THE EFFECT OF ADDING FERMENTED OLIVE CAKE WITH AND WITHOUT HERBAL AROMATIC PLANTS TO BROILERS CHICKEN DIET

H.A.F. Rahmy[1,2], Salma, N. El-Deen[2], Fatma, M. Abosamra[2], and A.M. Khaled[2]

[1]*Animal Production Research Department, Faculty of Agriculture, Cairo University, 12613, Giza, Egypt.*

[2]*Faculty of Organic Agriculture, Heliopolis University for Sustainable Development, 11785, Cairo, Egypt.*

(Received 2/12/2023, accepted 22/12/2023)

SUMMARY

The increased demand for animal products worldwide has led to a rise in the need for feed components. Nonetheless, there was always a need for feed ingredients due to the decrease in farmed land and natural resources. Therefore, researchers are particularly interested in studies on sustainable alternative feed additives. By-products of the olive industry, which could be substituted for other substances in animal and poultry feed, are among the main pollutants that the industry releases into the environment. The by-products of producing olive oil, especially olive cake, are not commonly utilized as feed ingredients for chickens. Even if they are low in nutrients, they could be used after the fermentation process that produce higher-quality nutrients.A total number of 5490 one-day-old unisex Saso chicks, were housed in a deep litter floor under a closed system house, including 3 different treatments with 5 pens (replicates) of 366 chicks in each. Three different feed combinations, were fed. The first group without olive cake representing the control, second group with 10% olive cake (OC) without herbal mixture, and third group with 10% olive cake and 4% herbal mixture. Live body weight (LBW), body weight gain (BWG), and feed conversion ratio (FCR) were all significantly impacted by the olive cake supplement. When OC was added to the diet, triglycerides and cholesterol of blood were considerably reduced in comparison to the control group. Conversely, OC supplementation raised the levels of lipid metabolites ($P > 0.05$) except for LDL. In conclusion, adding fermented olive cake to the feed won't have a detrimental impact on the birds' ability to grow. This study shows that using leftover olive cake in poultry feed affects growth.

Keywords: - *Saso, Olive cake, herbs, growth, feed utilization, blood*

INTRODUCTION

Poultry is one of the most common livestock species in animal husbandry, with chickens being one of the most popularly consumed (Agyare *et al.,* 2018). Globally, the chicken industry produces more than 9 trillion kilograms of chicken meat annually (Agyare *et al.,* 2018). Current and future projections show that the poultry industry continuously expanding in meat production (OECD/FAO, 2020) with the need to meet the protein demand of the ever-growing human population. To meet this increasing demand, the livestock feed supply is estimated to increase from 6.0 to 7.3 billion tonnes of DM (Kim *et al.,* 2019).

The cost of feeding makes up roughly 70% of the entire cost of producing chickens. Feed supplies are few in developing nations, and the issue grew more complex with the usage of grains and oilseeds for the manufacture of ethanol and biodiesel, respectively. To reduce the overall cost of chicken production, novel, unconventional, low-cost feedstuffs must be found (El-Ghamry & Fadel 2004; Molina-Alcaide & Yanez-Ruiz 2008; Al-Harthi *et al.,* 2011).

Agricultural and food-industry residues constitute a major proportion (almost 30%) of worldwide agricultural production. These wastes mainly comprise lignocellulosic materials, fruit and vegetable wastes, sugar-industry wastes as well as animal and fisheries refuse and by-products. Olive Cake (OC) is the solid residue obtained after olive oil extraction (Sensöz *et al.,* 2006). The utilization of OC as an animal feed is undoubtedly a good way of recycling this by-product. However, the biochemical composition of olive cakes was studied. OC contains a high number of insoluble fibers such as lignin, cellulose, and hemicellulose that renders it unpalatable and poorly digestible. Due to their high fiber content and low digestion, the use of crop wastes and by-products as replacements for cereal and soybean meals proved unsuccessful in the past. To help with fiber digestion (carbohydrases) or solubilize phytic phosphorus (phytase), exogenous enzymes can be introduced to broiler diets that contain these by-products, hence lessening the detrimental impact on broiler performance (Choct, 2006). Making animal feed out of the leftovers from the olive oil industry is one method to profit from it. Research has demonstrated that adding up to 150 g/kg of by-products, like cake and olive pomace, to grill diet does not negatively impact the performance of broilers (El Hachemi *et al.*, 2007; Sayehban *et al.*, 2016).

