



Olive cake's (OC) effects on broiler chickens' hematological parameters and growth performance

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تأثير كُسب الزيتون على المعايير الدموية وأداء النمو لدى دجاج التسمين

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المخلص:

أُجريت هذه الدراسة خلال موسم 2024 في مزرعة خاصة بمدينة بني وليد، ليبيا، لدراسة تأثير كسب الزيتون على معدل النمو والمعايير الدموية لدجاج التسمين. تم شراء 240 كتكوتًا من دجاج التسمين (روس 308) بعمر يوم واحد من مفرخ محلي. عند وصولها، وُزنت الطيور ووزعت عشوائيًا على ست مجموعات تجريبية، بواقع ثلاث مكررات لكل مجموعة، تضم كل منها 12 طائرًا، وفقًا لتصميم عشوائي كامل. شملت المعاملات الغذائية العلف الأساسي كمجموعة ضابطة، مع إضافة كسب الزيتون بنسب (3، 6، 9، 12، 15%) إلى العلف الأساسي. تم اختيار كميات المكملات الغذائية كعلاجات بناءً على متوسط محتوى المكونات الفعالة في كسب الزيتون. أظهرت النتائج أن زيادة نسبة كسب الزيتون حتى 15% سجلت أعلى وزن للجسم، ومعدل زيادة الوزن، واستهلاك العلف، مقارنةً بالعلاج الضابط الذي سجل أقل القيم في هذه الجوانب. في المقابل، سجلت نسبة كسب الزيتون 3% أعلى نسبة تحويل العلف إلى زيادة الوزن. كما سجلت زيادة نسبة كسب الزيتون حتى 15% أعلى قيم في تعداد خلايا الدم الحمراء والبيضاء، والهيموجلوبين، والليمفاويات، وحجم الخلايا المكذبة، ومتوسط حجم الخلايا، مقارنةً بالعلاج الضابط الذي سجل أقل القيم في هذه الجوانب. من ناحية أخرى، سجلت زيادة مستوى كعكة الزيتون حتى 15% قيمًا أقل للكوليسترول الكلي، والدهون الثلاثية، والكوليسترول الضار (LDL)، والألبومين (ALP)، وناقلة أمين الألانين (ALT)، وناقلة أمين الأسبارتات (AST)، بينما سجلت قيمًا أعلى للكوليسترول النافع (HDL)، مقارنةً بمعاملة الكنترول التي سجلت قيمًا أعلى للكوليسترول الكلي (TC)، والدهون الثلاثية (TG)، والكوليسترول الضار (LDL).

والألبومين (ALP)، وناقلة أمين الألانين (ALT)، وناقلة أمين الأسبارتات (AST)، وسجلت قيمة أقل للكوليسترول النافع (HDL)، على التوالي. وخلاصة القول، يمكن تغذية دجاج التسمين بمادة OC بأمان بنسبة تصل إلى 15٪، مع تقليل التلوث البيئي الناجم عن تراكم OC بعد التوسع في زراعة الزيتون لاستخراج الزيت للاستهلاك البشري.

الكلمات الدالة: دجاج التسمين، كُسب الزيتون، أداء النمو، المعايير الدموية والكيميائية الحيوية.

Abstract

The impact of olive cake (OC) on the growth performance and hematological parameters of broiler chickens was investigated throughout the 2024 season on a private farm in Bani Walid, Libya. We bought 241-day-old broiler chicks (Ross 308) from a nearby hatchery. Based on a fully randomized design, the birds were weighed upon arrival and then randomly assigned to one of six treatments, each consisting of three replicates of 12 birds. The dietary treatments included adding (3, 6, 9, 12, 15%, and control) olive cake to the basal diet, which served as the control treatment. The average active ingredient content of olive cake (OC) was taken into consideration when selecting the dosages of dietary supplements as treatments. In comparison to the control treatment, which recorded lower values of body weight, weight gain, and feed intake, the obtained results indicated that increasing the level of olive cake (OC) up to 15% recorded higher body weight, weight gain, and feed intake, while OC at 3% recorded a higher feed:gain ratio. Additionally, RBC, WBC, Hb, LYM, PCV, and MCV levels were greater when the amount of olive cake was increased by up to 15% than when the control therapy was used. In contrast to the control treatment, which recorded higher values of total cholesterol (TC), triglyceride (TG), LDL, Albumin (ALP), Alanine transaminase (ALT), Aspartate transaminase (AST), and HDL, increasing the amount of olive cake up to 15% resulted in lower values of these parameters. In conclusion, up to 15% of OC can be safely given to broiler chickens while lowering the environmental contamination brought on by the buildup of OC following an increase in the production of olives for oil extraction for human use.

