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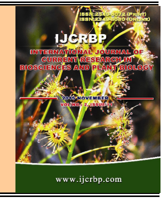

Original Research Article

Influence of Feeding Dried Vegetable Fat Blend with or without Emulsifier and/or Yeast Culture on Productive, Economic Performances and Some Biochemical Parameters of Broiler Chickens

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Abstract

Dried vegetable fat blend is commonly used in poultry ration as it is cheap source of energy, however it may have some adverse effect on productive performance. So this study was conducted to evaluate the effect of using dried vegetable fat blend with emulsifier and yeast culture or their combination on productive, economic performances and some biochemical parameters of broiler chickens. A total of 150 (Cobb) day old chicks were divided into five groups of 30 birds each. The treatments were: control group received no supplement (CON), basal diet with dried fat (T1), dried fat with 250 g ton^{-1} of emulsifier (T2), dried fat with 3 g kg^{-1}of yeast culture (T3), dried fat with emulsifier and yeast culture (T4). Higher significant values of final BWG ($p < 0.05$), improved FCR, dressing and breast meat yield, nutrient digestibility and net revenue were observed in broilers of T4. While T1 recorded higher thigh, abdominal fat percentage, serum cholesterol, triglycerides, LDL and VLDL. T2 and T4 had relatively greater antibody titer ($p < 0.05$) at 42 day of age . In conclusion, Our findings support the need for both exogenous emulsifier and dried yeast in broiler diet containing dried fat vegetable blend.

Keywords

Broiler chickens
Dried fat
Emulsifier
Yeast culture

Introduction

The continuous genetic improvement of broiler genetic lines results in continuous change in their nutritional requirements demanding improvements in feed formulation and manufacturing in order to supply these requirements. The addition of fat to broiler diet is mainly to increase the energy density, besides it improves the absorption fat soluble vitamins, diminish dust loss, increase palatability of ration, a source of linoleic acid and lubricant for equipment in feed mills. However the addition of high level of saturated fat to broiler rations may result in excessive visceral fat, loss of vitamin A and E which was found unbeneficial for growth and meat quality (Chae et al., 2006; Zulkifli et al., 2007). There have been controversial research results on the response of broiler chicks to dry fat. One hand, when it used to replace an equal parts (weight:weight), it resulted in inferior growth performance (Mala et al., 2004; Tabeidian and Sadegh, 2006). On the other hand, when the diets have been adjusted to compensate for the difference between the low metabolizable energy (ME) content or dry-fat and conventional oils characterized by high ME values, the change in growth performance of chicks became negligible (Mendlik et al., 1999; Dewi et al., 2011). Furthermore, it may be turned in favor of dry fat (El-Metnawy, 2005).

However, it must be considered that fat absorption increases with bird age, as young broilers have a physiological limitation to absorb that nutrient (Jeason and Kellog, 1992; Nir et al., 1993; Lima et al., 2003).Those physiological limitations of the digestive system of poultry may be overcome using endogenous and/or exogenous strategies to maximize feed digestion and absorption. The addition of a synthetic emulsifier to broiler diets is a recent practice as compared to other dietary supplements. The mode of action of emulsifiers is to increase the active surface of fats, allowing the action of lipase, which hydrolyze triglyceride molecules into fatty acids and monoglycerides and favor the formation of micelles consisting of lipolytic products. This is an essential step for lipid absorption, as it creates a diffusion gradient that increases absorption.

Chicks fed dry fat instead of oil accumulated a significantly higher percentage of abdominal fat, higher concentration of blood cholesterol and triglycerides (Abdelrahman, 2013). *Saccharomyces cerevisiae* known "baker's yeast" is one of the most widely commercialized species and one of the effective adsorbents which is rich in crude protein (40-45%) and also rich in vitamin B complex, biotin, niacin, pantothenic acid and thiamin and its biological value is high (Reed and Nagodawithana, 1999). Some studies have confirmed that the effects of yeast culture could be an alternative to antibiotic-based drugs in feed for broiler chicks (Hooge et al., 2003; Stanley et al., 2004). In addition, dietary SC has been known to lower cholesterol concentration in chickens (Stanley et al., 1993 and Lee et al., 2005). So the aim of the present study was to evaluate the influence of feeding broiler with ration containing dry fat supplemented with emulsifier (lysofort) or yeast (*Saccharomyces cerevisiae*) or combination of both on growth performance, blood parameters, immunity, carcass traits, nutrient digestibility and economic efficiency.