This study focuses on the possible bioconversion of The OC *Via* solid-state fermentation through microbial fermentation of the olive cake. As known, fermentation is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. In this research, OC is used as an organic substrate for microbial fermentation using solid-state fermentation (SSF), there are many challenges in the bioconversion of the OC.

The current study's goal is to find out what happens when starting feed for the Saso breed including fermented olive cake (FOC) besides, examining the impact of introducing a mixture of herbal and aromatic plants on growth performance, and blood parameters.

MATERIALS AND METHODS

Animal housing and handling procedures were approved by the Institutional Animal Care and Use Committee (CU-IACUC), Cairo University, Egypt, with approval number CU-II-F-43-22, in November 2022.

Diet, design, and birds:

The experiment aimed to study the utilization of fermented olive cake (FOC) as a non-traditional feedstuff in broilers. A total number of 5490 one-day-old unisex Saso chicks, were housed in a deep litter floor under a closed system house in Sekem Belbis, Sharkia governorate, Egypt. The experiment include three different treatments as presented in Table (1) with 5 replicates of 366 chicks in each.

Table (1): Experimental design of the growing experiment.

Group	Dietary treatment
Control	Without additives
(Treatment 1)	10 % of FOC without herbal mixture.
(Treatment 2)	10 % of FOC with 4% herbal mixture.

Diets were created based on the crude protein CP and ME results from the chemical and biological analysis of soybean and corn. Diets were designed to meet the nutrient requirements of Saso chicks using the 2014 Saso Broiler Nutrition Specifications during the starting (1-38 d) period (Table 2).

Herbal and aromatic plants:

The herbal and aromatic plants were obtained from SEKEM Company (Agricultural Seeds, Herbs and Plants Mixed Spices, Belbis, Sharkia governorate, Egypt). Three species of aromatic herbs were used in this study including Lemongrass, Chamomile, and Ment, they were mixed and added at 4% level to treatment 2 as feed additives.

Solid-state fermentation:

The goal of this study was to bio-transform and valorize the by-product of the Egyptian olive industry, olive cake, using the solid-state fermentation process to provide chicken feed with additional value. The difficulty in this situation is getting the complex fibers in the olive cake—lignin, cellulose, and hemicellulose—to become more digestible for birds.

Feed and water were available to all chicks for the duration of the 39-day trial. For the first week, the temperature was adjusted to a maximum of 30°C and a minimum of 2°C per week. After that, the temperature was kept at 24°C. Relative humidity was around 60% to 70% throughout the first week of life; during the second week and until the end of the experiment, it had dropped to 50% to 60%. The chicks were exposed to 23 hours of light and 1 hour of darkness during the first week's daylight. Every day between the second week and the experiment's end, birds were exposed to 20 hours of daylight and 4 hours of darkness. In neither of the two tests are there any appreciable variations in the initial body weights of the chicks (P>0.05). The average starting body weight of each chick was 45.00 +/- 1.00 g.

Table (2): Physical and chemical composition (%) of the experimental diets.

Item	Experimental Diet		
	Control	Treatment 1	Treatment 2
Yellow corn	50.35	41.70	41.70
Soybean meal (44 %)	42.00	41.00	41.00
Soybean oil	3.65	3.45	3.45
Olive cake	0.00	10.00	10.00
Herbal mixture	0.00	0.00	4.00
Calcium carbonate	1.30	1.30	1.30
Di-calcium phosphate	1.60	1.50	1.50
Common salt	0.30	0.30	0.30
Premix1	0.30	0.30	0.30
DL- Methionine	0.25	0.20	0.20
L-Lysine HCl	0.15	0.15	0.15
Toxenil	0.10	0.10	0.10
Chemical composition			
GE, Kcal/Kg	3204.83	3202.33	3204.436
CP, %	22.508	22.276	22.276
EE, %	6.138	6.0326	5.376
CF, %	2.411	2.3988	2.3689
Ca, %	1.202	1.198	1.1378
Available phosphorus, %	0.464	0.458	0.4307
Lysine, %	1.293	1.0949	1.0119
Methionine, %	0.651	0.5487	0.5352