Keywords: Broiler chickens, olive cake, growth performance, hematological and biochemical parameters.

Introduction

One of the most prevalent livestock species in animal husbandry is poultry, of which chickens are among the most often consumed (Agyare *et al.*, 2018). Over 9 trillion kg of chicken meat are produced worldwide each year (Agyare *et al.*, 2018). Forecasts for the present and the future indicate that the poultry business will continue to increase in terms of meat output (OECD/FAO, 2020) in order to satisfy the growing human population's need for protein. The supply of animal feed is predicted to rise from 6.0 to 7.3 billion tons of DM in order to satisfy this rising demand (Kim *et al.*, 2019). The cost of broiler feed may now account for more than 70% of all production expenses (Saleh *et al.*, 2020). The scarcity of feedstuffs is one of the biggest challenges to increasing poultry production. As a result, experts in chicken nutrition were forced to search for less costly feed ingredients due to the increase in feed prices, and these substitutes must not negatively impact broiler growth performance (Ahiwe *et al.*, 2018). Other reports, however, state that pomace is used as calf feed and as a soil fertilizer (Ghasemi *et al.*, 2014). Olive cake meal has a high nutritional value (fats 13–15%, proteins 9–10%) and is rich in non-starch polysaccharides (NSP) like xyloglucan and xylan-xyloglucan complexes (Al-Harthi and Attia, 2015).

Due to their high organic content and phytotoxicity, the numerous byproducts and wastes produced during the manufacturing of olive oil are typically released into the environment in enormous amounts, posing a serious threat to the ecosystem (Nunes *et al.*, 2016). Olive oil production byproducts are not commonly used as feed components in chicken nutrition. They can be utilized as a source of energy and nutrients as well as bioactive substances in broiler chicken diet, despite their low nutritional value (Pečjak *et al.*, 2020).

Moreover, calcium, iron, potassium, magnesium, sodium, phosphorus, and vitamin E are present in olive cake meal (OCM) (Ozcan *et al.*, 2020). Olive cake meal contains certain compounds that may have antioxidant properties (Pappas *et al.*, 2019). The high quantities of unsaturated fatty acids (UFAs), fiber, and phytic acid in olive cake meal can promote malnutrition, decreased palatability, and excessive fatty acid pre-oxidation (Al-Harathi, 2016). There is a significant amount of residual oil (6.8%) in OCM that can be used as an additional energy source. Furthermore, the fatty acid profiles of broiler tissue are influenced by the fatty acids (linoleic, oleic, and linolenic) present in OCM (Saleh *et al.*, 2020).

With no detrimental impacts on meat and egg production, broiler chickens can receive 5–10% and layers up to 20% OC in mash diets (Al-Harathi, 2016; 2017). According to earlier research, using OC within these bounds had no negative effects on the carcass or the ratios of internal organs. However, OC at 20% in the mash diets of broilers raised between 28 and 49 days of age was found to have detrimental effects. Both body weight gain (17%) and feed intake (14%) significantly decreased as a result. The high fiber content (14%) in OC was the reason for the decrease in feed consumption (Al-Harathi and Attia, 2016).

One potential solution to the scarcity of animal feed resources is the recycling of OC as a feed resource in livestock feeding. But OC also contains soluble fibers (pectin, mucilage, and gum) and a significant amount of insoluble fibers (cellulose, hemicellulose, and lignin) (Lamma *et al.*, 2019). These fibers have an impact on how OC is used, especially for pigs and poultry, when mixed with compounds like phytic acid and tannins. The absence of endogenous digestive enzymes that specifically target them is the first cause of this. Second, by interacting with amino acids, fatty acids, and minerals, reducing the utilization of dietary components, and increasing digesta viscosity, which inhibits the action of endogenous enzymes (Fritsch *et al.*, 2017; Al-Harathi *et al.*, 2018a, b).

