# The effect of adding different levels of cumin oil (cuminum cyminum) to feed on productive and physiological performance of local duck (Anaspater hycous)

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# The effect of adding different levels of cumin oil (Cuminum cyminum) to feed on productive and physiological performance of local duck (Anaspater hycous)

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**ABSTRACT.** The current study was conducted to investigate the effect of adding different levels of cumin oil as a feed additive and studying its effects on production and physiological characteristics of the local duck. A total of 200 one-day-old domestic ducklings were used in this study. The birds were divided into four treatments with five replicates per treatment (10 birds per replicate) for 8 weeks. The birds were fed on two experimental diets. Cumin oil was added to the birds' diets from the first day until the end of the study as follows: first treatment was control (free cumin oil treatment CTL), while it was added about 1, 2 and 3 ml of cumin oil per kg feed to the second(cu1), third(cu2) and fourth (cu3) treatments respectively. The results showed a significant increase ($p<0.05$) in the body live weight of the cu2 and cu3 treatments compared to the other treatments at ages 4, 6 and 8 weeks. In addition, there was a significant increase ($p<0.05$) in the carcass weights and the relative major parts weights (chest and thigh). Moreover, the results showed a significant increase ($p<0.05$) in the hematological parameters (RBC, PCV, and Hb). On the other hand, the results showed a significant decrease ($p<0.05$) in the heterophils to lymphocytes ratio (H/L) in the cu2 treatment compared to the other treatments. The antioxidant status of blood, malondialdehyde (MDA), superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) were significantly ($p<0.05$) improved after adding the cumin oil to birds diet. Therefore, this study confirmed that the addition of 2 ml of cumin oil per kilogram of feed had the ability to increase the rates of body life weights and carcasses weights as well as improved both physiological and immunological parameters.

***Keyword:*** *Cumin oil, Duck, physiological and productive performance*

## INTRODUCTION

Ducks production has increased dramatically over the previous years (Madeleine, 2006). Duck meat is red and it has a level of fat and energy higher than chicken and turkey (Baeza, 2006). The usage of antibiotics in poultry feed has increased their growth rates. It was also reduced the number of pathogens bugs in their intestines. However, antibiotics were prohibited to use in the European Union because of its negative effects on health consumers (Shabaan, 2012).

Herbs such as oils and extracts were considerably used instead of antibiotics (Demir et al., 2008), Lewis et al. (2003). The aromatic plants and their extracts were used to stimulate the secretion of digestive enzymes (lipase and amylase), intestinal mucous membranes, sexual hormones in broilers and quail respectively , stimulate feed digestion, impair pathogens and strengthen the microbial balance in the gut (Al-Salhie et al., 2017; Ramakrishna et al., 2003 and Ghazalah and Ibrahim, 1996 ) noted that the use of oils medicinal plant in feeding duck was significantly improved weight gain and conversion efficiency.

Cumin was known as an aromatic plant, antioxidant (Lawrence, 1992 ; Srinivas, 1986). Cumin seeds help digestion, secretion of bile salts and digestive enzymes in the small intestine (Muthamma et al., 2008 and Platel, 2000). Recent studies have indicated that the addition of cumin oil to the diets leads to improve the production, physiological performance and increase the immunity of birds. On the other hands, it prevents oxidation in the feed. Cumin oil can be used in feeding broiler chickens to improve production performance, carcass weight and reduced the number of mortality (Ashayerizadeh et al. (2009). AL-Kassie et al. (2011) noted that cumin oil has improved growth, conversion efficiency, reduced mortality and enhanced immune system in broiler chickens. The essential functions of cumin oil are strong external or internal antiseptic, an analgesic, anti-inflammatory, hemolytic, anti-enzymatic, sedative, stimulant and stomachic action (Guenther, 1950). It is therefore evident that cumin as feed additives has many useful impacts due to its aforementioned

characteristics. Research has shown that the use of chemical additives, particularly antibiotics, in animal nutrition can lead to the accumulation of chemical residues in animal products (Amir and Mojtaba, 2015). Previous research showed that uses of cumin oils had elevated antioxidant activity related to flavonoids, especially apigenin

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and cumin luteolin (Leung, 1980). Therefore, the present study aimed to investigate the effect of adding different levels of cumin oil as a feed additive and studying its effects on the production, physiological characteristics and antioxidant status of the local duck.