Premix: Each 2.5kg contains vit. A (10, 000000 IU), vit. D3 (2, 000000 IU), vit. E (10 g), Vit. k3 (1000 mg), Vit. B1 (1000 mg), Vit. B2 (5g), Vit. B6 (1.5 g), pantothenic acid (10 g), Vit. B12 (10 mg), niacin (30 g), folic acid (1000 mg), biotin (50 g), Fe (30 g), Mn (60 g), Cu (4 g), I (300 mg), Co (100 mg), Se (100 mg) and Zn (50 g) Herbal mixture include Lemongrass, Chamomile, and Mint.

Measurements and methods of interpreting results:

According to North (1984), chick's performance response variables were established; weekly individual live weight (LBW) and body weight gain (BWG) measurements were made. For each replicate, feed conversion ratio (FCR) (g feed/g live BWG), mortality rate (MR%), and weekly feed intake (FI) (g/d/bird) were measured.

The weight of each chick was measured to the closest gram. On the first day of life and subsequently every week until the experiment's conclusion, each subject's body weight was noted. Body weight gain was estimated by deducting the final body weight at the same period from the average initial body weight during the relevant period.

The feed intake (FI) of each replicate was recorded weekly until the end of the experiment as follows: -

Average feed intake/chick = feed intake in grams per week divided by the number of chicks during the same week.

Feed conversion ratio (FCR) was calculated weekly for each group, including the weight gain of the dead birds as follows: -

- FCR = feed intake in grams divided by body weight gain in grams.
- European Production efficiency index (EPEI)= LBW(kg) X %survival rate) X 100 / Feed conversation X duration of experiment.

Every day during the experiment, the mortality rate (MR%) was noted and calculated for each replicate at the end of each experimental period. Additionally, a cumulative mortality calculation was made.

Using commercial diagnostic kits, the following blood plasma lipid profiles were measured: total cholesterol (Watson 1960), low-density lipoprotein (LDL) (Wieland & Seidel 1983), high-density lipoprotein (HDL) (Lopez-Virella *et al.,* 1977), and triglycerides (Fossati & Prencipe 1982).

Statistical analysis:

SAS software's general linear model was used to do a one-way analysis of variance in the data gathered from this experiment (SAS, 2010). The olive cake inclusion level with and without an herbal mixture was the key determinant. When there were substantial discrepancies, Duncan's New Multiple Range test (Duncan, 1955) was used to compare the means. The analysis's fixed effects model was as follows:

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

Where:

Y_{ij}: the observation of the J^{th} chick in the i^{th} treatment.

μ: the overall mean.

Ti: effect of the i^{th} treatment (i = 1, 2, 3,).

e^{ij}: the experimental random error effect.

The significance level was set at (α = 0.05).

RESULTS AND DISCUSSION

Productive performance:

The data for the broiler chickens' growth, survival rate, feed intake, FCR, and EPEI between 1-38 days of age are presented in Tables 3 and 4. There were no discernible changes in the chicks' initial body weights among treatments supported their random distribution. It was noted that the FOC level added to the broiler feed had no appreciable impact on the BWG between 1-38 days of age, feed intake, FCR, or EPEI.

The results indicated the presence of differences in body weight and body weight gain among experimental groups. Body weight and body weight gain of the group that fed a 10% OC diet with an herbal mixture were significantly higher at 38d of age compared to the other experimental groups and the control. However, both the control and treatment 1 (OC without herbal mixture) experimental groups were nearly similar in survival rate without significant differences.

Table (3): Effect of experimental diet on live body weight, body weight gain, and survival rate of broiler chickens during the period from 1 to 38 d of age.

