ORIGINAL ARTICLE

EFFECT OF DIETARY FAT SOURCE AND LEVELS AND FEED MANIPULATION SYSTEMS ON BROILER SERUM AND CARCASS CHEMICAL ANALYSIS

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ABSTRACT

Back ground: there are many production factors and feed manipulations that affecting the meat chemical analysis sequent affecting meat quality and storage time. **Objectives:** these experiments are conducted to study the effect of nutrition and feed manipulation on meat traits. **Material and Methods**: This study comprised of four experiments. The first experiment was in the form of a feeding trial to study the effect of four levels and two sources of dietary fat on broiler chicks' carcass traits. The second, third, and fourth experiments were designed to investigate the effect of three methods of feed restriction (quantitative feed restriction, calorie to protein ratio, and phase feeding) on broiler carcass chemical analysis. The birds used in the experiment were commercial unsexed hybrid broiler strain (Ross 308), purchased at day-old from a local hatchery in Khartoum (coral). They were reared in an open deep litter experimental house in the poultry unit of the faculty of Animal Production. A number of 210 uniform chicks were selected and assigned at random to each of the twenty one experimental pens, at the rate of ten chicks per pen. The experimental diets were randomly assigned to the experimental units (pens) at the rate of three replicates per treatment in a completely randomized design arrangement. The diets were fed for an experimental period of six weeks. Feed and water were supplied ad libitum, and records were kept for weekly feed intake, live weight and daily mortality. As a fat source and level, beef tallow was added to three of dietary treatments at the rate of 2.0, 4.0, and 6.0 percent; while vegetable oil (sunflower) was similarly added to other three dietary treatments. The seventh experimental diet was used as a control diet (without addition of fat). The second study was in form of a six week broiler feeding trials, in the poultry experimental unit of the Faculty of Animal Production. 90 out of the purchased 110 day-old chicks were reared on a deep litter floor in an open experimental house and divided in to three experimental chick groups and each group was replicated thrice and hence at random in rate of 10 chicks per pen. The control group was fed adlibitum throughout the experimental period while the other two groups were restricted in respective during the third and fourth weeks of age to 80%, and 60% of the control group allowance then re-alimenting during the last two weeks. Third study: a number of 90 unsexed day old commercial broiler chicks (Ross308) reared for six weeks in deep litter open house and assigned to three dietary treatments of different protein to calorie ratios: (23:3200 (1:139); 24:3170 (1:128); and 21: 3267 (1:154)) were examined. The experimental diets were randomly distributed among the experimental birds for the first three weeks of age then the birds on (1:128, or 1:154) diets were switched to a finisher diet (1:162) for the last three weeks while the birds on (1:139) were continued on the same diet. Fourth study: a number of 90 chicks (Ross308) from the healthy and uniform chicks were selected and (Ross308) reared for six weeks in deep litter open house and assigned randomly to the three dietary treatments each replicated three times (nine experimental pens, at the rate of ten chicks per pen). Treatment one consisted of one diet (starter) for all experimental period. Treatment two consisted of two diets (starter and grower) introduced three week for each. Treatment three consisted of three diets (starter, grower, finisher) each introduced for two weeks. **The results:** the dietary fat source and level significantly affect only ether extract and ash. With exception of nitrogen free extract with physical feed restriction, the three experiments revealed no significant ($P<0.05$) effect on the other chemical characteristics. **Conclusion:** The dietary fat source and level and physical feed restriction significantly only affect ether extract, ash and nitrogen free extract.

Key words: poultry, broiler, fat, carcass, chemical analysis.

INTRODUCTION

Newman et al (2002) observed in birds fed fish oil and sunflower oil diets had significantly higher water contents of breast muscle ($P<0·05$) than tallow-fed birds, also they stated that the percentage incorporation being 4·7 and 4·4 respectively [1]. Ragab and Osman (2008) revealed no significant difference among dietary treatments in chemical composition of broiler meat pourcentage. No significant differences were detected among dietary treatments in the carcass traits [2]. Therefore, it is likely that the high dietary energy levels may not have differed enough to cause significant differences in carcass traits. Also the same authors indicated insignificant effects of high energy diets on serum constituents except that total protein ($P\leq0.01$) and globulin ($P\leq0.05$) had significant effect. Chicks fed diets containing high energy level (3320 kcal/kg diet for the last three weeks or two weeks (29 to 42 days)) had the highest values of total protein and globulin. Ozdogan, and Aksit (2003) revealed that the moisture content of thigh meat was significantly higher in broilers fed a diet

