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ALLEVIATING THE ADVERSE EFFECTS OF SUMMER SAESON ON PERFORMANCE AND HUMORAL IMMUNITY OF BROILER CHICKS USING DIFFERENT SOURCES OF FAT.

By

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Abstract: *Three hundred-two week old of Hubbard broiler chicks were randomly divided into ten groups of three replicates, ten chicks each. The first group was fed on the basal diet (control), while the other nine groups were supplemented one of graded levels of either corn or olive oil or tallow in the diet (0.5, 1, 1.5%). Humoral immune response to SRBC's, some blood constituents, body weight, feed conversion and carcass characteristics were measured.*

The results showed that:-

- *-Chicks given high level of olive oil or those received either low or high level of tallow possessed significantly lower antibody levels when compared with chicks given any levels of corn oil.*
- *Group given corn oil recorded significantly the highest relative lymphoid organ weights compared to the other groups.*
- *Chicks with 1.5% corn oil showed the highest level of both serum total protein and globulin. The lowest levels were attained by the control group.*
- *Birds received any level of tallow recorded the highest level of both total lipids and cholesterol compared with the other experimental groups.*
- *Liver functions (expressed by serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities were not affected by supplementing the different sources of fat.*
- *The lowest body weight gain was recorded for the control group and those received either 1 or 1.5% tallow.*
- *Chicks of control group had the highest feed consumption, and the worst feed conversion ratio as well as performance index.*
- The lower abdominal fat deposition was found in chicks fed corn and olive oils than those fed tallow.

INTRODUCTION

Considerable strategies have been conducted in order to alleviate the disadvantageous effects of heat stress in tropical and subtropical regions in particular, during summer on nutritional physiology and performance, such as feeding timing (Teeter *et al*., 1987), minerals and vitamins addition (Moreng, 1980) essential amino acids (Yanming and Baker, 1993), feed additives and growth promoters (Teeter, 1995), quantity and quality of food, and fat supplementation (Hussein, 1996).

Fats perform certain physiological functions within the body. They are used as an energy reserve, insulation against temperature extremes, and to protect tissue membranes and vital organs. Plant oils contain high levels of unsaturated fatty acids and well absorbed by fowl than animal fats which contain higher proportions of saturated fatty acids (Mossab *et al*., 2000).

Humoral immune response is an important aspect of the immunity and can be assessed by measuring antibody production and activity. Antibody production levels showed contradictory results depending on the source from which the unsaturated fatty acids are derived (Wang *et al*., 2000).

Variation in the level and composition of dietary fat influence the cell immune response in chickens by altering the structure of the cell membrane and modulating the synthesis of prostaglandins (Rama Rao *et al*., 2004). Fritsche and Johnston, (1990) noticed a higher natural killer cell activity when corn oil (plant oil) was added to mice diet than animal oil.

The age of bird has a marked influence on the utilization of dietary fat. Bird's physiological ability for fat utilization is poorly developed in the early days of age, due to an inadequate lipase enzyme and bile salts secretion in the intestine, but greatly improves with age (Mossab *et al*., 2000 and Attia *et al*., 2004).

The literature contains numerous reports on fat requirements for growing birds, but little attention has been given to their influence on physiological functions and chicken immune cells.

The purpose of this experiment was to investigate the specific effect of different profiles of supplemental vegetable or animal fats on productive, immunological and physiological traits of broiler chicks. An experiment was designed to test three types of fat rich in the main fatty acids families at three inclusion levels. We used tallow (rich in saturated fatty acids (SFA), olive oil (rich in monounsaturated fatty acids (MUSFA) and corn oil (rich in polyunsaturated fatty acids (PUSFA).

MATERIALS AND METHODS

The present study was carried out at Poultry Nutrition Section, Department of Poultry Production, Faculty of Agriculture, Ain Shams University, during the summer season of year 2004.

Birds Management and Diets

Three hundred 2-wk-old Hubbard broiler chicks were randomly divided into ten groups with 3 replicates each. The first group was fed the basal diet (control), while the other nine groups were fed the basal diet supplemented with one of each of three graded levels (0.5, 1, 1.5 %) of corn, olive oils or tallow in the diet.