	Experimental diet				
Item	**Control**	**Treatment 1**	**Treatment 2**	**SEM**	**P-Value**
Initial BW, g	42	45	48	1.87	0.956
Final BW 38 d of age, g	1044	1087	1154	21.24	0.237
BWG 1 to 38 d of age, g	1002^{C}	1042^{b}	1106^{a}	17.46	0.005
Survival rate 1 to 38 d of age, %	60b	65b	80a	1.49	0.009

a-c Means with different superscripts within each row are significantly different (P<.0001).

The findings show that OC had no detrimental effects on growth, feed intake, or FCR. This result could be explained by the use of isocaloric and isonitrogenous diets. These findings are in line with earlier research (Abo-Omar 2000; Rabayaa 2000; Abo-Omar 2005), which demonstrated that chickens may be fed OC up to 10% without suffering negative effects on growth, feed intake, or FCR. Additionally, it was demonstrated by El Hachemi *et al.* (2007) and Rupic' *et al.* (1992) that OC may be added to grill chicken feed up to 15% without harming feed intake or feed utilization. However, according to Al-Shanti and Abo-Omar (2003), broiler diets containing OC at 10% considerably increased FCR. Moreover, the incorporation of OC in broiler feeds did not adversely affect the availability of other nutrients, resulting in identical performances being attained. These findings are in line with those published in the literature, which suggests that the impact of FOC depends on the nutrient composition of the diet and the availability of an appropriate substrate (Stavric and Kornegay 1995, Onifade, 1998).

In comparison to the control group (OC-free diet), the results showed that OC at 10%, boosted the survival rate. These findings agree with those made public by Chumpawadee *et al.* (2008), Hassan *et al.* (2012), Karaoglu and Durdag (2005).

Table 4 displays the impact of OC addition to broiler diets on feed intake (FI), feed conversion ratio (FCR) and EPEI. The control group had the lowest feed consumption, while those fed 10% FOC consumed more feed without significant differences (P=0.156). Furthermore, no variations were seen in feed conversion ratios between the groups and the control group. Similarly, when looking at the European production efficiency index of grill chickens at 38 days of age, there were no changes between the groups (P = 0.245). The findings showed that broilers fed OC at a rate of 10% and supplemented with an herbal mixture at 38 days of age had the best European production index. From the perspective of the productivity index, broiler diets supplemented with up to 15% OC may be advantageous (Al-Harthi, 2017).

Table (4): Effects of experimental diets on feed intake, feed conversion ratio, and European Production Efficiency Index of broiler chickens from 1 to 38 d of age.

Item	Experimental diet			SEM	P-Value
	Control	Treatment 1	Treatment 2		
Feed intake (FI), 1 to 38 d of age, g	1513	1600	1530	35.02	0.136
Feed Conversion ratio (FCR), 1 to 38 d of age, g	1.41	1.44	1.41	0.028	0.203
European Production Efficiency Index	267.6	277.4	281.1	18.33	0.245

Blood biochemical parameters:

Table 5 lists the effects on liver, kidney, functions as well as blood biochemical markers after adding 10% fermented olive cake with or without herbal mixture. The outcomes demonstrate how OC affects the total protein in plasma. OC had no discernible impact on plasma total protein. According to Nakagi *et al.* (2013), these results highlight the liver's capacity to synthesize these proteins, which also demonstrates the effectiveness of the kidney, immune system, and metabolic processes. These findings are consistent with other research (Al-Shanti and Abo-Omar, 2003; Hajati, 2010) which found no detrimental effects of OC inclusion or enzyme addition on most of the blood's biochemical contents in chickens (Al-Shanti and Abo-Omar, 2003; Hajati, 2010; Sateri *et al.*, 2017).

The impact of OC addition on blood lipid components (triglycerides, cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and HDL/LDL ratio) is shown by the data in Table 5. Cholesterol and triglycerides were significantly impacted. Triglycerides were considerably greater in chickens on control diets than in those on OC-free diets, even when OC addition was not taken into account. At the OC level, no appreciable variations were found, nevertheless.

The HDL and HDL / LDL of chickens on the control diet (no OC and no enzyme supplementation) were lower than those of groups on a similar diet that included 10% OC.

Table (5): Effect of experimental diets on blood biochemical parameters.