Materials and methods

Birds, experimental design and husbandry

The experiment was carried out under the protocol approved by the Faculty of Veterinary Medicine, Sadat City University, Egypt. A total of 150 one-d-old Cobb 500 broiler chicks of mixed sex were randomly assigned to 5 treatments, each treatment comprised 3 replicates with 10 birds each. The birds were fed starter mash diets until 21 d of age and followed by finisher diet from d 22 to d 42 of age. Diets were formulated to meet NRC recommendations (NRC, 1994). The ingredients and chemical composition of the basal diets are presented in Table 1. Proximate analysis, which was conducted according to AOAC International (1995), showed no major deviation from calculated values. The effect of replacement of vegetable oil with dried fat source (polyfat) with or without emulsifier (Lysoforte) and/or yeast culture (*Saccharomyces cervisae*) supplements was the motivation for undertaking the current study. To provide iso-caloric diets, dried fat was included at the rate of 3.8% and 5.1% in starter and finisher diets respectively.

The 5 treatment diets were: 1) Basal diet, corn-soybean-oil meal diet (CON); 2) corn-soybean-dried fat diet (T1); 3) dried fat supplemented diet with 250 g ton^{-1} of lysofort (T2); 4) dried fat diet with 3 g kg^{-1} of yeast culture SC (T3); 5) dried fat supplemented diet with 250 g/ton of lysofort plus 3 g kg^{-1} of yeast culture SC (T4). Polyfat® was provided by Norel-Misr, Egypt, and according to the manufacturer it is calcium salts of 70% palm oil fatty acids, 25% sunflower and corn oils, and 5% soybean oil, and 6600 kcal ME kg^{-1}.

The fatty acids pattern of Polyfat® comprises 57.6% unsaturated fatty acids and 42.4% saturated fatty acids, while calcium contributes with 8.55% of the product. Lysoforte Booster® is composed mainly of lysophosphatidyle choline (Lysolecithin), recognized as a natural absorption enhancer and manufactured by Kemin Europa, Herentals, Belgium. Yeast culture is a commercial probiotic source (Bro-biofair, vitality Co., Egypt) labeled as each kg contains 100 g *Sacchromyces cervisae* (10^{10} cell/g) and 900g carrier (90% soy meal, 5% molt, 5% fenu Greek) .All birds were reared in the floor pens using wood shavings as litter. Temperature was adjusted at 32 ºC ± 2 in the first week then lowered 2 ºC each successive week, and then maintained at 28 ºC ± 2. Relative humidity was about 60 to 80%. The chicks were vaccinated against Newcastle disease (ND). Access to feed (mash form) and water was provided on an *ad libitum* basis.

Table 1. Ingredients and nutrient composition (% DM) of broiler starter and finisher rations.

Ingredient (%)	Starter		Finisher	
	CON	Dried fat	CON	Dried fat
Yellow corn	59.00	58.83	63.12	62.84
Soybean meal (44%)	26.70	24.60	22.50	19.80
Corn gluten	7.00	8.40	6.30	8.10
Vegetable oil	3.00	-	4.00	-
Dry fat	-	3.80	-	5.10
Sodium chloride	0.23	0.23	0.23	0.23
Sodium bicarbonate	0.27	0.27	0.27	0.26
monocalciumphosphate[1]	1.46	1.47	1.35	1.37
Premix[2]	0.30	0.30	0.30	0.30
Limestone	1.54	1.55	1.48	1.49
DL-Methionine[3]	0.19	0.18	0.17	0.15
L- Lysine-HCL[4]	0.31	0.34	0.28	0.36
Nutrient				
ME(kcal/kg)	3100	3100	3200	3200
Crude protein	21.03	21.00	19.02	19.00
Crude fat	5.73	5.98	6.79	7.14
Calcium	0.90	0.90	0.85	0.85
Available phosphorus	0.45	0.45	0.42	0.42
Methionine	0.60	0.60	0.54	0.54
Lysine	1.24	1.24	1.10	1.10

[1]Dicalcium phosphate, 18% granular phosphate and 23 % calcium.[2]Each 3 kilograms contain: vitamin A 12000000 IU, vitamin D3 3000000 IU, vitamin E 40000 mg, vitamin K3 3000 mg, vitamin B1 2000 mg, vitamin B2 6000 mg, vitamin B6 5000 mg, vitamin B12 20 mg, niacin 45000 mg, biotin 75 mg, folic acid 2000 mg, pantothenic acid 12000 mg, manganese 100000 mg, zinc 600000 mg, iron 30000 mg, copper 10000 mg, iodine 1000 mg, selenium 200 mg and cobalt 100 mg. [3]DL-Methionine, Met AMINO® (DL-2-amino-4-(methyl-thio)-butane acid, DL-methionine, α-amino-Y-methyl-oily acid) by Feed Grade 99% (EU). [4]L-Lysine HCL 99% (Feed Grade) L-Lysine: 78.0% Min (Indonesia).