## MATERIALS AND METHODS

The current study was conducted in the field of waterbirds in the college of Agriculture at University of Basrah. A total of 200 birds (one-day-old) domestic ducklings were used in this study. Ducks were obtained from the local markets of Basrah city. The birds were distributed into four experimental treatments with five replicates per treatment (10 birds per replicate) for 8 weeks. The birds were fed on two experimental diets. Birds were fed a starter diet from 0 to 2 weeks followed by grower diets from 3 to 8 weeks (Table 1).

**Table 1. Compositions and chemical analysis of the experimental diets**

| Ingredients | Starter diet (%) (0-2) weeks | Growth diet (%) (3-8) weeks |
|---|---|---|
| Yellow corn | 37 | 37 |
| Wheat | 22 | 30 |
| Protein concentrated | 8 | 8 |
| Soybean meal | 30 | 22 |
| Limestone | 0.7 | 0.7 |
| Oil plant | 2 | 2 |
| Iodide salt | 0.30 | 0.30 |
| Total | 100 | 100 |
| Chemical analysis | | |
| Metabolized energy (kcal/kg) | 2958.90 | 3030.10 |
| Protein (%) | 22.23 | 19.63 |
| Crude Fibers (%) | 2.50 | 2.26 |
| Ash (%) | 6.06 | 5.08 |
| Methionine | 0.4456 | 0.3522 |
| Lysine | 1.2114 | 1.021 |
| Methionine | 0.4456 | 0.3522 |
| Calcium (%) | 0.3719 | 0.3522 |
| Phosphorus (%) | 0.2928 | 0.2656 |
| Calorie : protein ratio | 133 | 154 |

The Feed and water were supplied ad libitum. Cumin oil was obtained from local markets in Basrah city. Cumin oil was added to bird diets starting from the first day to the end of the study as follows: First treatment was the control treatment. About 1, 2 and 3 ml of cumin oil per kilogram feed were added to the second, third and fourth treatments respectively. Birds at age 4, 6 and 8 weeks were weighed by a sensitive balance.

At the age of 8 weeks, six birds were slaughtered from each treatment. The carcasses and the major parts (breast and thigh) were weighed separately. The percentage of carcass weight was calculated according to (Hassan et al., 2013). Blood samples were withdrawn from the leg vein. At the end of the study, blood for six birds from each treatment was taken. Blood was collected for assaying the red blood cells count (RBC), the packed cell volume (PCV), the concentration of hemoglobin (Hb) and the ratio of heterophils to ylymphocytes (H/L) according to (Al-Salhie, 2014).

Blood for biochemical analysis (5 mL) was sampled after the end of the research for MDA, SOD and GSH-Px assays. Collected blood was centrifuged at 2000-3000 g for 15 min and divided from serum. Then, by continuous mixing for 5 min and centrifugation at 2000 g for 15 min, the serum was deproteinized with 25 percent trichloracetic acid. The deproteinized serum was used to determine lipid peroxidation. The complete quantity of lipid peroxidation products in serum was tested using the thiobarbituric acid (TBA) technique, measuring reactive spectrophotometric malondialdehyde (MDA) materials at 532 nm. Superoxide dismutase (SOD) operations using the xanthine/xanthine oxidase system for superoxide anion (O2 •-). generation. This anion decreased to formazan nitroblue tetrazolium (NBT), which was controlled at 560 nm. Glutathione peroxidase (GSH-Px) activity was evaluated using RANSEL kit (Randox Laboratories Limited, 55 Diamond Road, Crumlin, County Antrim, BT29 4QY, UK.