Diets and water were offered to chicks *ad-libtium* throughout the experimental period. The composition of the experimental diets is shown in Table (1). Chicks in all treatments were kept under the same management system. Artificial lighting was used to provide the chicks with heat needed for brooding. They were reared on the brooder battery up to the age of 6-wk.

Productive Performance Traits:

Weekly body weight and feed consumption were recorded. Mean gain and feed-to-gain ratio were used to determine growth performance. At the end of the experimental period (6-wk) 10 birds were randomly taken from each treatment group, weighed individually to the nearest 1 gram, and slaughtered by cutting the throat jugular vein with a sharp knife. After the removal of head, viscera, shanks, thymus, bursa, spleen, gizzard, heart, liver and abdominal fat; the eviscerated carcass was weighed. Each of front parts with wings and back parts were weighed separately, and their weights were proportionated to the live body weight.

The performance index (PI) was calculated according the equation described by North (1981) as follows: PI=Live body weight (Kg)/Feed conversion x 100.

Humoral Immune Responses:

The immunological performance was evaluated by; the relative weight of lymphoid organs (bursa, thymus and spleen) and the antibody production against sheep red blood cells (SRBC's). At an age of 21 d, 10 birds from each treatment group were injected intramuscularly with 1 ml sheep red blood cell (SRBC’s) 10% suspension in sterile physiological saline. The same dose of

antigen was reinjected intramuscularly two weeks later to the same birds. Seven days later, approximately 1.0 ml of blood was withdrawn from each bird. Blood samples allowed to clot to provide serum for antibody titration. The immune responses (Primary and Secondary) to SRBC's were measured using micro-titration hemeagglutination technique according to (Van der Zijpp and Leenstra, 1980). Antibody titer values were expressed as $\log_2$ of the highest serum dilution giving complete agglutination.

Physiological Blood Parameters:

One hundred Individual blood samples were obtained from the slaughtered chicks (10 samples /group). Serum samples were assigned for determination of total protein, albumin, total lipids, cholesterol, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) using available commercial kits (Stambio, San Antoni, Texas, USA). Globulin was calculated by subtraction of serum albumin from total protein.

Statistical Analysis

Data were subjected to analysis of variance using general linear model described in SAS User's Guide (SAS Institute, 1994). Differences among means were tested using Duncan's multiple range test (Duncan, 1955). Percentages of slaughter traits were divided by 100 and subjected to arc sin transformation of the square root before analysis; however actual percentage means are presented.

RESULTS AND DISCUSSION

Immunological Responses

Data illustrating the effect of different fat sources on antibody production are presented collectively in Table (2). The differences in antibody levels response to SRBC's at seven days after challenge (primary immune response) among the treatment groups were not significant. Maximum anti-SRBC's antibody levels were observed two week after the antigen challenge (secondary immune response). The chicks supplemented with high level (1.5%) of corn oil had significantly higher titer of antibody binding SRBC than control chicks or those received the other sources of fat except those given the lowest level of olive oil (O1). Additionally, the chicks given high level of olive oil or those received either low or high level of tallow possessed significantly lower antibody levels when compared to chicks given any levels of corn oil. Similar results were obtained by Parmentier *et al*. (1997) who found that adding oil containing linoleic acid such as corn oil to broiler diet produced a higher antibody titers. The higher

levels of unsaturated fatty acids may have enhanced immune function by stimulating macrophages (Rama Rao *et al*., 2004). However, these results are in disagreement with those of Takahashi *et al.* (1994) who reported that fat source had no effect on antibody titers.

Fat sources had pronounced effects on the relative weights of thymus, bursa and spleen (Table 2). In general the relative lymphoid organ weights were significantly highest in the birds given corn oil, lowest in those received tallow and intermediate in both control group and chicks given olive oil. These results on lymphoid organs are in agreement with those of Wang *et al*. (2000). They found that increase of polyunsaturated fatty acids in chicks diet significantly promoted the growth of thymus, spleen and bursa. Katanbaf *et al*. (1989) and Abdel-Fattah *et al*. (2003) reported that the increase in the relative organs weight is considered as an indication of the immunological advances.