Chicken performance measurements

Body weight (BW) and feed intake were monitored on a pen basis weekly, while weight gain (BWG) and feed conversion ratio (FCR) values were consequently calculated. Mortality was also recorded on a daily basis in each pen. Chickens were killed by cervical dislocation at the end of the trial. Nine birds per treatment group (3/replicate) were randomly selected for tissue sampling and for determining carcass yield. They were defeathered, eviscerated and dressed. Abdominal fat, tissues of liver, gizzard, heart, spleen, thigh and breast meat were collected by removing skin, and connective tissue.

Blood sampling and analysis

At 21 and 42 d of age, 9 birds from each treatment (3/replicate) were randomly selected for blood analysis. Blood samples were obtained from wing vein and directly aliquoted into 2-mL sterile vials and allowed to clot for 4 h. After centrifugation (20 min, 1500 rpm), the serum was aliquoted into 1-mL vials and stored at −20 °C for serum antibody measurements using haemagglutination inhibition test as described in Abou-Elkhair et al. (2014). The serum samples at 42 d of age were also used for total serum protein, albumin, concentrations, serum glucose, cholesterol and triglyceride, high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) , using commercially available kits (Biosystem S.A, Costa Brava, 30, Barcelona, Spain) according to manufacturer's instructions.

Nutrient digestibility

In order to determine dietary nutrient digestibility, excreta samples were collected every 12h for three consecutive days after day 40. Excreta was placed in plastic bags and stored at -20°C. At the end of the collection period, excreta samples were thawed, homogenized, and pre-dried in a forced ventilation oven at 55°C for 72h, after which they were ground for subsequent analyses. Dry matter (DM), ether extract (EE), and crude protein (CP) contents were determined according to the methodology recommended by the AOAC (1990) and the coefficients of digestibility were calculated according to the method proposed by Matterson et al. (1965).

Economic measurements

Total variable costs included the price of chicks and feed (CM and enzyme prices), labor costs, value of veterinary medicaments (vaccine, disinfectant costs and veterinary supervision), litter costs and miscellaneous cost (water, fuel and electrolyte costs). It was estimated per LE during the cycle of the experiment. Total fixed costs included the costs of building and equipment depreciation (L.E). The depreciation of the building and equipment was calculated according to the following equations (Saad et al., 2014)

Value of building depreciation for each chick = (value of building (L.E)/No. of years (20 yrs.))/No. of cycle per year ÷ Total number of chicks. Value of equipment depreciation for each chick = (value of equipment (L.E)/No. of years (5 yrs.) /No. of cycle per year ÷ Total number of chicks.

Total cost was calculated from the summation of total fixed cost and total variable cost. Total returns were the sum of litter sale and chicken sale. Chicken sale value = body weight at end of the experiment (6^{th} wk) × gram price. Net profit was the net income using the following equation: Net profit = Total return – Total cost. Efficiency measures were calculated as follow: feed Economic efficiency (FEE) = Revenue / Feed cost and Productive efficiency =Final body weight / Total feed intake.

Statistical analysis

Experimental data were subjected to ANOVA one way analysis of variance (Steel and Torrie 1980), Significant means among variables were separated by Duncan's multiple range test at 5% level of significance as outlined by Onuh and Igwemma (1998).

Results and discussion

Growth performance

The effect of replacing vegetable oil with dried fat blend in broiler diet with supplementation of exogenous emulsifier and/ or yeast culture during starter, finisher and overall periods on BW, BWG, feed consumption and FCR were summarized in Table 2. The data revealed negative effect on growth performance in birds fed on dried fat diet (T1) in term of BW, BWG and FCR when compared with control one (CON) all over experimental periods. This effect was significant in the starter phase of the experiment. However, the birds fed on dried fat supplemented with lysofort (T2) or yeast culture SC (T3) or combination of them (T4) showed significant improvement in growth performance parameters when compared with T1 during starter, finisher and overall periods. Additionally, birds fed on (T4) (dried fat + lysoforte + SC yeast) revealed higher BWG and best FCR compared to other groups during the whole experimental periods. While, birds in group T3 (dried fat + SC yeast) revealed higher feed intake along the experiment when compared with other groups.