The three main by-products of olive oil extraction are olive cake (OC), olive pulp, and olive leaves; however, olive pulp with or without seeds is more common (Al-Harathi, 2016). Livestock are given olive cake, a byproduct of the extraction of olive oil (Aloraibi *et al.*, 2025). Nevertheless, the oil-extracting techniques do not allow us to remove all of the oil from the seeds. As a result, this by-product had a greater fat content and contained a few chemicals that might have antioxidant qualities (Pappas *et al.*, 2019). It is beneficial to recycle these waste products by incorporating olive cake (OC) into chicken diets (Sadeghi *et al.*, 2009).

In order to lower feed costs and lessen pollution issues, olive by-products can be incorporated into chicken diets as an economical nutritional feedstuff. According to Al Afif and Linke (2019), olive meal, olive cake, or olive pomace is byproducts of the processes used to extract olive oil. According to (Wedyan *et al.* 2017), 35 kg of olive pomace were produced as a byproduct for every 100 kg of olives.

Olive pulp, also known as olive pomace, is preferred because it is produced in large quantities, is inexpensive, and has a high percentage of monounsaturated fatty acids, which may have an impact on the composition of intramuscular fatty acids (Serafini and Tonetto, 2019). This oil is used in metabolic processes primarily for energy production (Al Harathi, 2017). Consuming essential fats is known to promote a number of health benefits, including improvements in the

blood's circulating lipid profile, modulation of insulin sensitivity, and glucose homeostasis, all of which lower the risk of cardiovascular issues (Abdullah *et al.*, 2017; Aloraibi *et al.*, 2025).

The lack of purification of olive industry byproducts may be the cause of the detrimental impacts on growth performance at greater levels of addition. According to recent research, animal health and performance may be enhanced by purifying different bioactive chemicals present in olive by-products and supplementing them with refined olive oil (Liehr *et al.*, 2017; Leskovec *et al.*, 2018). Additionally, antibiotics, antimicrobials, antioxidants, and anti-inflammatory compounds found in olive by-products may be beneficial for broiler health and growth performance (Lillehoj *et al.*, 2018). Because of its excellent nutritional value, olive cake can be added to poultry diets as a source of fat and protein (Salih and Mirza, 2023; alhadad 2025). A sustainable, high-protein byproduct of the extraction of olive oil, olive cake improves the growth and profitability of poultry. In contemporary poultry nutrition programs, it is both economical and beneficial (Rahmy *et al.*, 2025).

Thus, the purpose of this study is to determine how olive cake (OC) affects broiler chicken growth performance and hematological parameters.

2.MATERIALS AND METHODS:

This study examined the impact of olive cake (OC) on broiler chicken development performance and hematological parameters over the 2024 season on a private farm in Bani Walid, Libya. We bought 241-day-old broiler chicks (Ross 308) from a nearby hatchery. Based on a fully randomized design, the birds were weighed upon arrival and then randomly assigned to one of five treatments, each consisting of four repetitions of twelve birds. The dietary treatments included adding 3, 6, 9, 12, and 15% olive cake (OC) to the basal diet, which served as the control therapy. The average active ingredient content of olive cake (OC) was taken into consideration when selecting the dosages of dietary supplements as treatments.

2-1.Data recorded

- **Growth performance**

Broiler weight increase and feed intake were measured. Weight gain and food consumption were tracked throughout time, and the feed conversion ratio (feed intake/weight gain) was computed. The weight of each bird was recorded to the closest gram. On the first day of the experiment and subsequently once a week until the trial was over, each subject's body weight was recorded. By deducting the final body weight concurrently from the average initial body weight during the pertinent time period, body weight increase was computed. Up until the experiment's conclusion, each replicate's feed intake (FI) was tracked on a weekly basis. The average feed intake/chick was calculated by dividing the weekly grams by the total number of chicks. Each group's feed conversion ratio (FCR), which is derived by dividing feed intake in grams by body weight growth in grams, was determined on a weekly basis, taking into account the weight gain of the dead birds. Eight birds, one for each treatment duplicate, were randomly chosen and slaughtered at the end of the experiment after an overnight fast. The weight of the carcass and internal organs was calculated in relation to the weight of the living body.

- **Blood samples collection:**

Six chicks from each group were randomly selected at 8:00–9:00 am when they were 42 days old. Approximately 3 ml of blood was drawn from the wing vein and placed in vacutainer tubes with K3-EDTA (1 mg/ml). Two portions of non-coagulated blood were separated. Shortly after collection, the first portion was utilized to estimate the blood image, while the second portion was spun for 15 minutes at 4000 rpm to separate the clear plasma, which was then kept in a deep freezer at -20°C until biochemical analysis. Commercial kits were used to determine all blood biochemical variables calorimetrically.