Serum Blood Constituents:-

Data illustrating the serum levels of total protein, albumin, globulin and albumin/globulin (A/G) ratio are presented in Table (3). It is obviously shown that serum total protein, albumin, and globulin were significantly increased with fat supplementation to broiler chicks diet. The highest level of both serum total protein and globulin was noted in chicks with 1.5% corn oil followed by those given 0.5% olive oil, while the lowest levels were reported for the control group. Similar results were found by Hamdy *et al*. (2003) who reported that serum total protein and globulin significantly increased in the broilers group supplemented with either plant oils or tallow than the control group. Supplementing the broiler diet with unsaturated fatty acid elevates the protein synthesis as a result of increasing the metabolic activities and to regulate the requirements for cell activity (Hamdy *et al*., 2003). The A/G ratio, which has been well-known as an indication for the metabolic activities and immune resistance, established the aforementioned results for the total protein and its fractions. Low A/G ratio indicates more disease resistance and immune response (Griminger, 1986).

Broiler chicks fed diet supplemented with either olive oil (1 or 1.5%) or any level of corn oil had lower level of total lipids as compared to those fed the basal diet supplemented with tallow (Table 3). In agreement with our results on total lipids, El-Husseiny *et al*. (2002) showed that the vegetable oil decreased significantly serum total lipids when compared with tallow. Griminger (1986)

stated an increase in lipid concentration and in the specific activity of hepatic lipogenesis in response to essential fatty acids deficient diet.

Results in Table 3 indicate that dietary levels of (0.5, 1.0, and 1.5) tallow produced relatively marked increase, although insignificant in the serum cholesterol level. Whereas, dietary levels of 0.5, 1.0, 1.5 olive oil, decreased serum cholesterol level compared with corn oil or non-supplemented control. It appears that serum cholesterol level depends primarily on the physiochemical nature of the fat. They can be related to the specific fatty acids composition and the specific ratio of unsaturated to saturated fatty acids in the diet. These results are in agreement with Maurice and Jensen (1978) who reported that animal fat or vegetable oil supplemented to basal diet did not affect serum cholesterol level. In broiler breeder hen, Mickey *et al*. (2001) found that dietary fat intake decreased serum level of cholesterol.

AST and ALT are intracellular enzymes involved in amino acid or carbohydrate metabolism. They are considered as indicators of hepatic function, since liver has many functions such as metabolism of protein, carbohydrate and fats.

Although, the lowest liver enzyme levels of both AST and ALT were recorded for the control group; insignificant differences were found among treatments and control (Table 3). These results are in partial accordance with those of Hamdy *et al*. (2003).

Productive Performance

1- Body Weight and Weight Gain Responses:

The relationship of fat sources to the live body weight and body weight gain is shown in Table (4). There were no differences in live body weight at two week of age (WOA) between treatment groups. At six WOA, the body weight was significantly lower in the chicks received 1% of tallow than those supplemented by either low level of tallow (0.5%) or any levels of olive oil. Additionally, reduction in body weight gain was found in chicks given 1% tallow as compared to all other experimental groups except those with high level of tallow or control group.

2- Feed consumption and conversion:

As shown in Table (4) the control group had significantly highest average of feed consumption than those of any of the other groups given different sources of fat. Broiler chicks fed diet supplemented with the different experimental sources of fats recorded better ($p<0.01$) average of

feed conversion when compared with the control group. Similar results were obtained by Crespo and Esteve-Garcia (2001) who showed that feed intake decreased significantly and feed efficiency was better in chicks fed diet supplemented with fat, because of the higher metabolizable energy content.

The improvement in weight gain and feed conversion at six WOA by adding vegetable oil to broiler diet agree with those of El-Kaiaty *et al*. (2001) and Attia *et al.* (2004). Rama Rao *et al.* (2002) illustrated that adding oil decrease the rate of passage of digesta induced an increase in feed utilization. Moreover, Vila and Garcia (1996) suggested that increasing the unsaturated fatty acids in the diet improves significantly metabolic function. An additional possibility, is that increasing the dietary oil may cause a significant increase in Messenger Adenosine Triphosphate (mATP), which is involved in most metabolic mechanisms (Soliman *et al*., 2003).