Carcass traits

The effects of feeding experimental diets on carcass characteristics were presented in Table 3. Dressing percentage of birds fed on T4 was significantly higher than CON and other treatments. Addition of dried fat either alone or supplemented with lysoforte and/ or SC yeast didn't influence relative weight of liver, gizzards, heart and spleen. However, the breast meat percentage increased significantly in birds fed on T4 and insignificantly in birds fed on T2 and T3 when compared to T1 and CON. Data concerning the thigh percentage in the present study revealed non-significant increase in thigh percentage in broiler of T1 (dried fat based diet) compared to other treatment groups. Additionally, feeding broiler on dried fat instead of oil without supplementation (T1) significantly resulted in a higher abdominal fat percentage among all groups.

Table 2. Body weight (BW), body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) values of broiler chickens in response to diet and age.

Age	Treatment				
	CON	T1	T2	T3	T4
0-21 days					
BW, g	$1096^{a} \pm 6.2$	$923^{c} \pm 5.9$	$1046^{ab} \pm 8.1$	$1087^{ab} \pm 4.7$	$1033^{ab} \pm 5.4$
BWG, g	$1045^{a} \pm 9.2$	$872^{c} \pm 5.8$	$995^{ab} \pm 8.4$	$1036^{ab} \pm 6.2$	$982^{b} \pm 9.3$
FI, g	$1266^{b} \pm 2.5$	$1276^{ab} \pm 1.9$	$1273^{b} \pm 1.9$	$1290^{a} \pm 1.9$	$1265^{b} \pm 1.6$
FCR	$1.21^{b} \pm 0.12$	$1.47^{a} \pm 0.15$	$1.28^{b} \pm 0.15$	$1.24^{b} \pm 0.21$	$1.29^{b} \pm 0.21$
21-42days					
BW, g	$2149^{ab} \pm 7.2$	$2044^{b} \pm 8.5$	$2184^{a} \pm 9.9$	$2216^{a} \pm 9.5$	$2261^{a} \pm 8.4$
BWG, g	$1053^{c} \pm 5.2$	$1120^{bc} \pm 3.4$	$1137^{b} \pm 6.7$	$1128^{bc} \pm 8.1$	$1228^{a} \pm 5.4$
FI, g	$3105^{b} \pm 4.05$	$3115^{b} \pm 5.08$	$3095^{b} \pm 3.3$	$3137^{a} \pm 3.3$	$3100^{b} \pm 3.1$
FCR	$2.99^{a} \pm 0.19$	$2.78^{b} \pm 0.24$	$2.76^{b} \pm 0.14$	$2.79^{b} \pm 0.14$	$2.56^{c} \pm 0.21$
0-42 days					
BWG, g	$2098^{ab} \pm 9.2$	$1992^{b} \pm 4.5$	$2133^{a} \pm 7.7$	$2165^{a} \pm 7.2$	$2210^{a} \pm 8.4$
FI, g	$4371^{c} \pm 3.1$	$4391^{b} \pm 6.3$	$4368^{c} \pm 4.8$	$4427^{a} \pm 4.9$	$4365^{c} \pm 3.2$
FCR	$2.10^{ab} \pm 0.12$	$2.20^{a} \pm 0.29$	$2.07^{b} \pm 0.23$	$2.05^{b} \pm 0.34$	$1.99^{b} \pm 0.26$

abc values in the same row with a different superscript differ significantly at $p<0.05$

Table 3. Effects of experimental diets on some carcass traits of broilers at 42 days age.

Parameter	Treatment				
	CON	T1	T2	T3	T4
Dressing%	$72.39^{b} \pm 1.3$	$71.81^{b} \pm 1.3$	$74.19^{ab} \pm 0.99$	$72.86^{b} \pm 1.4$	$77.21^{a} \pm 0.85$
Liver NS	2.85±0.004	2.86±0.003	2.68±0.008	2.74±0.006	2.9±0.007
Gizzard NS	2.13±0.06	2.00±0.01	2.08±0.08	2.17±0.09	2.01±0.02
Heart NS	0.59±0.009	0.56±0.005	0.61±0.001	0.62±0.003	0.58±0.006
Spleen NS	0.17 ±0.003	0.19±0.009	0.22±0.001	0.21±0.006	0.23±0.007
Breast meat %	$25.69^{b} \pm 0.07$	$25.64^{b} \pm 0.05$	$27.71^{ab} \pm 0.04$	$27.92^{ab} \pm 0.02$	$28.36^{a} \pm 0.07$
Thigh %	$6.75^{ab} \pm 0.01$	$7.37^{a} \pm 0.6$	$6.96^{ab} \pm 0.2$	$6.57^{b} \pm 0.4$	$6.91^{ab} \pm 0.09$
Abdominal fat %	$2.03^{b} \pm 0.16$	$3.05^{a} \pm 0.13$	$2.24^{b} \pm 0.13$	$2.08^{b} \pm 0.06$	$1.82^{b} \pm 0.11$

Abc values in the same row with a different superscript differ significantly at p □ 0.05

Table 4. Effects of experimental diets on some serum parameters of broiler chickens at 42 days of age.