containing Soybean oil (P < 0.05) compared to sunflower oil, but breast meat was not affected [3]. Sunflower oil was comparable to the other three fat sources, but breast meat was not affected. The ash contents of the thigh (P < 0.05) and breast (P < 0.01) meats were found to be significantly different as a result of feeding different fats. The diets containing Tallow had the highest ash content compared to SFO diets with the lowest levels. Zakaria (2013) conducted an experiment to evaluate the effect of different levels of dry energy sources, reported that Different significance was shown in meat analysis such as DM, fat and ash pourcentage with the different levels of fat and forms of feed [4]. Omenka and Anyasor (2010) in a study aimed to investigate the effect of vegetable based feed on the nutritive quality of broiler meat, found that there was no significant difference (P>0.05) in plasma-protein and muscle protein content between the treated groups [5]. This indicated that low fat and high protein meat could be obtained from birds fed on the experimental vegetable formulated feeds. Mohammed and Horniakova (2012)) stated that high level of total protein in blood for female was in group T3 (2% poultry fat +2.5% sunflower oil) (37.04g.l-1) and for male was in group T2 (2.5%PF+2.5% rapeseed) (48.35g.l-1). Differences were significant (P≤0.01) [6].

2. MATERIAL AND METHODS

2.1 Experiment I: Effect of the Dietary Fat Sources and Levels on broiler serum and carcass chemical analysis

2.1.1 Experimental: A six week feeding trial was carried out, with day-old broiler chicks, to study the effect of two sources and four levels of dietary fat on performance and lipid profile in serum and carcass.

2.1.2 Experimental diets: The formulated diets employed in experiment and their calculated and determined chemical composition as shown in Table (1) were seven boiler chicks starter diets, supplemented with various levels of sunflower oil or beef tallow. The diets were formulated from local feed ingredients commonly used for poultry feeding in the Sudan.

Table 1: The table presents the ingredients formulation of the experimental diets (percent as fed).

Item	Control	$BT_{2\%}$	$BT_{4\%}$	$BT_{6\%}$	$VO_{2\%}$	$VO_{4\%}$	$VO_{6\%}$
Sorghum	63.1	58.7	55.7	52	59	55	52.1
Groundnut meal	16.1	19.0	18.7	20.8	18.7	18.6	20.7
Sesame meal	9.6	9.0	10.5	10.0	9.0	11.0	10.0
Super concentrate	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Beef tallow	0.0	2.0	4.0	6.0	0.0	0.0	0.0
Vegetable oil (sunflower)	0.0	0.0	0.0	0.0	2.0	4.0	6.0
Wheat bran	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Dicalcium phosphate	2.7	2.7	2.7	2.7	2.6	2.5	2.7
Lysine	0.14	0.15	0.12	0.15	0.14	0.15	0.14
Methionine	0.05	0.06	00.04	0.06	0.05	0.10	0.05
Common salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100	100

Calculated analysis of the experimental diets:

ME (Kcal/Kg	3199	3253	3323	3381	3289	3378	3463
Crude protein (percent)	22.90	23.40	23.50	23.70	23.30	23.60	23.70
Fat	3.21	5.05	7.09	9.07	5.55	7.27	9.54
Crude fiber	4.70	4.90	4.90	4.95	4.90	4.95	4.95
Calcium	1.45	1.46	1.47	1.48	1.42	1.44	1.48
Lysine	1.19	1.22	1.19	1.23	1.20	1.22	1.22
Methionine	0.49	0.50	0.49	0.50	0.49	0.55	0.49

Proximate analysis of the experimental diets:

Moisture	1.00	1.50	1.00	1.00	1.50	1.23	1.00
Crude protein	22.80	22.9	22.92	22.90	22.95	22.90	22.87
Ether extract	3.40	5.00	7.00	8.97	4.98	7.10	9.00
Crude fiber	3.01	4.00	4.20	4.01	4.00	4.30	4.00
ME Kcal/Kg	3150	3200	3297	3300	3259	3348	3403

BT: beef tallow **VO**: vegetable oilBroiler chicks super-concentrate (5% Nutristar) contain 40% crude protein, 1.44% crude fiber, 3.9% crude fat, 1950Kcal/Kg metabolizable energy, 10% lysine, 3% Methionine.

2.1.3 Experimental birds and management: The birds used in the experiment were commercial unsexed hybrid broiler strain (Ross 308), purchased at day-old on 23th July, 2007 from a local hatchery in Khartoum (coral). They were reared in an open deep litter experimental house in the poultry unit of the faculty of Animal Production. A number of 210

uniform chicks were selected were assigned at random to each of the twenty one experimental pens, at the rate of ten chicks per pen.