Data were collected and analyzed using the Statistical Analysis Program (SPSS, 2017). The means were compared by one-way ANOVA for significant differences among treatments ($p<0.05$).

## RESULTS

The growth rates of the bird at ages 4, 6 and 8 weeks were showed in Table 2. The results indicate that the growth rates of the third (cu2) and fourth (cu3) treatments were significantly ($p<0.05$) increased compared to control (CTL) and second (cu1) treatments. The results were also showed a significant ($p<0.05$) increase in the life body weights of second (cu1) treatment compared to control (CTL) treatment at all ages. Body weight of fourth(cu3) treatment at 6 and 8 weeks of age was a significant ($p<0.05$) decrease compared to third(cu2) treatment (Fig. 1 and 2).

Table 2. the effect of cumin oil feed supplementation on local duck growth rates

| **Treatments Ages** | **CTL** | **cu1** | **cu2** | **cu3** | ***p* value** |
|---|---|---|---|---|---|
| 4 weeks | $647.50^{b}\pm7.49$ | $6630.23^{b}\pm8.12$ | $691.67^{a}\pm5.78$ | $702.67^{a}\pm7.54$ | <0.001 |
| 6 weeks | $1272.13^{d}\pm5.28$ | $1363.21^{c}\pm3.77$ | $1446.43^{a}\pm12.88$ | $1413.95^{b}\pm2.89$ | <0.001 |
| 8 weeks | $1619.43^{c}\pm2.22$ | $1768.75^{b}\pm2.60$ | $1837.17^{a}\pm2.63$ | $1766.91^{b}\pm2.31$ | <0.001 |

CTL:control treatment, cu1: adding 1 ml of cumin oil per kilogram feed, cu2: adding 2 ml of cumin oil per kilogram feed, cu3: adding 3 ml of cumin oil per kilogram feed, a,b,c,d Means in the same row with different letters show significant differences ($p<0.05$) among treatments.

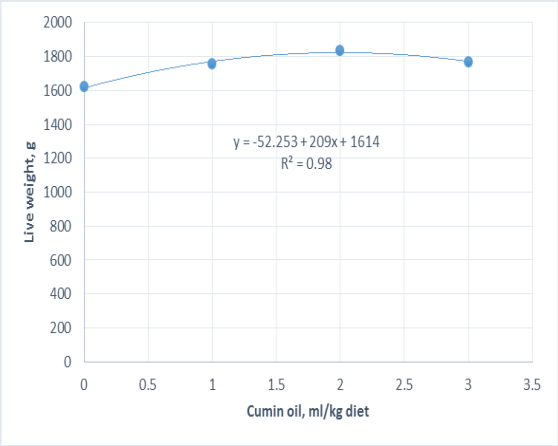


Figure 1. Effect cumin oil feed supplementation on body weight of local duck at 8 weeks of age

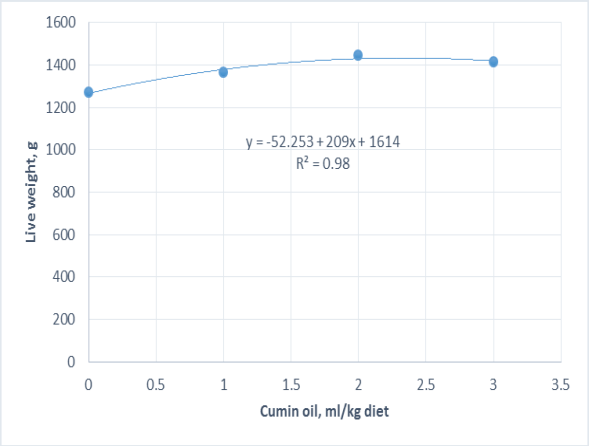


Figure 2. Effect cumin oil feed supplementation on body weight of local duck at 6 weeks of age

The carcass and relative major parts weight (breast and thigh) were shown in Table 3. The results showed a significant ($p<0.05$) increase in the carcass and relative major parts weight in third(cu2) and fourth(cu3) treatments compared to other treatments. It was also found that second (cu1) treatment increased significantly ($p<0.05$) compared to the control (CTL).