Item	Experimental diet			SEM	P-Value
	Control	Treatment 1	Treatment 2		
Total Protein, g/dl	3.26	3.30	2.90	0.15	0.1670
Triglycerides, mg/dl	162.66 a	124.00 b	126.00b	5.00	<0.0001
Total Cholesterol, mg/dl	150.33 a	128.00 b	125.00 b	6.03	0.0003
HDL, mg/dl	83.33 b	97.00 a	96.00 a	2.403	0.0531
LDL, mg/dl	20.00	19.00	18.66	2.09	0.8960
HDL/LDL ratio	4.16 b	5.10 a	5.14 a	0.57	0.0481

a-c Means with different superscripts within each row are significantly different (P=Ns, P<.0001).

CONCLUSION

It is determined that fermented olive cake, when added to a herbal mixture and fed to broilers for up to 10% of their diet during the first 38 days of life, is a valuable and safe element. Additionally, some beneficial impacts were observed in those feds on OC, which led to better growth performance in terms of vitality.

ACKNOWLEDGMENTS

The research has received funding from the European Union's PRIMA Program for Research, Technological Development, and Demonstration under grant agreement n°2013 and the Basque Country government through the FEADER funds.

REFERENCES

Abo-Omar J. 2000. Effect of different levels of olive pulp on the digestibility of broiler chicks. Bethlehem Univ J. 12:34–40. Abo-Omar J. 2005. Carcass composition and visceral organ mass of broiler chicks fed different levels of olive pulp. J Islamic Univ Gaza. 13:75–84.

Abo-Omar J. 2005. Carcass composition and visceral organ mass of broiler chicks fed different levels of olive pulp. J Islamic Univ Gaza. 13:75–84.

Agyare C, Boamah VE, Zumbi CN and Osei FB. Antibiotic use in poultry production and its effects on bacterial resistance. Antimicrob. Resist. Glob. Threat 2018:1e20. https://doi.org/10.5772/intechopen.79371.

Al-Harthi MA, El-Deek AA and Attia YA. 2011. Impacts of dried whole eggs on productive performance, quality of fresh and stored eggs, reproductive organs, and lipid metabolism of laying hens. Br. Poult. Sci. 52:333–344.

Al-Harthi M. A. 2017. The effect of olive cake, with or without enzymes supplementation, on growth performance, carcass characteristics, lymphoid organs and lipid metabolism of broiler chickens. Br. Poult. Sci. 19:83-90.

Al-Shanti, H.A. and Abo-Omar J.M., 2003. Effect of olive cake on layers performance and egg quality. J. Al-Azhar University 1, 65-72.

Choct M. 2006. Enzymes for the feed industry: past, present and future. World's Poultry Science Journal;62(1):5-16.

Chowdhury K, Banu LA, Khan S and Latif A 2007. Studies on the fatty acid composition of edible oil. Bangladesh Journal of Scientific and Industrial Research;42(3):311-316.

Chumpawadee S, Chinrasri A, Somchan T, Ngamluan S, and Soychuta S. 2008. Effect of dietary inclusion of cassava yeast as probiotic source on growth performance, small intestine (Ileum) morphology and carcass characteristic in broilers. Int J Poult Sci. 7:246–250.

Duncan, D.B. (1955). The multiple ranges and multiple F-Tests. Biometrics, 11:1-42.

El-Ghamry AA, and Fadel M. 2004. The influence of dietary low protein and energy as supplemented with active yeast or fungi duck performance. Egypt Poult Sci J. 24:655–673.

El Hachemi, A., K. E. El, Mecherfi, K. Benzineb, D. Saidi, and O. Kheroua. 2007. Supplementation of olive mill wastes in broiler chicken feeding. Afr. J. Biotechnol. 6:1848–1853.

Fossati P, and Prencipe L. 1982. Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. Clin Chem. 28:2077–2080. Friedewald WT, Levy RI, Fredrickson DS. 1972. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem. 18:499–502.

Hajati, H., 2010. Effects of enzyme supplementation on performance, carcass characteristics, carcass composition, and some blood parameters of broiler chicken. Am. J. Anim. Vet. Sci. 5, 221-227.