In terms of performance index the different sources of fat improved significantly the performance index as compared to the control but the improvement was insignificant in the chicks given low level (0.5%) of corn oil or both of the mid and the high level of tallow.

Carcass Traits:

The relative weights of hot carcass and back half were the greatest in the group given 1.5% corn oil than those of the other treatment groups (Table 5). However, there were no treatment differences in either front half or liver relative weight was observed. The percentage of abdominal fat was significantly ($p>0.05$) higher in chicks given tallow when compared with the oils; olive or corn. The highest percentage of abdominal fat was found in group with 1.5% tallow. The lower abdominal fat deposition in chicks fed corn oil and olive oils than those fed tallow are in agreement with those of Crespo and Esteve-Garcia (2001). They indicated that abdominal fat content could be influenced by the fatty acid profile. Thus, the possible reduction in lipid deposition should concomitant with an increase in energy expenditure.

From the current study it could be concluded that modification of antibody production, activity and chick performance by dietary fatty acid manipulation may provide an avenue to strengthen chick humoral immunity and protection against various pathogens.

Table (1): Composition of basal diets and chemical analysis:

Ingredients (%)	**Starter** (0- 4 weeks)	**Finisher** (4 -6 weeks)
Yellow corn	61.77	73.00
Soybean meal (44% CP)	24.50	13.60
Corn gluten meal	10.00	10.00
Bone meal	2.60	2.00
Limestone	0.30	0.60
Vit& Min Premix*	0.30	0.30
NaCI	0.25	0.25
Lysine	0.18	0.20
DL- Methionine	0.10	0.05
Total	100.00	100.00
Chemical analysis:-		
A-Detemined analysis:		
Crude protein %	22.06	18.15
Crude fiber %	3.53	3.13
Ether extract %	2.86	3.12
Total ash	6.77	6.58
B-Calculated analysis:		
ME (KCal/Kg diet)	2988	3120
Calcium %	1.02	0.90
Availabile phosphorous %	0.45	0.35
Lysine%	1.15	0.90
Methionine %	0.51	0.40
Cystine %	0.38	0.33
Meth. + Cys. %	0.89	0.73

***** Each 3 kg of vit-mineral mixture contain vit A 10 m IU, vit D3 1 m IU, vit E 10 g, vit k3 1 g, vit B1 1g, vit B2 4.0g, vit B6 1.5g, Nicotinic acid 20g, Pantothenic acid 10g,vit B12 0.01g, Biotin 0.05g, Folic acid 30g, Choline chloride 50g, Iron 30g,Manganese 40g, Copper 3g, Iodine 0.45g, Zinc 45g and Selenium 0.1g.

Table 2: Humoral immune response and relative lymphoid organ weight of broiler chicks as affected by supplemental different fat sources.

Trait	Treatment										
	C	C1	C2	C3	O1	O2	O3	T1	T2	T3	Sig.
Humoral Immunity											
Primary Immune Response											
	1.50 ±0.50	2.75 ±0.63	2.50 ±0.29	2.50 ±0.64	1.50 ±0.29	2.67 ±0.67	2.00 ±0.41	2.25 ±0.63	1.75 ±0.25	1.67 ±0.33	NS
Secondary Immune Response											
	5.40^{bc} ±0.37	6.60^{ab} ±0.51	6.60^{ab} ±0.40	7.00^{a} ±0.45	5.80^{abc} ±0.37	5.40^{bc} ±0.51	5.20^{c} ±0.37	5.20^{c} ±0.47	5.60^{bc} ±0.24	5.20^{c} ±0.27	**
Relative Lymphoid Organ Weight											
Thymus	0.22^{c} ±0.01	0.24^{bc} ±0.01	0.28^{ab} ±0.03	0.30^{a} ±0.01	0.24^{bc} ±0.01	0.22^{c} ±0.01	0.24^{bc} ±0.01	0.21^{cd} ±0.01	0.23^{c} ±0.01	0.18^{d} ±0.02	**
Spleen	0.09^{bc} ±0.01	0.13^{a} ±0.01	0.11^{ab} ±0.02	0.09^{bc} ±0.01	0.09^{bc} ±0.01	0.11^{ab} ±0.01	0.09^{bc} ±0.01	0.09^{bc} ±0.01	0.08^{bc} ±0.01	0.07^{c} ±0.01	**
Bursa	0.07^{b} ±0.01	0.11^{a} ±0.01	0.11^{a} ±0.01	0.13^{a} ±0.01	0.07^{bc} ±0.00	0.11^{a} ±0.02	0.06^{bc} ±0.00	0.06^{bc} ±0.00	0.07^{bc} ±0.01	0.05^{c} ±0.00	**