2.1.4 Experimental procedures: The experimental diets were randomly assigned to the experimental units (pens) at the rate of three replicates per treatment in a completely randomized design arrangement. The diets were fed for an experimental period of six weeks. Feed and water were supplied ad libitum, and records were kept for weekly feed intake, live weight and daily mortality. At the end of the experimental period, three birds were selected at random from each pen (9 birds per treatment). The selected birds were slaughtered by severing the throat, jugular veins, carotids, trachea and esophagus, and allowed to bleed. Blood samples were taken for plasma analysis; the birds were weighed, and then scalded by immersion into hot water at 65C for 30 minutes. They were then hand plucked, and thoroughly washed and drained. Each plucked carcass was weighed and its warm carcass weight was recorded. The head was removed, eviscerated, The following part of each carcass were weighed individually, The carcasses were then chilled, carcasses were cut into smaller parts, and deboned into meat and bone. The blood samples were centrifuged and serum samples were used for determination of plasma total protein, albumin, cholesterol, and triglycerides.

2.1.5 Experiment chemical analysis: Cholesterol concentration (mg/dl) was estimated by kit method named as Enzymatic Colorimetric Test (Cholesterol oxidase- Peroxidase (CHOD-PAP) with ATCS). The reagent and their concentrations are shown in Table (2).

Table 2: The table presents the reagent composition and concentrations.

COMPONENTS	concentration
Good´s buffer, pH 6.7	50 mmol/L
Phenol	5 mmol/L
4-Aminoantipyrine	0.3 mmol/L
Cholesterol Esterase	≥ 200 U/L
Cholesterol Oxidase	≥ 50 U/L
Peroxidase	≥ 3 KU/L

Triglycerides (mg/dl) were detected by kit method called GPPO-PAP with ATCS.

Table 3: The table presents the reagent concentration of the triglycerides test.

Reagent	concentration
PIPES [Piperazine-1.4-bis (2-ethane-sulfonic acid)]	50.0 mmol/L
EDTA	0.13 mmol/L
ATP (Adenosine-tri-phosphate)	1.65 mmol/L
Magnesium ions	0.5 mmol/L
4-Aminophenazone	0.6 mmol/L
4-Chlorophenol	1.55 mmol/L
GPO (Glycerophosphate-Oxidase)	≥ 2.5 KU/L
Glycerolkinase	≥ 1.0 KU/L

Detergent, Stabilizer, preservative. Standard: The Concentration as indicated on vial.

Fatty acids determined with 1g with mixture of chloroform-methanol and 0.88% NaCl in water bath at 50C under N_2 flow then adds boron-trifloride-methyl solution to covert fatty acids methyl ester which will be analyzed by gas liquid chromatography then fatty acid peaks (percent) determined by gas chromatograph were then used to calculate the amount of fatty acids (g/100 g fat) by theoretical response factors.

2.1.6 Statistical analysis: The data of weekly and overall experimental period performance parameters, carcass and visceral parts, carcass composition, and plasma composition were collected and statistically analyzed for a 2×3 factorial experiment for the determination of the main effect and interaction for source and level of dietary fat. Treatment differences were estimated by analysis of variance according to statistix computer programme using 2×3 factorial design, and the differences among treatment means were tested for significance using Duncan's Multiple Range Test (1985).

2.2 Experiment II: The effect of quantitative feed restriction on broiler serum and carcass chemical analysis

2.2.1 Experimental: The experimental work of this study was in form of a six week broiler feeding trials, in the poultry experimental unit of the Faculty of Animal Production. The study was designing to investigate the effect of quantitative feed restriction on broiler performance, cholesterol, triglycerides, and carcass-serum characteristics.

2.2.2 Experimental diets formulation: The diet employed in this experiment is chick starter diet. The diet was formulated from local ingredients commonly used for poultry feeding in the Sudan, plus an imported broiler chick super-concentrate (Nutristar) which is incorporated at the rate of 5%, to upgrade the dietary protein content to investigate the effect of feed restriction, the formulated experimental diet was either fed *adlibitum* through the experimentation period or the feed amount regiment for growing chicks was restricted to 60 or 80% during 3rd and 4th weeks of age. In other words, 90 out of the purchased 110 day-old chicks were divided in to three experimental chick groups and each group was replicated thrice to be accommodated in the prepared experimental pens and hence at random. The first group was fed *adlibitum* the second and the third groups were restricted in respective to 60 and 80% of the control group allowance during 3rd and 4th weeks of experimentation period. The formulation, calculated and determined chemical composition of the experimental diet and detailed content of the super concentrate are shown in Table (2).