Table 3. the effect of cumin oil feed supplementation on carcass weight and the relative major parts weights (breast and thigh)

| **Treatments Traits** | **CTL** | **cu1** | **cu2** | **cu3** | ***p* value** |
|---|---|---|---|---|---|
| Carcass weight (g) | $1100.73^{d}\pm2.91$ | $1171.33^{c}\pm4.10$ | $1380.03^{a}\pm4.04$ | $1363.23^{a}\pm4.58$ | <0.001 |
| Thigh (%) | $13.11^{c}\pm0.16$ | $13.74^{b}\pm0.10$ | $14.93^{a}\pm0.10$ | $14.78^{a}\pm0.15$ | <0.001 |
| Breast (%) | $43.66^{b}\pm0.40$ | $43.96^{b}\pm0.21$ | $45.53^{a}\pm0.06$ | $45.30^{a}\pm0.36$ | <0.001 |

CTL: control treatment, cu1: adding 1 ml of cumin oil per kilogram feed, cu2: adding 2 ml of cumin oil per kilogram feed, cu3: adding 3 ml of cumin oil per kilogram feed, a,b,c,dMeans in the same row with different letters show significant differences ($p<0.05$) among treatments.

The results of hematological parameters were shown in Table 4. The results indicate a significant ($p<0.05$) increase in RBC, PCV, and Hb in the third(cu2) treatment compared to others. The results revealed in table 4 showed a significant ($p<0.05$) decrease in the ratio of heterophils to lymphocytes (H/L) in the third(cu2) treatment compared to other treatments. The results were showed a significant ($p<0.05$) decrease in PCV, Hb and RBC in the fourth(cu3) treatment compared to third(cu2) treatment (Fig. 3,4 and 5).

Table 4. the effect of cumin oil feed supplementation on some blood parameters

| **Treatments**<br>**Parameters** | **CTL** | **cu1** | **cu2** | **cu3** | ***p* value** |
|---|---|---|---|---|---|
| H/L | $0.61^{a}\pm$ 0.009 | $0.55^{b}\pm$ 0.018 | $0.42^{c}\pm$ 0.023 | $0.53^{b}\pm$0018 | <0.001 |
| PCV% | $30.33^{b}\pm$0.88 | $32.33^{b}\pm$0.88 | $40.67^{a}\pm$0.67 | $32.00^{b}\pm$0.58 | <0.001 |
| Hb (g/100ml) | $11.03^{b}\pm$0.29 | $11.37^{b}\pm$0.23 | $13.27^{a}\pm$0.23 | $11.36^{b}\pm$0.15 | <0.001 |
| BRC ($10^6$ / $ml^3$) | $3.07^{c}\pm$0.05 | $3.37^{b}\pm$0.03 | $4.29^{a}\pm$0.08 | $3.21^{bc}\pm$0.03 | <0.001 |

CTL: control treatment, cu1: adding 1 ml of cumin oil per kilogram feed, cu2: adding 2 ml of cumin oil per kilogram feed, cu3: adding 3 ml of cumin oil per kilogram feed, a,b,c,Means in the same row with different letters show significant differences ($p<0.05$) among treatments.

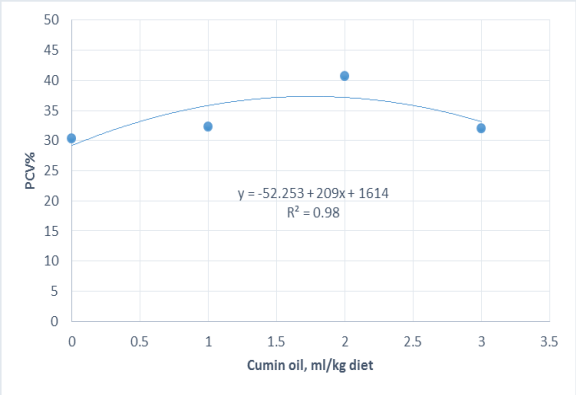


Figure 3. Effect cumin oil feed supplementation on bood PCV of local duck at 8 week of age