2-2.Hematological parameters

The total number of RBCs and WBCs was measured using a Neubauer Hemocytometer (Abuoghaba, 2018). Wakenell's (2010) DLC standard techniques were used to count lymphocytes and monocytes. Using a compound microscope, PLT counting was carried out during DLC (Mayengbam *et al.*, 2020). The concentration of hemoglobin was measured using Sahli's hemoglobinometer (Patil *et al.*, 2013). The Microhematocrit Capillary Tube was used to determine Ht, and it was centrifuged for five minutes at 10,000 RPM (López *et al.*, 2018; Duah *et al.*, 2020).

The red blood cell count (RBCs 10^6 / ml³) was calculated in accordance with Feldman *et al.* (2000). According to Drew *et al.* (2004), measurements of hemoglobin (Hb) concentration (g/dl) and the percentage of packed cells volume (PCV %) were made. The average weight of hemoglobin in RBC (MCH, pg) = [hemoglobin concentration (g/dL)/ RBC] × 10 and the average volume (size) of RBC (MCV, μ m³) = [hematocrit (%) / RBC] × 10 were computed. A little drop of blood was used to create a thin blood film. Giemsa stain was applied when the blood film had completely dried.

- **Blood biochemical parameters**

For every treatment, blood samples were taken from the birds during their killing. The materials were put in sterile 2 mL containers and allowed to coagulate for four hours. After centrifuging the serum for 10 minutes at 2000 rpm, it was kept at -20 EC until analysis. Using particular kits, plasma total cholesterol (mg/dl) was measured on an individual basis in accordance with Bogin and Keller's (1987) recommendations. The colorimetric method of Bauer (1982) was used to quantify the concentration of alkaline phosphatase (ALP, U/L). Commercial diagnostic kits were used to measure triglycerides by Fossati and Prencipe10, low-density lipoprotein (LDL) by Wieland and Seidel (1983), and high-density lipoprotein (HDL) by Lopez-Virella *et al.* (1977).

2-3.Statistical analysis:

The General Linear Model techniques of the SAS Institute (1997) were used to expose the data to analysis of variance procedures suitable for a fully randomized design.

3.RESULTS AND DISCUSSION

A) Growth performance

Table (1) and Fig. (1) present the findings of the effects on growth performance of five additional levels of olive cake (OC) (3, 6, 9, 12, 15%, and control). In contrast to the control treatment, which recorded lower values of body weight, weight gain, and feed intake (2350.73, 2309.97, 3891.64 g), the results indicated that increasing the level of olive cake up to 15% recorded higher values of body weight, weight gain, and feed intake (2607.48, 2567.84, 4150.63 g), followed by OC at 12% and control treatment (1.68).

This could be because olive cake meal has anti-inflammatory properties and stimulates the growth of digestive system cells, which in turn increases the quantity of beneficial microbes in the intestines (Herrero-Encinas *et al.*, 2020). Additionally, OCM's polyphenol, triterpenic acid, long-chain fatty acid, unsaturated hydro-carbonate, tocopherols, sterols, anti-oxide, and inflammatory eroxidase may be to blame (King *et al.*, 2014; Gerasopoulos *et al.*, 2015). According to Lillehoj *et al.* (2018), olive by-products include antibacterial, antimicrobial, antioxidant, and anti-inflammatory properties that may be beneficial for broiler health and growth performance. The results showed that the olive cake had no detrimental effects on the FCR, feed consumption, or growth performance of broilers. This outcome might have been influenced by the use of isocaloric and isotrogenous diets. These results are consistent with earlier studies (Rabayaa, 2000), which showed that broiler chickens may be fed up to 10% OC without

experiencing adverse effects on growth, feed intake, or FCR. Olive cake can be fed to broilers and hens up to 15% without affecting feed intake, the researchers found (**El-Hachemi et al., 2007**). However, the study's findings showed that adding olive cake to broiler meals significantly increased FCR. Nonetheless, the high fiber content of olive cake allows helpful microorganisms to enhance digestion rates (**Ahmed et al., 2020**).

According to some writers (**Sateri et al., 2017**), broiler chickens' diets should contain up to 10% OCM. It has been suggested that broiler chickens be fed OCM at a rate of 5–10%. When compared to the control group, broiler chicks fed diets containing 5 and 10% OCM in place of maize at 35 days of age shown an improvement in body weight (BW) (**Saleh and Alzawqari, 2021**). (**Sayehban et al., 2016**) also reported using leftover olive pulp in broiler meals to increase carcass and other organ weights.

