substituted for up to 15% of corn in the diet without negatively affecting broiler growth performance.

Table (1): Composition and calculated analysis of starter diets.

Ingredients	Control	OP15	OP20	OP25
Yellow corn	53.72	45.66	42.98	40.29
Orange peel by-product (OP)	---------	8.06	10.74	13.43
Soybean meal (44% CP)	31.60	32.70	33.22	33.30
Corn gluten (60% CP)	7.90	6.80	6.20	6.10
Soybean oil	2.30	2.3	2.40	2.40
Mono calcium phosphate	1.58	1.58	1.58	1.58
Limestone	1.8	1.80	1.8	1.80
Vitamins and minerals mix.*	0.30	0.30	0.30	0.3
Common salt	0.40	0.40	0.40	0.40
D.L methionine	0.15	0.15	0.15	0.15
L-Lysine	0.25	0.25	0.25	0.25
Total	100	100	100	100
Price (LE)/ ton **	23175	21307	20691	20063
Calculated analysis***				
Crude protein (CP) %	23.10	23.17	23.11	23.17
Metabolizable energy (kcal/kg)	3003	3000	3001	3004
Crude fiber	3.70	4.20	4.37	4.52
Crude fat	4.99	5.68	6.02	6.25
Calcium %	1.027	1.031	1.032	1.033
Available phosphorus %	0.50	0.50	0.499	0.500
Lysine %	1.335	1.35	1.363	1.36
Methionine %	0.593	0.579	0.57	0.57
Methionine +cysteine %	0.978	0.96	0.94	0.94
Sodium %	0.17	0.17	0.173	0.174

*Each 3 kg contains: Vit A 12 000 000 IU,Vit D_3 4 000 000 IU, Vit E 50 g, Vit K_3 3g, Vit B_1 3 g,Vit B_2 7g, Vit B_6 4g, Vit B_{12} 20mg , Nicotinic acid 50g, Pantothenic acid 15g, Folic acid 2g, Biotin 150mg, Choline 500 g, Iron 30 g, Copper 10 g, Zinc 80 g, Manganese 100 g, Iodine 1.25 g, Selenium 0.3 g, Cobalt 0.1 g and carrier ($CaCO_3$) up to 3 kg.

**Starter diet price (LE/Ton) = 23175, dried orange peel (LE/Ton) = 2200 .

** *According the Egyptian Regional Center for Food and Feed (RCFF, 2001).

broilers, orange peel, growth performance, replacement.

Table (2): Composition and calculated analysis of grower and finisher diets.

Ingredients	**Control**	**OP15**	**OP20**	**OP25**
Yellow corn	58.52	49.74	46.82	43.89
Orange peel by-product (OP)	--------	8.78	11.70	14.63
Soybean meal (44% CP)	26.20	27.50	27.50	28.00
Corn gluten (60% CP)	7.90	6.40	6.40	5.90
Soybean oil	2.90	3.10	3.10	3.10
Mono calcium phosphate	1.58	1.58	1.58	1.58
Limestone	1.80	1.8	1.80	1.80
Vitamins and minerals mix.*	0.3	0.3	0.30	0.30
Common salt	0.40	0.40	0.40	0.40
D.L methionine	0.15	0.15	0.15	0.15
L-Lysine	0.25	0.25	0.25	0.25
Total	100	100	100	100
Price (LE)/ton**	23125	21095	20420	19742
Calculated analysis* **				
Crude protein (CP)%	21.095	21.033	21.12	21.13
Metabolizable energy (kcal/kg)	3093	3098	3102	3100
Crude fiber	3.415	3.963	4.12	4.312
Crude fat	5.689	6.648	6.905	7.159
Calcium %	1.012	1.015	1.016	1.018
Available phosphorus %	0.49	0.49	0.49	0.49
Lysine %	1.187	1.209	1.208	1.218
Methionine %	0.568	0.547	0.547	0.542
Methionine +cysteine %	0.923	0.896	0.895	0.888
Sodium %	0.17	0.172	0.173	0.174

*Each 3 kg contains: Vit A 12 000 000 IU,Vit D_3 4 000 000 IU, Vit E 50 g, Vit K_3 3g, Vit B_1 3 g,Vit B_2 7g, Vit B_6 4g, Vit B_{12} 20mg , Nicotinic acid 50g, Pantothenic acid 15g, Folic acid 2g, Biotin 150mg, Choline 500 g, Iron 30 g, Copper 10 g, Zinc 80 g, Manganese 100 g, Iodine 1.25 g, Selenium 0.3 g, Cobalt 0.1 g and carrier ($CaCO_3$) up to 3 kg.