a-d Means within a row with different superscripts are significantly different ($P \leq 0.05$).
C= Nonsupplemented control.
C1, C2 and C3 = Corn oil with 0.5, 1.0 and 1.5%, respectively.
O1, O2 and O3 = Olive oil with 0.5, 1.0 and 1.5%, respectively.
T1, T2 and T3 = tallow with 0.5, 1.0 and 1.5%, respectively.

Table 3. Some blood constituents of broiler chicks as affected by supplemental different fat sources.

Trait	Treatment								
	C	C1	C2	C3	O1	O2	O3	T1	T2	T3	Sig.
Total Proteins (g/dL)	2.94^{e} ±0.14	4.31^{ab} ±0.16	4.08^{b} ±0.20	4.60^{a} ±0.19	4.35^{ab} ±0.15	4.30^{ab} ±0.15	3.93^{bc} ±0.21	3.13^{dc} ±0.21	3.93^{bc} ±0.11	3.30^{cd} ±0.21	**
Albumin (A) (g/dL)	1.68^{cd} ±0.09	2.23^{a} ±0.12	1.92^{bc} ±0.08	1.89^{bc} ±0.011	1.89^{bc} ±0.12	2.01^{ab} ±0.02	1.94^{bc} ±0.10	1.46^{d} ±0.06	1.87^{bc} ±0.07	1.78^{bc} ±0.06	**
Globulin (G) (g/dL)	1.25^{d} ±0.17	2.08^{bc} ±0.07	2.17^{bc} ±0.19	2.72^{a} ±0.24	2.46^{a} ±0.12	2.28^{ab} ±0.03	1.99^{bc} ±0.1	1.67^{cd} ±0.23	2.06^{bc} ±0.17	1.52^{cd} ±0.23	**
A/G Ratio	1.39^{a} ±0.15	1.07^{abc} ±0.07	0.91^{bc} ±0.08	0.73^{c} ±0.11	0.77^{c} ±0.04,	0.88^{bc} ±0.01	0.97^{bc} ±0.08	0.88^{bc} ±0.14	0.94^{bc} ±0.09	1.17^{ab} ±0.14	**
Cholesterol (g/dL)	133.71 ±9.03	135.51 ±2.90	136.76 ±4.32	139.74 ±3.20	122.20 ±3.86	125.44 ±10.48	118.79 ±10.79	136.69 ±4.49	130.54 ±7.91	125.44 ±10.34	NS
Total Lipid (mg/dL)	657.52^{bcd} ±50.93	624.87^{cd} ±17.22	617.27^{cd} ±47.12	603.27^{cd} ±35.74	648.09^{bcd} ±43.66	565.82^{d} ±8.71	575.75^{d} ±26.16	719.35^{abc} ±57.02	802.92^{a} ±30.10	767.01^{ab} ±43.84	**
AST (U/l)	146.83 ±4.44	142.07 ±2.28	146.20 ±4.26	143.80 ±2.18	141.80 ±2.78	142.80 ±2.60	144.60 ±2.56	140.63 ±5.05	150.45 ±4.00	148.33 ±4.23	NS
ALT (U/l)	12.61 ±3.84	14.61 ±0.87	14.05 ±1.86	15.09 ±1.20	15.04 ±1.59	13.07 ±1.52	13.77 ±1.29	17.97 ±1.42	17.05 ±2.09	17.45 ±2.54	NS

$^{a-d}$ Means within a row with different superscripts are significantly different ($P \leq 0.05$).

C= unsupplemend control.

C1, C2 and C3 = Corn oil with 0.5, 1.0 and 1.5%, respectively.

O1, O2 and O3 = Olive oil with 0.5, 1.0 and 1.5%, respectively.