A recent study by **Papadomichelakis et al. (2019)** found that broiler chickens fed 50–80 g kg⁻¹ of dried olive pulp showed increased performance (BW and feed conversion ratio) and meat quality (better color and lower oxidative stability). In fact, **Herrero-Encinas et al. (2020)** found that while there was no change in the average daily feed intake across treatments, broilers fed an olive pomace supplement (750 ppm) exhibited higher average daily growth and FCR than the control group.

However, **Branciari et al. (2017)** found that broilers fed diets with varying amounts of olive cake (8.3 and 16.5%) had a lower FCR. Supplementation with varying quantities of olive leaves showed the similar pattern, with a larger concentration linearly lowering the FCR (**Varmaghany et al., 2013**).

Table (1): Impact of feeding varying amounts of olive cake (OC) on broiler growth performance in 2024 in terms of weight gain, feed intake, and feed:gain ratio.

| Treatments | Body weight (g) | Weight gain (g) | Feed intake (g) | Feed: gain ratio (FCR) |
|-----------------------------|-----------------|-----------------|-----------------|------------------------|
| Control | 2350.73 | 2309.97 | 3891.64 | 1.68 |
| OC 3 % | 2421.36 | 2381.90 | 4020.65 | 1.69 |
| OC 6 % | 2538.06 | 2498.57 | 4055.57 | 1.62 |
| OC 9 % | 2541.09 | 2501.23 | 4129.29 | 1.65 |
| OC 12 % | 2584.85 | 2544.42 | 4131.23 | 1.62 |
| OC 15 % | 2607.48 | 2567.84 | 4150.63 | 1.62 |
| LSD_(0.05) | 0.06 | 0.06 | 0.00 | 0.02 |

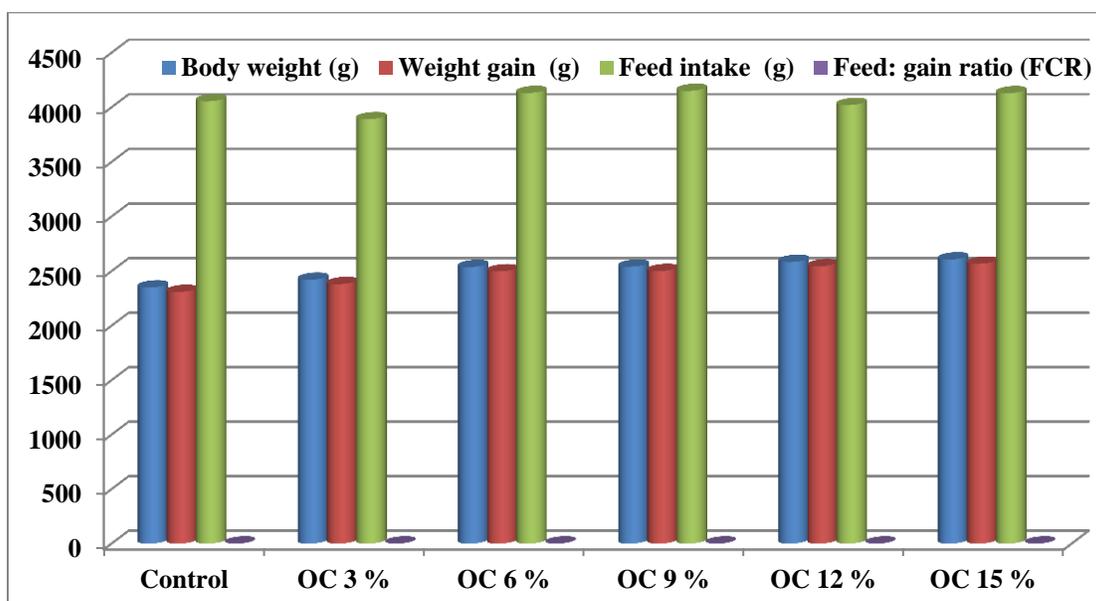


Fig. (1): Impact of feeding varying amounts of olive cake (OC) on broiler growth performance in 2024 in terms of weight gain, feed intake, and feed:gain ratio.