Table 4: Table presents the ingredient formulation percent of the experimental diet (percent as fed).

Ingredients	chick starter diet
Sorghum	63.08
Groundnut meal	16.1
Sesame meal	09.6
Super concentrate	05.0
Wheat bran	03.0
Dicalcium phosphate	02.73
L-lysine	0.14
DL-methionine	0.05
Common salt	0.3
Total	100
Calculated analysis of the experimental diet:	
ME (kcal/kg)	3199
Crude protein	22.9
Fat	3.21
Crude fiber	4.7
Proximate analysis of experimental diets (percent):	
ME kcal/kg	3150
Crude protein	22.8
Fat	3.40
Crude fiber	3.01
Moisture	1.00

Broiler chicks super-concentrate (5% Nutristar) contain 40% crude protein, 1.44% crude fiber, 3.9% crude fat, 1950Kcal/Kg metabolizable energy, 10% lysine, 3% Methionine.

2.2-3 Experimental birds and management: 110 unsexed day old commercial broiler chicks (Ross308) were purchased from a local hatchery Koral. They were reared from day old to six week of age on a deep litter floor in an open experimental house. The house was constructed of iron posts, wire netting walls, corrugated iron sheets roof and concrete floor. The house extends east to west. Both northern and southern sides of the house were covered with plastic sheets protecting chicks from cold, draught, and wind. Fresh wood shaving spread in each pen in depth of 6cm. The house partitioned into 9 experimental pens of equal sizes (1×1) meter area and 1.8 meters height. The dividing partitions were made of wire netting. The experimental pens were arranged in three parallel rows with two meter service gangways. Each pens provided with a round tube feeder and a fountain drinker, and a 60-watt electric bulbs, hanged from the ceiling at one meter above the floor as a source of light and brooding heat. The experimental house and the equipment were thoroughly cleaned and disinfected a week before the arrival of chicks. The feeders and drinkers were introduced in the pens one day before the arrival of chicks.

2.2.4 Experimental procedure: Unless otherwise was stated the same procedure as followed in experiment one was adopted.

2.2.5 Experiment chemical analysis: Followed the same steps as described in experiment one.

2.2.6 Experiment statistical analysis: Data were statistically analyzed with General Linear Model for analysis of variance under complete randomize design using Statistix computer program. Test of significant for the difference between means was done by Duncan's Multiple Range Test.

2.3 Experiment No (ΠI): The effect of dietary calorie to protein ratio on broiler serum and carcass chemical analysis:

2.3.1 Experimental: Six week feeding trial to study the effect of caloric to protein ratio on the broiler performance and carcass characteristics in addition to cholesterol, triglycerides, and fatty acids of the abdominal fat pad, serum and carcass.

2.3.2 Experimental diets: The study was conducted to investigate the effect of three different of protein to energy ratios (23:3200 (1:139), 24:3170 (1:132), 21: 3267 (1:155)) on the broiler carcass fat accumulation. Three starters experimental diets as shown in Table (3) were randomly distributed among the three groups of the experimental birds were each group was replicated three times (9 experimental pens). Each bird group was fed one of the three treatments through the first three weeks of age then the two dietary groups (1:132, and 1:155) were switched to the finisher diet the rest of the experimental period (3 week) while the 3rd dietary group (1:139) was continued utilizing the same diet to the end of the experimentation period. The formulation, calculated and determined chemical composition of the experimental diet and detailed content of the super concentrate are shown in Table 3.

Table 5: The table presents the ingredients of the formulated experimental diets (percent as fed).

Ingredients	Control	Diet one	Diet two	finisher
Sorghum	63.08	58.00	70.00	71.78
Groundnut meal	16.1	19.00	11.00	6.00
Sesame meal	9.6	12.05	9.00	10.85
Super concentrate	5.0	5.00	5.00	5.00
Wheat bran	3.0	3.00	2.01	3.00
Dicalcium phosphate	2.73	2.40	2.50	2.73
L-Lysine	0.14	0.15	0.14	0.14
DL-Methionine	0.05	0.10	0.05	0.20
Common salt	0.3	0.30	0.30	0.30
Total	100	100	100	100
Calculated analysis of experimental diets:				
ME (Kcal/Kg	3199	3170.00	3267.62	3263.23
Crude protein	22.90	24.60	21.14	20.10
Calorie: protein	1/139	1/132	1/155	1/162
Fat	3.21	3.28	3.31	3.54
Crude fiber	4.70	5.16	4.30	4.13
Calcium	1.45	1.44	1.35	1.41
L-Lysine	1.19	1.23	1.13	1.10
DL-Methionine	0.49	0.53	0.47	0.47
Proximate analysis of experimental diets:				
ME (Kcal/Kg	3150	3149.00	3257.02	3254.20
Crude protein	22.80	24.06	21.00	19.92
Calorie: protein	1/138	1/131	1/155	1/163
Fat	3.40	3.45	3.21	3.45
Crude fiber	3.01	4.30	4.00	4.03
Moisture	1.00	2.00	2.23	2.06