Parameter	Treatment				
	CON	T1	T2	T3	T4
Total protein (g/dl)	$4.46^{b} \pm 0.1$	$4.74^{b} \pm 0.1$	$5.25^{b} \pm 0.2$	$7.15^{a} \pm 0.3$	$5.13^{b} \pm 0.2$
Albumin (g/dl) NS	2.55±0.06	2.35±0.06	2.38±0.01	2.51±0.05	2.42±0.03
Glucose (g/dl) NS	66.19±1.3	66.89±1.8	67.53±1.1	65.58±1.8	65.34±1.9
Cholesterol (mg/dl)	$201.6^{ab} \pm 9.5$	$235.6^{a} \pm 9.4$	$208.6^{ab} \pm 8.7$	$193.0^{b} \pm 8.9$	$172.4^{b} \pm 9.3$
Triglyceride (mg/dl)	$65.95^{ab} \pm 0.65$	$69.51^{a} \pm 0.57$	$64.16^{ab} \pm 0.78$	$58.50^{b} \pm 0.93$	$60.7^{b} \pm 0.36$
HDL(mg/dl) NS	61.70±0.64	63.55±0.96	64.16±0.78	59.73±0.89	60.64±0.70
LDL(mg/dl)	$113.86^{ab} \pm 10$	$145.58^{a} \pm 9.2$	$112.83^{ab} \pm 8.1$	$92.3^{b} \pm 3.5$	$84.76^{b} \pm 4.6$
VLDL(mg/dl)	$28.35^{ab} \pm 1.7$	$31.60^{a} \pm 1.2$	$28.09^{ab} \pm 1.6$	$28.09^{b} \pm 1.6$	$27.08^{b} \pm 1.3$

Abc values in the same row with a different superscript differ significantly at $p<0.05$

Serum metabolites

Table 4 summarizes the effect of experimental diets on total protein, albumin, total cholesterol, triglycerides, HDL, LDL and VLDL. Significant increase in serum total protein was noticed in birds of T3 compared to all experimental groups. No significant influence was found for experimental treatments on serum albumin, glucose and HDL. Furthermore, chicken fed on T1 (dried fat based diet without supplementation) had higher serum cholesterol, triglycerides, LDL and VLDL, this increment was significant compared to T3 and T4 however it was insignificant compared to T2 and CON.

Antibody titer

Table 5 presents the effect of replacing vegetable oil with dried fat blend in broiler diet with supplementation of lysoforte and/ or SC yeast on antibody titer (Ab) at d 21, and 42 of age. No significant differences were found in Ab titer at 21 d of age; however, at 42 d of age, there was a significant increase in Ab in broilers of T4 and no significant increase in Ab in chickens of T2 and T3 compared to T1 and CON groups.

Table 5. Effects of experimental diets on antibody titer against ND.

Treatments	Age	
	21d of age	42d of age
CON	6.75±0.5	6.25[b]±0.4
T1	7.00±0.6	6.25[b]±0.2
T2	6.25±0.4	8.00[ab]±0.01
T3	6.25±0.7	6.75[ab]±0.6
T4	6.50±0.3	8.50[a]±0.4
ab values in the same column with a different superscript differ significantly at *p*<0.05		

Nutrient digestibility

Digestibility data are presented in Table 6, the digestibility of DM was significantly higher in T4. Moreover, digestibility of dietary fat was significantly higher in T2 and T4 than other groups. Regarding protein digestibility T4 and T3 showed higher digestibility % compared to other groups, however T2 was higher compared to CON and T1.

Economic efficiency

In accordance to Table 7, revenue and profit were significantly (P>0.05) higher for T4 group of broilers (35.360 and 9.900 LE) and lower for T1 group (31.872 and 6.308 LE) respectively in contrast to control group. Fig. 1 explained the effect of diet on productive efficiency of broilers, as T4 treated group characterized by higher productive efficiency (0.5) in comparison to control group. On the other hand, the least productive efficiency was obvious in treated T2 group.