B) Haematological constituents of blood

The results on the effects of five supplementary levels of Olive cake (OC) (3, 6, 9, 12, 15 % and control), on blood haematological values are shown in **Table (2)** and **Fig. (2)**. However, results showed that increasing level of Olive cake up to 15% recorded the higher values of RBC (91.85 mil/ mm³) and WBC (35.13 thous/ mm³), Hb (143.72 g/dL), LYM (76.35%), PCV (45.49 %), MCV (231.29 μm³), followed by 12 % of Olive cake recorded RBC (88.70 mil/ mm³) and WBC (34.94 thous/ mm³), Hb (123.32 g/dL), LYM (72.50 %), PCV (42.84 %), MCV (226.68 μm³), as compared to control treatment which recorded the lower value of RBC (70.52 mil/ mm³) and WBC (21.49 thous/ mm³), Hb (83.70 g/dL), LYM (62.55%), PCV (23.10 %), MCV (146.48 μm³), respectively.

The results of this study are consistent with those of **Al-Harathi and Attia (2016)**, who found no adverse changes in the characteristics of red blood cells in broilers fed 10 or 20% OC in their mash diets between 28 and 49 days of age. Only those fed 20% OC, however, displayed some variation in MCV, MCH, and RBC count.

Table (2): Impact of feeding varying amounts of olive cake (OC) on blood values' haematological components in 2024.

| Treatments | RBC (mil/ mm ³) | WBC (thous/ mm ³) | Hb (g/dL) | LYM (%) | PCV (%) | MCV (μm ³) |
|-----------------------------|-----------------------------|-------------------------------|--------------|-------------|-------------|------------------------|
| Control | 70.52 | 21.49 | 83.70 | 62.55 | 23.10 | 146.48 |
| OC 3 % | 75.07 | 22.10 | 94.68 | 65.67 | 34.81 | 195.46 |
| OC 6 % | 80.25 | 27.30 | 100.10 | 68.55 | 38.66 | 204.58 |
| OC 9 % | 84.55 | 29.25 | 112.67 | 71.15 | 40.70 | 215.35 |
| OC 12 % | 88.70 | 34.94 | 123.32 | 72.50 | 42.84 | 226.68 |
| OC 15 % | 91.85 | 35.13 | 143.72 | 76.35 | 45.49 | 231.29 |
| LSD_(0.05) | 0.001 | 0.02 | 0.001 | 0.01 | 0.02 | 0.04 |

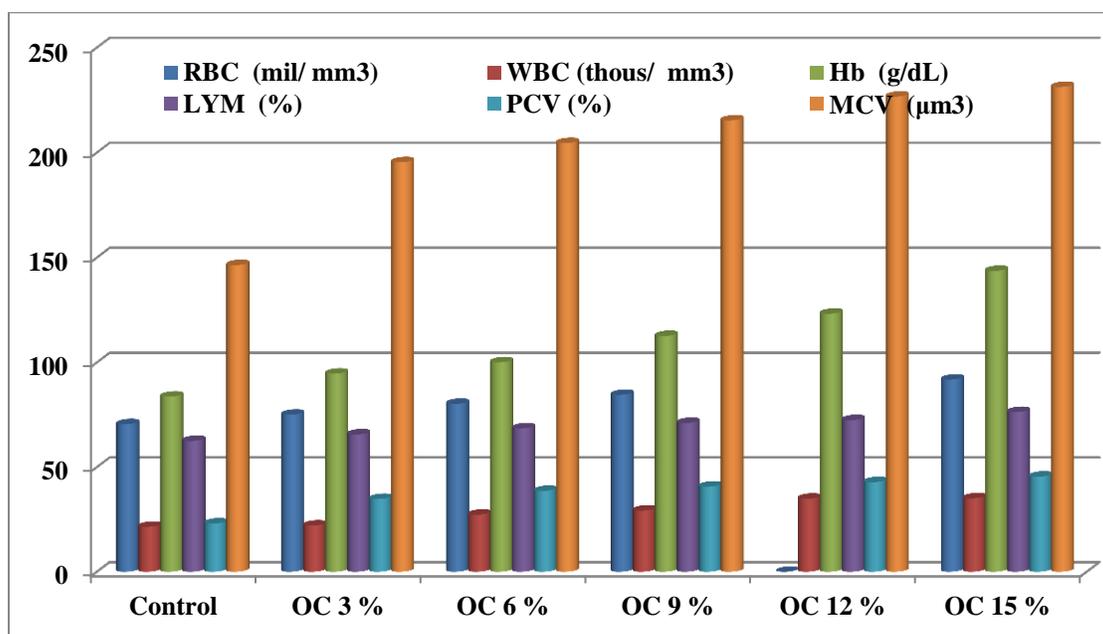


Fig. (2): Impact of feeding varying amounts of olive cake (OC) on blood values' haematological components in 2024.