Broiler chicks super-concentrate (5% Nutristar) contain 40% crude protein, 1.44% crude fiber, 3.9% crude fat, 1950Kcal/Kg metabolizable energy, 10% lysine, 3% Methionine.

2-3.3 Experimental birds and management: 110 unsexed day old commercial broiler chicks (Ross308) were purchased from a local hatchery Koral. They were rearing from day old to six week of age on deep litter house in an open experimental house. The house was constructed of iron posts, wire netting walls, corrugated iron sheets roof and concrete floor. The house extends east to west. Both northern and southern sides of the house were covered with plastic sheets protecting chicks from cold, draught, and wind. Fresh wood shaving spread in each pen in depth of 6cm. The house was partitioned in to 9 experimental pen of equal size (1×1) meter area and 1.8 meters height, the dividing partitions were made of wire netting. The experimental pens were arranged in three parallel rows with two meter service

gangways. Each pens provided with a round tube feeder and a fountain drinker, and a 60-watt electric bulbs, hanged from the ceiling at one meter above the floor as a source of light and brooding heat. The experimental house and the equipments were thoroughly clean and disinfected a week before the arrival of chicks. The feeders and drinkers were introduced in the pens one day before the arrival of chicks. A number of 110 day-old chicks were unpacked in a separate pen (3×2 meter) inside the experimental house. They were kept for 24-hours resting period, during which they were given a dose of vitamins mix and antibiotics in the drinking water to help ease transportation stress. They were visually inspected for health and vigour, and weak, unhealthy and underweight chicks will exclude from the experiment. A number of 90 chicks were select from the remaining birds for uniformity in size, and were assigned at random to each of nine experimental pens, at the rate of ten chicks per pen.

2.3.4 Experimental procedure and data analysis: The adopted experimental procedure as well as chemical and statistical analysis was the same as that followed up in the experiment NO (6).

2.4 Experiment No (IV): The effect of phase feeding on broiler serum and carcass chemical analysis

2.4.1 Experimental: This experiment was conducted to evaluate the effect of phase feeding diets (starter, grower and finisher) on broiler performance and serum-carcass cholesterol or fatty acids profile.

2.4.2 experimental diets and procedure and management: The experiment consisted of three dietary treatments by feeding three diets (starter, grower, and finisher). Treatment one consisted of one diet (starter) for all experimental period. Treatment two consisted of two diets (starter and grower) introduced three weeks for each. Treatment three consisted of three diets (starter, grower, finisher) each introduced for two weeks. A 150 one day old commercial unsexed hybrid broiler Ross308 strain were used in the study, which purchased from coral a local hatchery in Khartoum. The birds reared in an open deep litter experimental house in the poultry unit of the Faculty of Animal Production. Experimental house portioned in to nine experimental pens. The experimental house, pens, and management were similar to that described in experiment one. A number of 90 chicks from the healthy and uniform chicks were selected and randomly assigned to the nine experimental pens, at the rate of ten chicks per pen. The calculated chemical compositions of the experimental diets were estimated from the table of Ellis (1981) for the nutrient composition of the Sudanese animal feeds. The formulation, calculated and determined chemical composition of the experimental diets and detailed content of the super concentrate are shown in Table 4.

Table 6: The table presents the ingredients of the formulated experimental diets (percent as fed):

Ingredient	control (starter) %	grower%	finisher %
Sorghum	63.08	66.212	58
Groundnut cake	16.1	17.7	19
Sesame cake	9.6	5	12.05
Concentrate	5	5	5
Wheat bran	3	3	3
Dicalsium phosphate	2.73	2.6	2.403
L-Lysine	0.14	0.14	0.15
DL-Methionine	0.05	0.048	0.097
Sodium chloride	0.3	0.3	0.3
Total	100	100	100
Calculated analysis of experimental diets: Metabolizable			
energy kcal/k	3199	3224	3170
Crude protein%	22.9	22	24.6
Calcium %	1.45	1.44	1.44
Fiber%	4.8	4.7	5.1
Ether extract%	3.6	3.4	3.8
L-Lysine%	1.19	1.17	1.25
DL-Methionine%	0.49	0.44	0.57
A proximate analysis of experimental diets:			
Metabolizable energy kcal/kg	3150	3224	3165
Crude protein%	22.8	21.8	23.5
Crude fiber%	3.01	4.2	4.00
Ether extract%	3.4	3.3	3.10
Moisture%	1.00	2.53	2.57

Broiler chicks' super-concentrate (5% Nutristar) contains 40% crude protein, 1.44% crude fiber, 3.9% crude fat, 1950Kcal/Kg metabolizable energy, 10% lysine, 3% Methionine.