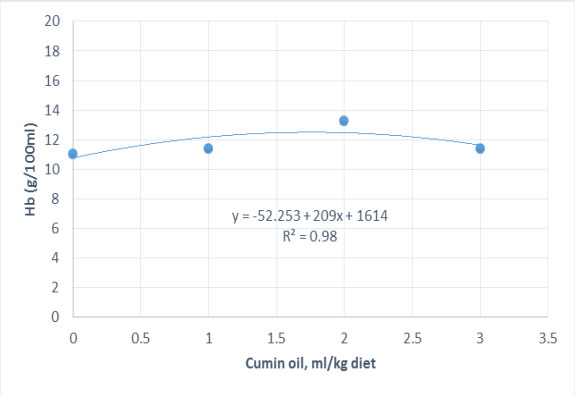


Figure 4. Effect cumin oil feed supplementation on blood Hb of local duck at 8 week of age

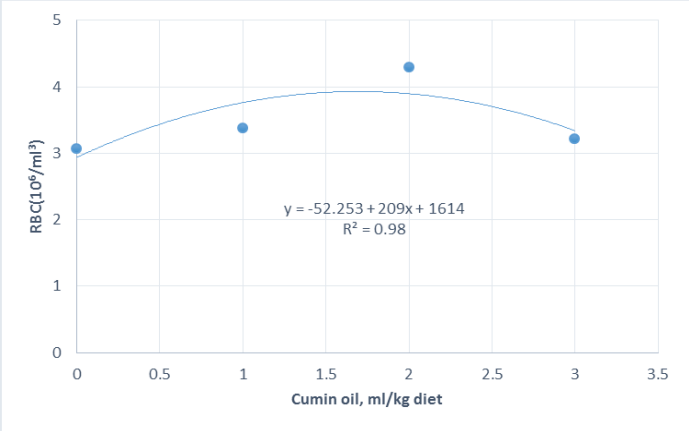


Figure 5. Effect cumin oil feed supplementation on blood RBC of local duck at 8 week of age

Blood antioxidant status, malondialdehyde (MDA), superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) were shown in Table 5. The results showed the malondialdehyde for control (CTL) treatment increased significantly ($p<0.05$) in comparison with other treatments. On the other hand, a significant ($p<0.05$) increase in superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) activity for cu1, cu2 and cu3 treatments compared to control (CTL). The results were showed a significant ($p<0.05$) decrease in glutathione peroxidase (GSH-Px) and superoxide dismutase (SOD) activity in the fourth (cu3) treatment compared to third (cu2) treatment (Fig. 6 and 7).

Table 5. The effect of cumin oil feed supplementation on MDA, GSH-Px, SOD activities in ducks serum.

| **Treatments**<br>**Traits** | **CTL** | **cu1** | **cu2** | **cu3** | ***p* value** |
|---|---|---|---|---|---|
| MDA(n mol/ml) | $15.59^{a}$ ±0.09 | $14.64^{b}$±0.13 | $13.42^{c}$±0.08 | $14.43^{b}$±0.12 | <0.001 |
| GSH-Px (µmol/L) | $1129.51^{d}$±13.71 | $1282.33^{c}$±9.82 | $1400.44^{a}$±11.65 | $1335.00^{b}$±8.19 | <0.001 |
| SOD(U/ml) | $250.33^{d}$±3.75 | $266.33^{c}$±5.29 | $314.45^{a}$±3.84 | $285.00^{b}$±2.28 | <0.001 |

CTL: control treatment, cu1: adding 1 ml of cumin oil per kilogram feed, cu2: adding 2 ml of cumin oil per kilogram feed, cu3: adding 3 ml of cumin oil per kilogram feed, a,b,c,dMeans in the same row with different letters show significant differences ($p<0.05$) among treatments. MDA; Malondialdehyde, GSH-Px; glutathione peroxidase, SOD; superoxide dismutase.