T1, T2 and T3 = tallow with 0.5, 1.0 and 1.5%, respectively.

Table 4. Productive performance of broiler chicks as affected by supplemental different fat sources.

Trait	Treatment										Sig.
	C	C1	C2	C3	O1	O2	O3	T1	T2	T3	
Live Body Weight (g).											
At 2 WOA	296.73 ±2.54	294.40 ±1.45	294.00 ±2.31	294.10 ±1.24	291.20 ±1.45	295.50 ±1.50	296.05 ±1.36	297.03 ±0.84	289.05 ±4.05	295.40 ±0.78	NS
At 6 WOA	1682.10^{ab} ±55.54	1708.00^{ab} ±55.77	1720.47^{ab} ±14..55	1745.67^{ab} ±12.57	1772.40^{a} ±14.84	1765.75^{a} ±13.55	1761.45^{a} ±17.48	1788.00^{a} ±49.70	1637.00^{b} ±21.66	1698.00^{ab} ±36.72	*
Body Weight Gain (g) .											
2 to 6 WOA	1385.17^{bc} ±52.80	1412.27^{abc} ±54.33	1437.60^{abc} ±11.32	1457.60^{ab} ±9.59	1481.20^{ab} ±13.39	1457.25^{ab} ±5.05	1462.48^{ab} ±11.85	1512.15^{a} ±45.79	1348.45^{c} ±33.45	1402.27^{bc} ±37.47	*
Feed Consumption (g).											
2 to 6 WOA	2950.00^{a} ±43.30	2850.00^{b} ±28.87	2624.00^{dc} ±26.35	2746.33^{c} ±22.81	2685.00^{cd} ±20.21	2753.50^{c} ±36.50	2748.50^{c} ±24.37	2875.00^{b} ±24.43	2610.35^{c} ±35.00	2692.00^{cd} ±23.46	**
Feed Conversion Ratio											
2-6 WOA	2.14^{a} ±0.05	2.02^{b} ±0.06	1.83^{cd} ±0.02	1.88^{cd} ±0.01	1.81^{d} ±0.02	1.89^{cd} ±0.02	1.88^{cd} ±0.02	1.91^{cd} ±0.05	1.94^{bc} ±0.02	1.92^{bcd} ±0.05	**
Performance Index											
	78.93^{c} ±4.45	80.33^{c} ±5.07	94.29^{ab} ±1.60	92.73^{ab} ±0.50	97.79^{a} ±0.97	93.45^{ab} ±0.79	93.89^{ab} ±0.64	94.09^{ab} ±4.92	84.61^{c} ±2.90	88.52^{bc} ±4.39	**

$^{a-e}$ Means within a row with different superscripts are significantly different ($P \leq 0.05$).
C= Nonsupplemented control.
C1, C2 and C3 = Corn oil with 0.5, 1.0 and 1.5%, respectively.
O1, O2 and O3 = Olive oil with 0.5, 1.0 and 1.5%, respectively.
T1, T2 and T3 = tallow with 0.5, 1.0 and 1.5%, respectively.

Table 5. Relative percentage weight of carcass and yields of individaul parts of eviscerated caracass of broiler chicks as affected by supplemental different fat sources.

Trait	Treatment								
	C	C1	C2	C3	O1	O2	O3	T1	T2	T3	Sig.
Hot carcass	70.77^{b} ±0.49	69.30^{b} ±0. 64	70.41^{b} ±0.76	74.97^{a} ±1.90	71.06^{b} ±0.47	70.90^{b} ±0.81	70.31^{b} ±0.71	68.58^{b} ±0.65	69.90^{b} ±0.71	68.50^{b} ±1.07	**
Front half (breast &wings)	39.75 ±0.41	38.83 ±0.49	39.66 ±0.57	40.53 ±1.53	40.12 ±0.46	39.93 ±0.74	39.25 ±1.42	38.55 ±0.40	39.15 ±0.48	37.90 ±.95	NS
Back half (thigh &legs)	31.04^{b} ±0.24	30.95^{b} ±0.22	30.74^{b} ±0.45	32.89^{a} ±0.86	31.16^{b} ±0.40	31.12^{b} ±0.42	31.50^{b} ±0.57	30.21^{b} ±0.28	30.75^{b} ±0.49	30.57^{b} ±0.30	*
Abdominal fat	1.16^{d} ±0.06	1.24^{d} ±0.17	1.34^{d} ±0.09	1.37^{d} ±0.11	1.18^{d} ±0.03	1.19^{d} ±0.08	1.46^{cd} ±0.09	1.72^{bc} ±0.13	1.90^{b} ±0.08	2.45^{a} ±0.12	*
Liver	2.50^{b} ±0.20	2.61^{b} ±0.21	2.13^{b} ±0.12	2.45^{b} ±0.03	2.12^{b} ±0.11	2.16^{b} ±0.10	2.19^{b} ±0.13	2.11^{b} ±0.07	2.08^{b} ±0.10	2.38^{b} ±0.06	NS