Table 6. Effects of experimental diets on digestibility percentage of nutrients

Treatments	Parameter		
	DM%	EE%	CP%
CON	74.61 [ab]±2.50	82.23[b]±1.85	81.95[c]±1.20
T1	73.63[b]±2.20	80.03[c]±2.60	80.00[d]±1.95
T2	73.87[ab]±2.3	84.24[a]±2.40	85.88[b]±1.90
T3	75.84[ab]±1.95	82.58[b]±2.01	87.95[a]±2.10
T4	76.24[a]±1.90	84.44[a]±2.20	88.18[a]±2.10
ab values in the same column with a different superscript differ significantly at *p*<0.05			

Table 7. Effect of experimental diets on costs, revenue, profit and economic efficiency of broiler chicken.

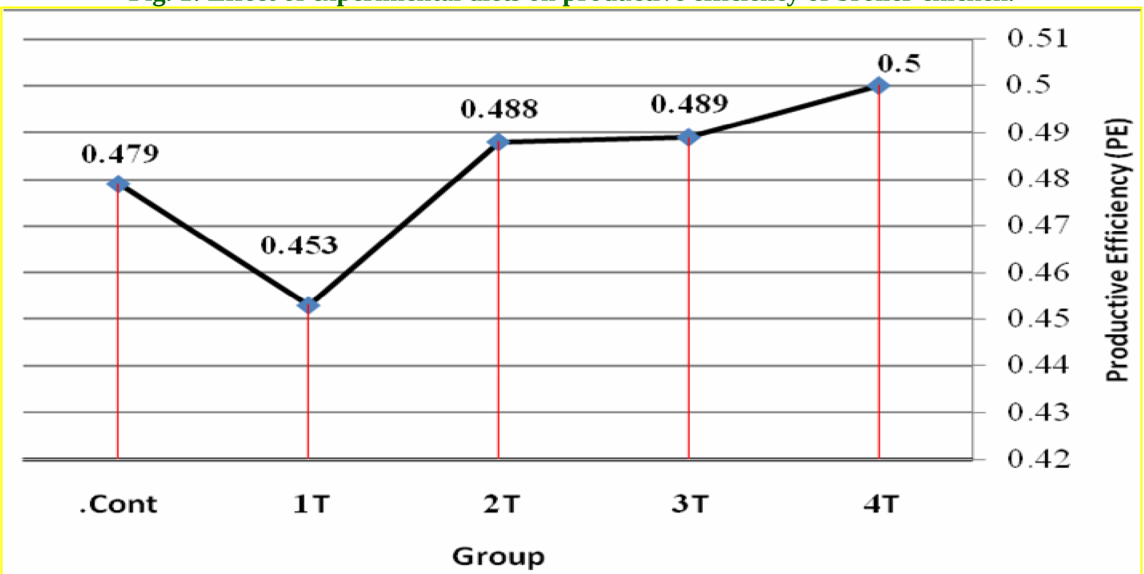
Groups	Costs (LE)		Revenue (LE)	Profit (LE)	Economic efficiency of diet
	Feed Cost	Total Cost			
Control	17.484±0.53[a]	25.484±0.34[a]	33.568±0.84[c]	8.084±0.50[c]	1.91
T1	17.564±0.76[a]	25.564±0.48[a]	31.872±1.55[d]	6.308±1.07[d]	1.81
T2	17.472±0.44[a]	25.472±0.75[a]	34.128±0.76[b]	8.656±0.01[b]	1.95
T3	17.708±0.56[a]	25.708±0.45[a]	34.640±0.65[b]	8.932±0.20[b]	1.95
T4	17.460±0.23[a]	25.460±0.76[a]	35.360±0.86[a]	9.900±0.10[a]	2.02