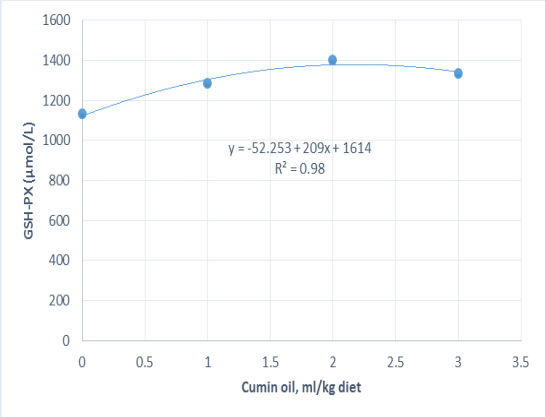


Figure 6. Effect cumin oil feed supplementation on plasma GSH-Px of local duck at 8 week of age

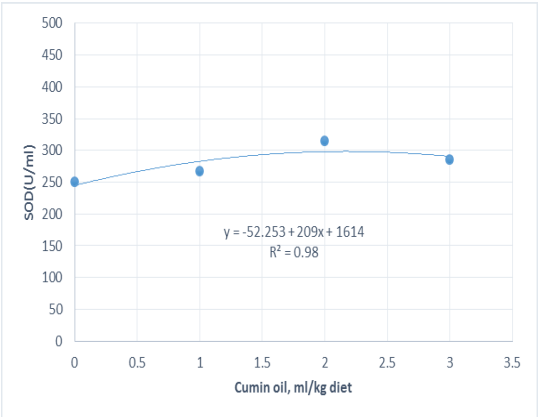


Figure 7.Effect cumin oil feed supplementation on plasma SOD of local duck at 8 week of age

## DISCUSSION

The improvement in bird growth rates may be due to the biological function of the cumin (Cowieson et al., 2003). Cumin acts as a stimulating for the secretion of digestive enzymes and as anti-microbial (Jonas et al., 2007). The use of aromatic plants and their extracts has positive effects on the digestive system (Ramakrishna et al., 2003). Ghazalah and Ibrahim (1996) reported that feeding ducks on medicinal plants oil added to diets lead to an increase in their growth rates. The findings of the present study were an agreement with (AL-Kassie et al., 2011; Khan, et al., 2012 and William and Losa, 2001) who reported to the high rates of final body weight when adding herbs and medicinal plants to diets. Moreover, medicinal plants and their extracts have been used as feed additives in animal diets over the previous few years to enhance their conversion efficiency and health. This use of aromatic plants is based on their broad spectrum of antimicrobial characteristics (Sivropoulou et al., 1996), antioxidant (Botsoglou et al., 1997) or even stimulating characteristics of appetite and digestion (Kamel, 2001). As a general finding of this study, the antibiotic (Flavomycin) caused significant cant growth-promoting impacts, superior feed conversion efficiency, and decreased the quantity of Clostridia in the ileum (Miles et al., 2006). There were indications that herbs, spices, and multiple plant extracts have appetizing and digestive-stimulating characteristics and antimicrobial impacts (Hernandez et al., 2004). Hadavi et al. (2017) reported that adding 100 mg of fennel extract(herbs) to CCl4-administered diets partly improves the detrimental impacts of CCl4 and could also enhance the poduction parameter of laying hens. A significant decrease of body weight for fourth(cu3) treatment at 6 and 8 weeks of age compared to third(cu2) treatment might be due to cumin oil (3ml/kg feed) which lead to increase energy level in feed. On the other hand, it lead to decrease feed intake, subsequently growth rate was decreased (Ibraheem, 2000).