3. RESULTS

Chemical analysis of abdominal fat pad is shown in Table (7). The table revealed no significant interaction (P>0.05) effect of dietary fat source and level on abdominal fat chemical analysis (moisture and dry matter), while it significantly (P<0.05) affected abdominal fat pad chemical analysis mainly crude protein, nitrogen free extract, ether extract, and ash. No significant (P>0.05) effect for fat source on the chemical analysis parameters of abdominal fat pad. Dietary fat levels showed only significant (P<0.05) effect on abdominal fat pad ether extract.

Table 7: The table presents the effect of dietary fat source and level on chemical analysis of abdominal fat pad (percent).

Item	Moisture	Dry matter	Crude protein	Nitrogen free extract	Ether extract	Ash
Interaction effect:						
Beef tallow%						
0	88.00	12.00	5.47^{ab}	49.87^{a}	28.33^{ab}	1.00^{b}
2	88.33	11.67	5.60^{a}	49.60^{a}	31.67^{ab}	4.47^{a}
4	85.00	15.00	5.17^{ab}	33.27^{b}	40.10^{a}	1.00^{b}
6	84.67	15.33	5.60^{a}	45.23^{ab}	32.83^{ab}	1.00^{b}
Vegetable oil%						
0	88.00	12.00	5.47^{ab}	49.87^{a}	28.33^{ab}	1.00^{b}
2	83.00	17.00	5.40^{ab}	45.10^{ab}	30.83^{ab}	1.66^{ab}
4	85.67	14.33	4.80^{b}	40.93^{ab}	24.43^{b}	1.17^{b}
6	84.00	16.00	5.23^{ab}	40.87^{ab}	35.93^{ab}	1.93^{ab}
SE	4.60	2.00	4.62	7.61	0.36	1.45
SD	NS	NS	*	*	*	*
Source effect						
Beef tallow	86.50	13.50	5.46	44.49	33.23	1.87
Vegetable oil	85.17	14.83	5.23	44.19	29.88	1.44
SE	2.31	2.31	0.18	3.80	3.10	0.72
SD	NS	NS	NS	NS	NS	NS
Level effect%						
0	88.00	12.00	5.47	28.33	49.87^{a}	1.00
2	85.67	14.33	5.50	31.25	49.35^{ab}	3.06
4	85.33	14.67	4.98	32.27	37.10^{b}	1.08
6	84.33	15.67	5.43	34.38	43.05^{ab}	5.43
SE	3.27	327	0.26	4.39	5.38	0.23
SD	NS	NS	NS	NS	*	NS

Values are means of 3 replicates of 10 birds; **SE**: Standard error of means; **SD**: significant difference. **NS**: Not statistically significant. a, b: means in the same column with different superscripts are statistically significant (P< 0.05). * Statistically significant (P< 0.05).

Table (8) contained data of broiler carcass chemical analysis. Dietary fat source and levels show no significant interaction (P>0.05) effect on moisture, dry matter, crude protein, and nitrogen free extract, it shows significant interaction (P<0.05) effect on ether extract and ash. Dietary fat source revealed no significant effect (P>0.05) through all broiler carcass chemical analysis parameters. Dietary fat levels significantly (P<0.05) only affect ether extract over all the carcass meat chemical analysis parameters. Table (9) showed serum chemical analysis parameters. There were a significant interaction (P<0.05) between dietary fat sources and levels on the serum albumin and total protein. No dietary fat source effect on broiler serum chemical analysis parameters. Dietary fat levels showed significant (P<0.05) decreasing effect on broiler serum chemical analysis parameters.

Table 8: The table presents the effect of dietary fat source and level on broiler carcasses' chemical analysis (percent).