Discussion

Growth performance

The significant lowest growth performance for birds fed on dried fat based diet (T1) along the experimental periods, especially in the starter phase might be due to increased saturated fatty acids (56.2%) and lowest ratio of unsaturated to saturated fatty acids (0.78) in the dried fat blend. In addition to high levels of free saturates are not well utilized by young birds where the young birds have less efficient fatty acids binding proteins, can't recycle bile salt as the adult birds (Wiseman et al., 1991). This finding match with Abdelrahman, (2013) and Mala et al., (2004) who reported inferior growth response of broiler to dry-fat feeding. On other hand, El-Metnawy (2005) and Dewi et al., (2011) stated that feeding a dry fat product rich in unsaturated fatty acids could improve growth performance of broilers to levels equal to conventional oils rich in unsaturated fatty acids, provided that it was compared to iso-caloric based diets. The positive effect for exogenous emulsifier (lysoforte) on growth performance of birds in groups T2 and T4 compared to T1 and CON groups may be due to emulsifier increase the active surface of fat, allowing the action of lipase and favor formation of micelles which create diffusion and increase fat absorption. This result is confirmed by some studies which indicate that lecithin improves growth performance of broilers (Huang et al., 2007) and Roy et al.(2010) who reported beneficial results for emulsifier on digestibility, BW and FCR and gain weight. However others indicate no positive effects (Azman and Ciftci, 2004). These contrasts may be associated with an interaction between the type of fat and (or) the use of external emulsifiers (Zhang et al., 2011). De Vos and Maertens (2010) reported that a vegetable emulsifier added to broiler diets had no enhancing effect on growth performance of broilers compared to the control group without supplementation. While, Zhang et al. (2011) reported positive response for Lysoforte supplementation during the starter period, and not for latter or total growth periods.

Fig. 1: Effect of experimental diets on productive efficiency of broiler chicken.



The higher growth performance in birds of group T3 and T4 which were supplemented with SC yeast culture compared to T1 and CON groups was in conformity with the findings of Abdelrahman (2013) who reported that adding yeast culture (3kg ton^{-1}) to a diet containing dry fat improve BWG and FCR of broiler chickens. Moreover, Swamy and Upendra (2013), Hosseini (2011), Zhang et al, (2005), Gao et al. (2008) and Paryad and Mahmoudi (2008), who found that feeding SC yeast culture to chicks improved body weight gain and feed conversion ratio. Additionally Paryad and Mahmoudi (2008) observed that feeding 1.5 % yeast fed to chicks increased feed intake compared to control. Significant increase in body weight gain on supplementation of SC yeast in the present study could be possibly due to alleviation of stress in birds by providing necessary vitamins, release of unidentified growth factors, secretion of digestive enzymes by yeast and the release of high biological value protein (Stanely et al., 1993) and improving protein digestibility (Bonomi et al., 1977).

Carcass traits

The data of the present study suggested that dried fat feeding to broiler chickens had no negative effect on dressing and the breast meat percentage, liver, gizzard, heart and spleen relative weight . These results were in good agreement with those reported by Boulos et al. (2011), Shahryar et al. (2011), Tabeidian and Sadegh (2006) and El-Metnawy (2005). However insignificant increase in the thigh percentage due to dried fat feeding is in accordance with findings of Lesson and Summer (2005). The increased of thigh weight might be due to increased ME from increased utilization of other components of diets and not from fat itself (Carew Jr et al., 1963). Additionally, significant increase in abdominal fat percentage in birds of T1 compared to CON and other groups is similar to the results of Abdelrahman (2013) and Gazalah et al. (2007) who demonstrated significant accumulation of abdominal fat in chicks fed dried fat instead of oil. In contrary, Boulos et al. (2011) and Dewi et al. (2011) stated a reduction in abdominal fat in broiler fed dried fat. The positive effect of exogenous emulsifier (lysoforte) on dressing percentage, breast meat and reduction of abdominal fat are in the same trends with the results of Roy et al. (2010) and Ashraf (2007) who indicated improvement in carcass and breast yield due to supplementation of exogenous emulsifier to broiler ration. However, other works reported no effect for emulsifier on carcass, breast yield or abdominal fat (Aguilar et al., 2013; Neto et al., 2011; Boulos et al., 2011). Moreover, addition of the dried yeast SC to dried fat diet significantly decreased abdominal fat, in agreement with the findings of Abdelrahman (2013), Paryad and Mahmoudi (2008) and Kalavathy et al. (2003). Additionally, the increases in dressing and breast meat percentage due to yeast supplementation were in agreement with previous studies (Paryad and Mahmoudi, 2008; Zhang et al., 2006; Kannan et al., 2005). In the current study, the improvement in carcass traits of the broiler chicks in group T4 may be due to the synergistic effect for emulsifier and yeast culture.