Hassan AM, Manal MA, Dalia M, and Omnia E. 2012. Effect of dietary yeast supplementation on growth performance and colonization of salmonella enteritidis in Japanese quails. YYU Veteriner Fakultesi Dergisi. 23:45–50.

Karaoglu M, Durdag H. 2005. The influence of dietary probiotic (Saccharomyces cerevisiae) supplementation and different slaughter age on the performance, slaughter and carcass properties of broilers. Int J Poult Sci. 4:309–316.

Khan SA, Chaudhry HR, Mustafa YS, and Jameel T. 2013. The effect of phytase enzyme on the performance of broilers. Review Biologia Pak. 59:99–106.

Kim SW, Less JF, Wang L, Yan T, Kiron V, Kaushik SJ, and Lei XG. Meeting global feed protein demand: challenge, opportunity, and strategy. Annu. Rev. Anim. Biosci. 2019; 7:221e43.

Lee SA, Apajalahti J, Vienola K, Gonzalez-Ortiz G, Fontes CMGA, and Bedford MR. 2017. Age and dietary xylanase supplementation affect ileal sugar residues and short-chain fatty acid concentration in the ileum and caecum of broiler chickens. J of Anim Feed Sci Techn. 234:29–42.

Lopez-Virella MF, Stone P, Ellis S, and Colwell JA. 1977. Cholesterol determination in high-density lipoproteins separated by three different methods. Clin Chem. 23:882–884.

Martin CA, Visentainer JV, and Oliveira AN 2008. Fatty acid contents of Brazilian soybean oils with emphasis on trans fatty acids. Journal of The Brazilian Chemical Society;19(1):117-122.

Molina-Alcaide E, and Yanez-Ruiz DR. 2008. Potential use of olive by-products in ruminant feeding. A review. Anim Feed Sci Technol. 147:247–264.

Nakagi, V.S., C.M.C. Amaral, M.R. Stech, A.C. Frizzas De Lima, F.A. Harnich, A.C. Laurentis, J.M. and Pizauro, 2013. Acid and alkaline phosphatase activity in broiler chicks fed with different levels of phytase and non-phytate phosphorus. J. App. Anim. Res. 41, 1-5.

North, M.O. (1984). Broiler, roaster, and capon management. in: Commercial Chicken Production Manual. 3rd edition. By the AVI Publishing Company Inc. West Port Connecticut. 387 p.

OECD/FAO. “OECD-FAO agricultural outlook”,OECD agriculture statistics(database). 2020. https://doi.org/10.1787/e481f6bb-en.

Onifade AA. 1998. Proposing fortification of foods with yeast for optimal nutrition value and salubrious effects. Nutr Food Sci. 4:223–226.

Qiujuan S, Yuming G, Shoudong MA, Jianmin, Y, Shengying A, and Jianhui L. 2012. Dietary mineral sources altered lipid and antioxidant profiles in broiler breeders and post hatch growth of their offsprings. Biological Trace Element Research;145(3):318-324.

Rabayaa E. 2000. Utilization of olive pulp in broiler rations. MS Thesis. An-Najah National Univ. Nablus, Palestine.

Rupic´ V, Huskic´ L, Varnesic N, Bozac R, Stipic´ N, and Vesnik F. 1992. Olive cake in broiler fattening. Krmiva 34:175–184.

SAS (2010). SAS User’s Guide: Statistics. Version 9.1 SAS Inst. Inc., Cary, NC., USA.

Sateri, S., A. Seidavi, M. Bouyeh, P. Neumann, M. Kutzler, V. Laudadio, F. Loperfido, and V. Tufarelli, 2017. Effect of olive meal and supplemental enzymes on performance traits, blood biochemistry, humoral immunity response and caecal microbiota of broilers. S. Afr. J. of Anim. Sci. 47, 804-812.

Sayehban, P., A. Seidavi, M. Dadashbeiki, A. Ghorbani, W. A. G. Araújo, and L. F. T. Albino. 2016. Effects of different levels of two types of olive pulp with or without exogenous enzyme supplementation on broiler performance and economic parameters. Rev. Bras. Cienc. Avic. 18:489–500.