A significant improvement in the carcass and relative major parts weight in third(cu2) and fourth(cu3) treatments can be attributed to the high rates of final weights of birds fed on diets supplemented with cumin oil (Table 2). Or it may be due to the positive relationship between the carcass weight and breast meat yield (Hassan et al., 2013). Rance et al. (2002) reported that there is a positive correlation (0.76) between body weight and breast meat yield, indicating that heavier chickens produce higher breast yield. On the other hand, the lower body weight was primarily affected by differences in breast and thigh meat weight (Bartov, 1998). Zhaleh et al. (2019) reported that flaxseeds (herbs) supplied with a finished diet of 10 percent rather than 5 or 15 percent, resulting in an acceptable carcass weight, meat quality, n-3 fatty acids and MDA content in meat.

A significant increase in RBC, PCV and Hb in the third(cu2) treatment may be due to an improvement in the bird's health status and consequently improved their body weight. Some reports were mentioned that the addition of cumin oil to broiler diets lead to improve both production and physiological performance. In addition, the bird's immunity system increased its activity against many diseases (Ashayerizadeh et al., 2009). Moreover, it may be due to the positive relationship between body weight and red blood cells count, as well as a positive relationship between the packed cell volume and red blood cells count. The improvement of the productive traits is positively reflected in the characteristics of the blood traits (Hauptmanova et al., 2006). The results of this study were consistent with (Arora and Samples, 2011) who found that red blood cells, hemoglobin, and packed cell volume were increased significantly with quails weights. A significant decrease in PCV, Hb and RBC in the fourth(cu3) treatment compared to third(cu2) treatment might be due to decrease in the body weight of fourth(cu3) treatment at 6 and 8 weeks of age (Table 2).Whereas, it found a positive relationship between body weight and red blood cells count (Hauptmanova et al., 2006). Moreover, it found a positive relationship between PCV, Hb and RBC(Campbell, 1988). A significant decrease in the ratio of heterophils to lymphocytes (H/L) in the third(cu2) treatment may be due to cumin oil feed supplementation was improved the birds immune status (Habibi et al., 2016). On the other hand, the reason may be that cumin oil was increased the number of lymphocytes and decreases the heterophils cells. The results of the current study were an agreement with (Golian et al., 2010) who noted that adding 10 g of cumin seed powder per kilogram of feed increased the number of lymphocytes and reduced the heterophils cells. The ratio of heterophils cells to H / L indicates a stress index (Mahmoud et al., 2013).

The balance between reactive oxygen species (ROS) and inherent antioxidant defenses determines cellular antioxidant activity (Burton and Jauniaux, 2011). Different products such as MDA are formed by lipid peroxidation (Droge, 2002). The findings of the present research showed that cumin oil feed supplementation to the duck diet lowered blood MDA concentrations. Interestingly, blood GSH-Px content and SOD operations have considerably enhanced in blood. These results are in agreement with the findings of (El-Hack and Alagawany, 2015) who discovered that serum SOD activity and GSH-Px concentrations were considerably improved in diet groups with medicine plant. Blood MDA concentrations were considerably reduced by adding 2 and 3 ml of cumin oil/kg. It has

been suggested that the elevated biological activity of cumin oil as a natural antioxidant is linked to the existence of phenolic hydroxyl groups that serve as a hydrogen donor to the proxy radicals generated in the first phase of lipid oxidation, thereby inhibiting the development of hydroxyl peroxide (Hashemipour et al., 2013). Gangandeep et al (2003) noted that supplementation of cumin seed (2,5 and 5 percent diet) in mice tended to improve superoxide dismutase, catalase and decreased glutathione, but the activity of glutathione peroxidase and glutathione reductase stayed unchanged by both cumin doses. Cuminaldehyde has also been shown to scavenge the superoxide anion (Krishnakantha and Lokesh, 1993).

## CONCLUSION

The study confirmed that the addition of 2 ml of cumin oil feed supplementation per kilogram has significantly increased the rates of body life and carcass weights in a local duck.
In addition, it improved the overall body physiological condition, antioxidant status, and immunological system.

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