Serum metabolites

The present results showed that broiler chicks fed ration contains dried fat supplemented with yeast culture SC had significantly higher serum total protein among other groups. This observation corroborated data published by some authors (Akhavan-Salamat et al., 2011; Paryad and Mahmoudi, 2008; Gudev et al., 2008; Kannan et al., 2005). This increment may be due to serum total protein have been reported to be directly responsive to protein intake and quality (Eggum, 1989). Whereas , there was no influence for the treatments on serum albumin. Reduction in serum circulating cholesterol, triglycerides, LDL, VLDL with supplemental yeast was remarkable and agrees with the results of other researchers (Paryad and Mahmoudi, 2008; Lee et al., 2005; Abdelrahman, 2013) who reported a significant higher concentration of blood serum cholesterol in the chicks fed dry fat which is reduced by supplementation with dried yeast culture SC. These findings support our results, which conclude that the feeding of higher saturated fatty acid as dry fat increases the deposition of fat in broiler tissues and the cholesterol level in the blood serum when compared to vegetable oil. The mechanisms proposed for the lowering of the blood serum cholesterol level by yeast culture probiotics are numerous. One of the proposed mechanisms includes the enzymatic effect on gallbladder bile salt deconjugating under anaerobic conditions by bile-salt hydrolase of probiotics, which mainly consist of cholesterol. Once deconjugated, bile acid is less soluble and is easily eliminated in the feces. Hence, the cholesterol will be used to synthesize new bile salts in a homeostatic response that results in lowering the serum cholesterol (Begley et al., 2006). Other researchers reported that probiotics remove cholesterol by binding onto the cell surface and incorporating in the cellular membrane during growth (Chiang et al., 2008). Moreover in this scene, supplemental exogenous emulsifier insignificantly reduce serum cholesterol, triglycerides, LDL and VLDL taking into account that the inclusion of high level saturated fatty acids in diets increase concentration of VLDL, LDL and triglycerides (Aguilar et al., 2011). This are coincided with other researches (Fascina et al., 2009, Huang et al., 2007 and Spilburg et al., 2003) who observed lower triglycerides and cholesterol level in broilers fed soybean oil as compared to those fed diet containing animal fat. On other hand no significant difference was found in HDl between treatments which is confirmed by Aguilar et al. (2013), Neto et al. (2011) and Huang et al. (2007). Additionally no significant difference was found in serum glucose level (Cho et al., 2012).

Antibody titer

In this study the inclusion of both lysoforte and SC yeast to broiler dried fat diet, resulted in increased antibody titers against NDV in 42 days of age. Several workers reported that SC improved the efficacy of immune system, improved intestinal lumen health and increased digestion and absorption of nutrients which resulted in better performance (Mehdi and Hasan, 2012; Gao et al., 2008; Spring et al., 2000). Additionally lysolecithin play a role in T- lymphocyte activation improving both cellular and humoral immunity (Yoshinori et al., 1992). Moreover, it plays a role in promoting rapid reflux of monocytes and activates the macrophage consequently causing phagocytosis of myelin debris (Ousman and David, 2000).

Nutrient digestibility

The digestability data showed that the supplementation of lysolecithin and SC to dried fat diet increased significantly DM digestibility (T4) and the effect of lysolecithin was more pronounced in fat digestibility resulted in significant increase in T2 and T4. Moreover the role of SC yeast was appeared in T3 and T4 indicating higher detestability of protein. These results were in agreement with that of (Akhavan-Salamat et al., 2011 and Woyengo et al., 2010) who recorded a significant increase in DM and protein utilization in broiler fed yeast culture. Moreover, the use of dietary emulsifier has proved to be a tool to improve utilization of fats in birds (Roy et al., 2010). Zhang et al., 2011 found that the dietary addition of an emulsifier stimulates the formation of emulsion droplets which favors fat digestibility. Additionally Maertens et al. (2013) reported that the emulsifier addition in broiler diet significantly increased fat and protein digestibility. Also Swamy and Upendra (2013), Stanely et al. (1993) and Buche et al. (1992) demonstrated maximum retention of nitrogen and improved protein digestibility in broilers supplemented with yeast.

Economic efficiency

The present results may be attributed due revealed positive effect of dried fat on feed efficiency and best feed utilization by birds. The feed economic efficiency was higher (2.02) for group T4, this means that, the method of treatment for group 4 was the best one in decision making during choice among dried vegetable fat for broiler. These resulted run parallel with Ezema and Eze (2009) who reported that addition of different level of dried fat and yeast improve feed utilization and economic efficiency in commercial broilers. The results also support the results of Abd El-Gawad et al. (2004) and Omer (2014).

Conclusion

It was concluded that supplementation broiler diet containing dried vegetable fat blend with both exogenous emulsifier and yeast culture significantly improve productive performance, economic efficiency, nutrient utilization and health status of broiler chicks.

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