Item	Moisture	Dry matter	Crude protein	Nitrogen free extract	Ether extract	Ash
Interaction effect:						
Beef tallow%						
0	76.17	23.83	17.53	53.98	2.83^{ab}	1.67^{ab}
2	74.67	25.33	17.65	52.53	3.05^{a}	1.83^{a}
4	74.67	25.33	18.28	51.97	2.85^{ab}	2.00^{a}
6	74.67	25.50	18.37	52.18	2.70^{b}	1.17^{b}
Vegetable oil%						
0	76.17	23.83	17.53	53.98	2.83^{ab}	1.67^{ab}
2	73.00	27	17.83	50.82	2.83^{ab}	1.83^{a}
4	75.50	26.5	18.20	51.10	2.68^{b}	1.50^{ab}
6	75.17	24.33	17.83	52.12	2.78^{b}	1.67^{ab}
SE	2.12	2.10	0.61	2.28	0.10	0.29
SD	NS	NS	NS	NS	*	*
Source effect						
Beef tallow	75.04	25.00	17.96	52.67	2.86	1.67
Vegetable oil	74.46	25.54	17.91	52.00	2.87	1.67
SE	1.06	1.05	0.31	1.14	0.05	0.14
SD	NS	NS	NS	NS	NS	NS
Level effect%						
0	76.17	23.83	17.53	53.98	2.83^{ab}	1.67
2	73.83	26.17	17.74	51.68	2.93^{a}	1.83
4	74.08	25.92	18.24	51.53	2.77^{b}	1.75
6	74.92	25.17	18.22	52.15	2.74^{b}	1.42
SE	1.50	1.48	0.43	1.61	0.07	0.20
SD	NS	NS	NS	NS	*	NS

Values are means of 3 replicates of 10 birds; **SE**: Standard error of means; **SD**: significant difference; **NS**: Not statistically significant; **a, b:** means in the same column with different superscripts are statistically significant (P< 0.05); ***** statistically significant (P< 0.05).

Table 9: The table presents the effect of dietary fat source and level on broiler serums' albumen and total protein content (percent).

Item	Albumin	Total protein
Interaction effect:		
Beef tallow%		
0	3.53^{a}	6.67^{a}
2	3.30^{ab}	6.40^{ab}
4	3.23^{ab}	6.27^{b}
6	3.17^{b}	6.27^{b}
Vegetable oil%		
0	3.53^{a}	6.67^{a}
2	3.23^{ab}	6.30^{b}
4	3.30^{ab}	6.40ab
6	3.30^{ab}	6.37^{ab}
SE	0.15	0.17
SD	*	*
Source effect		
Beef tallow	3.31	6.40
Vegetable oil	3.34	6.43
SE	0.07	0.08
SD	NS	NS
Level effect%		
0	5.53^{a}	6.67^{a}
2	3.27^{b}	6.35^{b}
4	3.27^{b}	6.33^{b}
6	3.23^{b}	6.32^{b}
SE	0.11	0.12
SD	*	*

Values are means of 3 replicates of 10 birds; **SE**: Standard error of mean; **SD**: significant difference; **NS**: Not statistically significant; **a, b**: means in the same column with the different superscripts are statistically significant (P< 0.05); ***** statistically significant (P< 0.05).

Physical feed restriction in Table (10) revealed no significant (P>0.05) effect among all the carcass meat chemical analysis parameters (moisture, dry matter, crude protein, ether extract, nitrogen free extract, and ash). Also showed no significant differences (P>0.05) on total protein and albumin of the broiler serum. But, significantly (P<0.05) affected broiler abdominal fat pad chemical analysis mainly moisture and dry matter percent, whereas no significant (P<0.05) effect on crude protein, ether extract, nitrogen free extract, and ash Table 10.

Table 10: Effect of physical feed restriction on broiler carcass, serum and abdominal fat pads' chemical analysis (percent).

Item	Treatments			SE	SD
	T1	T2	T3		
Carcass					
Moisture	74.19	74.07	72.78	1.62	NS
Dry matter	25.81	24.92	27.22	1.01	NS
Crude protein	18.00	17.08	17.47	0.45	NS
Ether extract	3.22	3.22	2.87	0.17	NS
Nitrogen free extract	51.94	52.93	50.75	1.17	NS
ash	1.33	2.00	1.70	0.29	NS
Serum					
Total protein	6.3	6.30	6.30	0.21	NS
Albumin	3.30	3.37	3.37	0.19	NS
Abdominal fat pad					
Moisture	16.62^{a}	12.35^{b}	13.22^{b}	1.05	*
Dry matter	83.38^{b}	87.65^{a}	85.60^{ab}	1.07	*
Crude protein	5.87	5.87	5.87	0.39	NS
Ether extract	35.28	35.37	34.17	2.55	NS
Nitrogen free extract	40.40	45.32	45.72	3.03	NS
Ash	2.00	1.75	1.42	0.34	NS

T1: control; **T2**: restricted group to 60% of feed requirements; **T3**: restricted group to 80%of feed requirements; Values are means of 3 replicates of 10 birds. SE: Standard error of means; **SD**: significant difference; **NS**: Not statistically significant; Means in the same row with the same superscripts are statistically not significant (P< 0.05); **a, b**: means in the same row with the different superscripts are statistically significant (P< 0.05); ***** Statistically significant (P< 0.05).