- **Biochemical constituents of blood**

The results on the effects of five supplementary levels of Olive cake (OC) (3, 6, 9, 12, 15 % and control), on biochemical constituents of blood values are shown in **Table (3) and Fig. (3)**. However, results showed that increasing level of Olive cake up to 15% recorded the lower values of total cholesterol (TC) (96.22 mg/dL), triglyceride (TG) (49.71 mg/dL), LDL (31.56 mg/dL), Albumin (ALP) (348.88 U/L), Alanine transaminase (ALT) (18.24 U/L), Aspartate transaminase (AST) (256.70 U/L), while recorded the higher values of HDL (63.70 g/dL), as compared to control treatment which recorded the higher values of total cholesterol (TC) (124.53 mg/dL), triglyceride (TG) (74.79 mg/dL), LDL (45.20 mg/dL), Albumin (ALP) (377.98 U/L), Alanine transaminase (ALT) (27.91 U/L), Aspartate transaminase (AST) (293.81 U/L) and recorded the lower value of HDL (54.74 g/dL), respectively.

The findings supported the study and showed that adding 10% OC to broiler diets has a beneficial impact since it raises plasma HDL levels and lowers blood cholesterol and triglyceride levels (**Biswas et al., 2018**). Additionally, the study found that probiotics (*Lactobacillus acidophilus* at 106 and 107 cfu/g) considerably lowered cholesterol when compared to the control group (**Kalavathy et al., 2003**).

Researchers found that probiotic supplements including *Lactobacillus* species dramatically reduced triglycerides, cholesterol, and LDL. in contrast to the group under control (**Kalavathy et al., 2003**). Additionally, it was discovered that broilers fed a diet containing the probiotic *Aspergillus oryzae* had lower blood cholesterol (**Kim et al., 2003**). The interaction between OC and probiotics was found to significantly alter total lipids, TG, cholesterol, LDL, HDL/LDL ratio, and VLDL, according to the earlier study (**Al-Harathi and Attia, 2016**). It is uncommon to do research on the biochemical blood parameters of broilers utilizing OC. However, more research is required to determine how OC's unsaturated fatty acids can lower total lipids and raise the LDL ratio (**Dal Bosco et al., 2012**). These findings demonstrate that the use of OC up to 15% in the pelleted diets of broilers aged 7 to 28 days did not adversely impact health status indices. Total protein and albumin plasma levels were unaffected by the OCM diet.

Similarly, (Al-Harthi, 2017) found that the levels of albumin and total serum protein in birds were unaffected by OCM administration. OCM was found to significantly lower the levels of triglycerides and total plasma cholesterol in broiler meals. Similarly, phytase supplementation affects broiler lipid metabolism (Sateri *et al.*, 2017). Researchers have found that blood triglyceride and cholesterol levels are significantly lower in broiler diets supplemented with 10% OCM. According to Akordint, feeding OCM raised plasma HDL levels while lowering plasma cholesterol levels (Saleh *et al.*, 2020).

In broilers, feeding OCM and/or BL raised the concentration of plasma HDL cholesterol while lowering plasma total cholesterol. Regretfully, there are very few studies of a similar nature regarding the addition of OCM and/or BL to the diet of broilers. Because OCM contains unsaturated and polyunsaturated fatty acids, it has generally been shown to lower total cholesterol and raise HDL lipids (Dal Bosco *et al.*, 2012). Similarly, it has been demonstrated that adding OCM to broiler feed lowers overall cholesterol levels (Abd El-Samee and Hashish, 2011).

The results also showed that the degree of OCM incorporation affects how BL affects blood cholesterol levels. Probiotics have an impact on lowering total cholesterol because they break down bile acids and total lipids to prevent cholesterol from being re-synthesised (Blajman *et al.*, 2014). High density lipoprotein (HDL) and albumin levels rose when OCM was added to broiler diets. According to research by Abd El-Dayem (2021), it also resulted in a higher HDL/LDL ratio, which was linked to reduced levels of LDL and total cholesterol. Furthermore, broilers fed a diet containing OCM had higher levels of polyunsaturated fatty acids (PUFAs) in their breast muscle (Saleh *et al.*, 2020). The correct enzymes can be added to olive cake meal to increase its effectiveness in broiler feed and yield favorable outcomes.