** Grower and finisher diet price (LE/Ton) = 23125, dried orange peel (LE/Ton) = 2200.

***According the Egyptian Regional Center for Food and Feed (RCFF, 2001)

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Table (3): Effect of replacing yellow corn with orange peel by-product (OP) in broiler diet on live body weight and weight gain.

Treatments	**Live body weight (g)**				**Body weight gain (g)**			
	IW	**Starter (15 d)**	**Grower (28 d)**	**Finisher (35 d)**	**Starter (1-15d)**	**Grower (16-28d)**	**Finisher (29-35 d)**	**Overall (1-35d)**
1 (Control)	41.35	491.00^{ab}	1500.0^{a}	2149^{a}	449.65^{ab}	1009.0^{a}	649.0^{a}	2107.65^{a}
2 (OP15)	41.40	493.00^{a}	1475.5^{ab}	2124^{a}	451.6^{a}	982.5^{b}	648.5^{a}	2082.6^{a}
3 (OP20)	41.30	484.00^{bc}	1465.0^{b}	2069.5^{ab}	442.7^{bc}	981.0^{b}	604.0^{ab}	2028.2^{ab}
4 (OP25)	41.45	476.50^{c}	1456.5^{b}	2021.5^{b}	435.05^{c}	980.0^{b}	565.0^{b}	1980.05^{b}
SE	0.17	2.88	9.17	27.69	2.87	7.41	19.68	27.67
P. value	0.93	0.001	0.012	0.012	0.0009	0.024	0.012	0.012

a, b and c = Means in the same column with different superscripts, differ significantly P<0.05)

Table (4): Effect of replacing yellow corn with orange peel by-product (OP) in broiler diet on feed intake and feed conversion ratio.

Treatments	Feed intake (g)				Feed conversion ratio			
	Starter (1-15d)	Grower (16 - 28 d)	Finisher (29 - 35 d)	Overall (1 - 35 d)	Starter (1 - 15d)	Grower (16 -28d)	Finisher (29-35d)	Overall (1 - 35d)
1 (Control)	587.0	1520.5	1159.5^{a}	3267	1.31^{b}	1.51	1.79^{b}	1.55^{b}
2 (OP15)	590.5	1474.0	1179.0^{a}	3243.5	1.31^{b}	1.50	1.82^{ab}	1.56^{ab}
3 (OP20)	592.0	1489.5	1104.5^{ab}	3186.0	1.34^{a}	1.52	1.83^{a}	1.57^{a}
4 (OP25)	592.0	1484.5	1037.5^{b}	3114.0	1.36^{a}	1.51	1.84^{a}	1.57^{a}
SE	5.12	12.67	37.70	49.38	0.008	0.007	0.011	0.006
P. value	0.888	0.075	0.052	0.146	0.0001	0.299	0.024	0.024

a and b= Means in the same column with different superscripts, differ significantly (P 0.05)

Table (5): Effect of replacing yellow corn with orange peel by-product (OP) in broiler diet on carcass characteristics.

Treatments	Carcass %	Liver %	Gizzard %	Heart %	Total edible parts(TEP)* %
1 (Control)	68.99	2.34	1.83	0.49	73.65
2 (OP15)	68.15	2.10	1.73	0.50	72.48
3 (OP20)	69.32	2.14	1.72	0.47	73.65
4 (OP25)	68.10	2.25	1.82	0.50	72.67
SE	0.70	0.06	0.05	0.02	0.70
P. value	0.526	0.305	0.349	0.900	0.542

*TEP% = Total edible parts (Carcass %+ Liver% + Gizzard % + Heart %).

Table (6): Effect of replacing yellow corn with orange peel by-product (OP) in broiler diet on nutrients digestibility.