Sensöz E, Lemus-Mondaca R, Vega-Gálvez A, Zamorano M, QuispeFuentes I, Pasten A, Di Scala K 2006. Infuence of process temperature on drying kinetics, physicochemical properties and antioxidant capacity of the olive-waste cake. Food Chem 147:170–176.

Stavric S, and Kornegay ET. 1995. Microbial probiotic for pigs and poultry. In: John Wallace R, Andrew Chesson, editors. Biotechnology in animal feeds and animal feeding. Weinheim, Germany: VCH. p. 205–231.

Zyla K, Mika M, Duliński R, Swiatkiewicz S, Koreleski J, Pustkowiak H, and Piironen J. 2012. Effects of inositol, inositol-generating phytase B applied alone, and in combination with 6-phytase A to phosphorus-deficient diets on laying performance, eggshell quality, yolk cholesterol, and fatty acid deposition in laying hens. Poultry Science;91(8):1915- 27.

Watson D. 1960. A simple method for the determination of serum cholesterol. Clin Chim Acta. 5:637–643.

Wieland H, Seidel D. 1983. A simple specific method for precipitation of low-density lipoproteins. J Lipid Res. 24:904–909.

تأثير إضافة تفل الزيتون المتخمرة مع وبدون النباتات طبية عطرية إلى علائق الدجاج التسمين

[1,2]حسن عوني فؤاد رحمي، [2]سلمي محمد محمود نور الدين، [2]فاطمة محمد مصطفي، [2]عادل محمد خالد

[1]قسم الإنتاج الحيواني - كلية الزراعة- جامعة القاهرة

[2]كلية الزراعة الحيوية – جامعة هليوبوليس لتنمية المستدامة

أدى الطلب المتزايد على المنتجات الحيوانية في جميع أنحاء العالم إلى زيادة الحاجة إلى مكونات الأعلاف .ومع ذلك، كانت هناك دائمًا حاجة إلى مكونات الأعلاف بسبب انخفاض الأراضي الزراعية والموارد الطبيعية .ولذلك، يهتم الباحثون بشكل خاص بالدراسات المتعلقة بإضافات الأعلاف البديلة المستدامة .تعتبر المنتجات الثانوية لصناعة الزيتون، والتي يمكن استبدالها بمواد أخرى في أعلاف الحيوانات والدواجن، من بين الملوثات الرئيسية التي تطلقها الصناعة في البيئة .لا يتم استخدام المنتجات الثانوية لإنتاج زيت الزيتون، وخاصة تفل الزيتون، بشكل شائع كمكونات علفية للدجاج. وحتى لو كانت منخفضة في العناصر الغذائية، فيمكن استخدامها بعد عملية التخمير التي تنتج مواد مغذية ذات جودة أعلى. تم إيواء إجمالي 5490 من كتكوت الساسو للجنسين بعمر يوم واحد في أرضية فرشة عميقة تحت نظام مغلق، بما في ذلك 3 معاملات مختلفة مع 5 حظائر (مكررات) بواقع 366 كتكوت في كل منها. تم تغذية ثلاث مجموعات علفية مختلفة. المجموعة الأولى بدون تفل الزيتون تمثل الكنترول، المجموعة الثانية بنسبة 10% تفل زيتون (OC) بدون خليط أعشاب، والمجموعة الثالثة مع 10% تفل زيتون و4% خليط أعشاب. تأثر وزن الجسم الحي (LBW)، وزيادة وزن الجسم (BWG)، ونسبة تحويل العلف (FCR) بشكل كبير بمكمل كعكة الزيتون. عندما تمت إضافة OC إلى النظام الغذائي، انخفض مستوى الدهون الثلاثية والكوليسترول في الدم بشكل كبير مقارنة بالمجموعة الكنترول. على العكس من ذلك، أدت مكملات OC إلى رفع مستويات مستقبلات الدهون ($P < 0.05$) باستثناء LDL. في الختام، فإن إضافة تفل الزيتون المتخمرة إلى العلف لن يكون لها تأثير ضار على قدرة الطيور على النمو. أظهرت هذه الدراسة أن استخدام تفل الزيتون في أعلاف الدواجن له تأثير على النمو.