Phytase is now widely used to improve feeds because of its many potential advantages, such as the capacity to overcome anti-nutritional elements like phytic acid, improve gut ecology and digestion, which increases the utilization of nutrients to produce meat, decrease environmental contamination, and increase revenue due to the nutrient equivalency value (Dailin *et al.*, 2018; Attia *et al.*, 2020). Dailin *et al.* (2018) state that phytase primarily enhanced meals that were high in phytate and phosphorus as well as the utilization of energy, phosphorus, calcium, protein/amino acids, and different trace minerals.

Table (3): Impact of feeding varying amounts of olive cake (OC) on blood values' biochemical components in 2024.

| Treatments | TC (mg/dL) | TG (mg/dL) | LDL mg/dL) | HDL (g/dL) | ALP (U/L) | ALT (U/L) | AST (U/L) |
|-----------------------------|---------------|---------------|---------------|---------------|--------------|--------------|--------------|
| Control | 124.53 | 74.79 | 45.20 | 54.74 | 377.98 | 27.91 | 293.81 |
| OC 3 % | 116.88 | 73.33 | 44.95 | 57.14 | 369.84 | 26.25 | 280.32 |
| OC 6 % | 115.82 | 54.51 | 39.56 | 56.98 | 345.43 | 24.09 | 279.90 |
| OC 9 % | 105.39 | 50.77 | 27.27 | 57.72 | 334.42 | 23.70 | 270.43 |
| OC 12 % | 100.34 | 61.83 | 30.81 | 57.27 | 373.54 | 23.47 | 263.12 |
| OC 15 % | 96.22 | 49.71 | 31.56 | 63.70 | 348.88 | 18.24 | 256.70 |
| LSD_(0.05) | 0.001 | 0.001 | 0.03 | 0.81 | 0.05 | 0.02 | 0.06 |

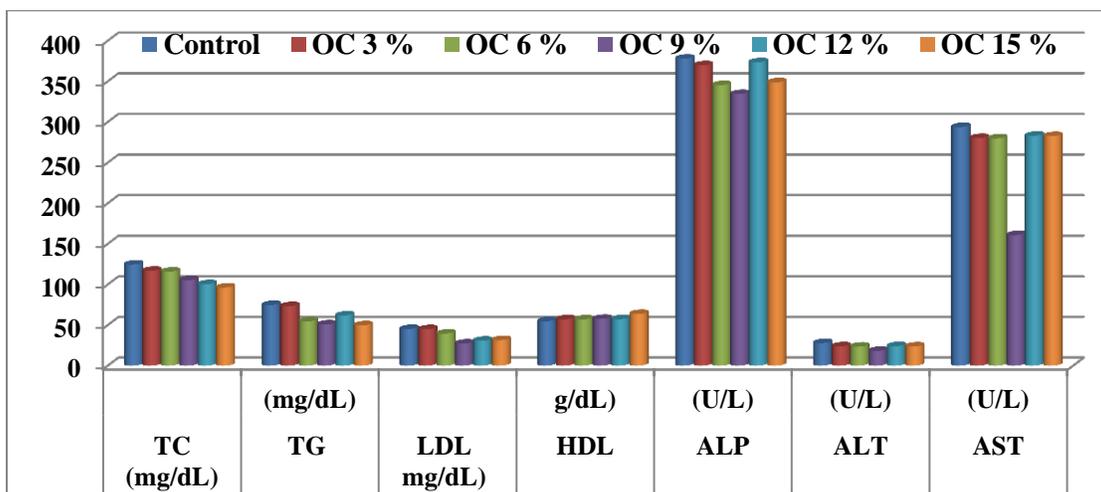


Fig. (3): Impact of feeding varying amounts of olive cake (OC) on blood values' biochemical components in 2024.

Conclusions:

According to the study's findings, broiler diets can benefit from the addition of OC at a supplementation dose of up to 10%. The idea of using agricultural by-products, which can minimize feeding costs, increase profitability, and lessen environmental impact, is also supported by these data. However, more investigation is required to ascertain whether using higher OC ratios or OC in conjunction with another by-product in chicken diets is practical. These results can be connected to suitable additives at different dosages that may increase OC consumption or, at the absolute least, preserve control performance.

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