Treatments	CP%	EE %	CF %	NFE %	OM %
1 (Control)	90.36	60.17 ^{b}	30.03	81.46	87.36
2 (OP15)	93.19	67.27^{a}	28.62	80.82	87.22
3 (OP20)	89.09	67.06^{a}	31.04	80.04	86.80
4 (OP25)	89.69	68.60^{a}	27.44	79.26	86.39
SE	1.34	0.94	1.80	0.49	0.33
P. value	0.218	0.0009	0.543	0.060	0.232

a and b= Means in the same column with different superscripts, differ significantly (P<0.05)

Table (7) : Effect of replacing yellow corn with orange peel by-product (OP) in broiler diet on some blood parameters.

Treatments	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Triglycerides (mg/dl)	Total cholesterol (mg/dl)
1 (Control)	3.12	1.25	1.87	153.33	213.33^{a}
2 (OP15)	3.32	1.20	2.12	146.83	185.67^{ab}
3 (OP20)	3.15	1.27	1.89	146.33	153.83^{b}
4 (OP25)	3.15	1.21	1.94	142.33	190.67^{ab}
SE	0.14	0.03	0.13	9.08	16.07
P. value	0.71	0.30	0.51	0.86	0.01

a and b = Means in the same column with different superscripts, differ significantly P<0.05).

broilers, orange peel, growth performance, replacement.

Table (8): Effect of different treatments on economic efficiency.

Treatments	Total feed cost (LE)/ chick	Total cost LE/chick	LBW	Total revenue LE / chick	Net revenue/ chick (LE)	Economic efficiency (EEf)	Relative EEf%
1 (Control)	75.58	100.58	2.149	149.03	48.45	48.17	100
2 (OP15)	68.66	93.66	2.124	148.68	55.02	58.74	121.94
3 (OP20)	65.22	90.22	2.070	144.9	54.68	60.61	125.83
4 (OP25)	61.67	86.67	2.022	141.54	54.87	63.31	131.43

Fixced price /chick (LE) = 25, Price /LBW (LE) = 70.

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تأثير الإحلال الجزئى للاذرة الصفراء باستخدام مخلفات قشر البرتقال على الأداء الإنتاجي لكتاكيت التسمين

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تهدف الدراسة الحالية إلى تقييم تأثير استبدال الاذرة الصفراء بمخلفات قشر البرتقال في علائق دجاج التسمين. تم توزيع 500 كتكوت من سلالة أربور إيكرز (ذكور، عمر يوم واحد) عشوائيًا على أربعة مجموعات تجريبية، تحتوي كل مجموعة على 125 كتكوت (25 كتكوت في كل مكرر).تغذت المجموعة الأولى (الضابطة) علي عليقة قياسية، بينما تم تغذية المجموعات الثانية والثالثة والرابعة على علائق تم فيها استبدال الاذرة الصفراء بمخلفات قشر البرتقال بنسبة 15% ، و20% ، و25% على التوالي. استمرت التجربة لمدة 35 يومًا. وكانت أهم النتائج كما يلي:

1. أظهرت الكتاكيت في كل من المجموعتين الضابطة و 15% مخلفات قشر برتقال أوزانًا نهائية حية أعلى وكفاءة تحويل غذائي (FCR) أفضل مقارنةً بمجموعتي 20% و20% مخلفات قشر برتقال.
2. لم يظهر أي من المعاملات تأثيرًا معنويًا على صفات الذبيحة.
3. حسّنت جميع المعاملات الغذائية من معامل هضم مستخلص الإيثر مقارنة بالمجموعة الضابطة.
4. تحسنت مستويات الكوليسترول الكلي في الدم في مجموعة 20% مخلفات قشر برتقال دون اختلافات معنوية مقارنةً بـ 15% مخلفات قشر برتقال و25% مخلفات قشر برتقال ، في حين سجلت المجموعة الضابطة أعلى مستوى.
5. سجلت جميع المجموعات التجريبية تحسنًا تدريجيًا في الكفاءة الاقتصادية مقارنة بالمجموعة الضابطة.

ويمكن الاستنتاج أن مخلفات قشر البرتقال قد تمثل بديلًا جيدًا للاذرة الصفراء، ويمكن أن تصل نسبة الاستبدال إلى 15% دون أن تؤثر سلبًا على الأداء الإنتاجي لدجاج التسمين.