$^{a-d}$ Means within a row with different superscripts are significantly different (*P≤0.05)*.

C= Nonsupplemented control.

C1, C2 and C3 = Corn oil with 0.5, 1.0 and 1.5%, respectively.

O1, O2 and O3 = Olive oil with 0.5, 1.0 and 1.5%, respectively.

T1, T2 and T3 = tallow with 0.5, 1.0 and 1.5%, respectively.

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الملخص العربي

معالجة التأثيرات السلبية لموسم الصيف علي الأداء الإنتاجي والمناعة الذاتية لكتاكيت اللحم باستخدام مصادر مختلفة من الدهون

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استخدمت في هذه التجربة عدد ٣٠٠ كتكوت تسمين عمر أسبوعين من سلالة الهابرد. وزعت الكتاكيت عشوائياً علي عدد عشر مجموعات تجريبية اشتملت كل منها علي ٣٠ كتكوت موزعة بالتساوي علي ثلاثة مكررات.

استخدمت المجموعة الأولي كمجموعة مقارنة (كنترول) غذيت علي العليقة الأساسية بدون إضافات، بينما أعطيت المجموعات التسع الأخرى احد المستويات التالية (٠,٥ أو ١,٠ أو ١,٥%) من أي من المصادر الآتية (زيت الذرة أو زيت الزيتون أو الدهن الحيواني)، وتم تقدير المناعة

الذاتيـة ضـد كـرات دم الغـنم وبعـض مكونـات الـدم وكـذلك وزن الجـسم ومعـدل التحويـل الغـذائي ومواصفات الذبيحة.

وكانت أهم النتائج ما يلي:-

- سـجلت الكتاكيـت المعطـاة زيـت الـذرة بـأي مـن مـستوياته الـثلاث قيمـا اعلـي معنويـا للاسـتجابة المناعيـة عـن تلـك المعطـاة زيـت الزيتـون بالمـستوي العـالي (١,٥%) وتلـك المغـذاة علـي عليقـة مضاف إليها الدهن الحيواني بالمستويات ٠,٥ و ١,٥%.

- الوزن النسبي للأعضاء اللمفاوية في الكتاكيت المغذاة علي علائق مضاف إليها زيت الذرة بأي من مستوياته الثلاث كان اعلي معنويا من المجموعات التجريبية الأخرى.

- أدت التغذية علي ١,٥% من زيت الذرة إلي ارتفاع مستوي كل من بروتينات الدم والجلوبيولين بالمقارنة بالمجموعات التجريبية الأخرى.

- ارتفع مستوي كل من الليبيدات الكلية والكوليستيرول في الدم للمجموعات المغذاة علي علائق مضاف إليها الدهن الحيواني بالمستويات الثلاث.

- لم تتأثر وظائف الكبد سلبيا مع استخدام أي من المصادر الثلاثة.

- سـجلت اقـل زيـادة فـي وزن الجـسم لطيـور المجموعـة المقارنـة وتلـك المعطـاة الـدهن الحيـواني بالنسب ١ و١,٥%.

- أظهرت كتاكيت المجموعة المقارنة اعلي استهلاك غذائي وأسوأ تحويل غذائي وكفاءة اقتصادية.

- زاد محتوي دهن البطن مع استخدام الدهن الحيواني بالمقارنة باستخدام الزيوت النباتية.