Table 11 presented the effect of different calorie to protein ratio on chemical analysis of carcass showed no significant (P>0.05) effect on moisture, dry matter, crude protein, and ether extract, whereas significantly affected nitrogen free extract and ash. Table (11) revealed no significant effects (P>0.05) of different calorie to protein ratio on serum total protein and albumin. Also abdominal fat pad showed only significant (P<0.05) effect on moisture and dry matter percent, whilst no significant differences were observed (P>0.05) on crude protein, ether extract, nitrogen free extract, and ash.

Table 11: Effect of calorie to protein ratio on broiler carcass, serum and abdominal fat pads' chemical analysis (percent).

Item	Treatments			SE	SD
	T1	T2	T3		
Carcass					
Moisture	74.19	77.17	77.33	0.90	NS
Dry matter	25.81	22.83	22.67	0.90	NS
Crude protein	17.78	17.93	17.67	0.43	NS
Ether extract	3.22	2.91	2.98	0.15	NS
Nitrogen free extract	51.94^{b}	54.83^{a}	55.48^{a}	1.09	*
Ash	1.33^{b}	1.90^{a}	1.73^{a}	0.3	*
Serum					
Total protein	6.30	6.27	6.63	0.18	NS
Albumin	3.30	3.37	3.73	0.18	NS
Abdominal fat pad					
Moisture	16.62	18.84	14.38	0.89	NS
Dry matter	83.38^{b}	81.16^{b}	85.95^{a}	1.04	*
Crude protein	5.65	5.4	5.05	0.37	NS
Ether extract	35.28	37.15	36.50	3.43	NS
Nitrogen free extract	40.40	36.58	42.45	3.52	NS
Ash	2.00	1.62	2.07	0.27	NS

T1: control: **T2**: (1:154) calorie to protein ratio ; **T3**: (1:128) calorie to protein ratio ;Values are means of 3 replicates of 10 birds; **SE**: Standard error of means; **SD**: significant difference; **NS**: Not statistically significant; a, b: means in the same row with the different superscripts are statistically significant (P< 0.05); Means in the same row with the same superscripts are statistically not significant (P< 0.05); ***** Statistically significant (P< 0.05).

The effect of phase feeding on broiler carcass was assayed and chemical analysis parameters values were shown in Table (12). One, two, and three diets phase feeding revealed no significant (P>0.05) effects on carcass meat chemical analysis parameters (moisture, dry matter, crude protein, ether extract, nitrogen free extract, and ash). Table (12) monitored the total protein and albumin parameters of the serum chemical analysis. Phase feedings (one, two, and three diets) revealed no significant (P>0.05) effect on serum chemical analysis parameters. Chemical analysis of abdominal fat pad chemical analysis is monitored in Table (12) and showed no significant (P>0.05) effects of one, two, and three diets phase feeding on abdominal fat pad chemical analysis parameters.

Table 12: The table presents the effect of phase feeding on broiler carcass meat, serum and abdominal fat pads' chemical analysis (percent).

Item	Treatments			SE	SD
	One phase	Two phases	Three phases		
Carcass					
Moisture	76.67	76.67	77.17	1.31	NS
Dry matter	23.33	23.33	22.83	1.31	NS
Crude protein	17.78	17.93	17.67	0.43	NS
Ether extract	2.9	2.95	2.8	0.09	NS
Nitrogen free extract	53.82	54.28	54.87	1.4	NS
Ash	2.17	1.5	1.83	0.3	NS
Serum					
Total protein	6.57	6.33	6.27	0.19	NS
Albumin	3.4	3.23	3.23	0.15	NS
Abdominal fat pad					
Moisture	9.67	10.67	8.00	3.70	NS
Dry matter	90.33	89.33	92.00	3.70	NS
Crude protein	5.47	5.43	5.63	0.37	NS
Ether extract	36.83	38.8	37.5	1.57	NS
Nitrogen free extract	47.03	44.10	47.83	3.01	NS

Values are means of 3 replicates of 10 birds. **SE**: Standard error of means; **SD**: significant difference; **NS**: Not statistically significant; Means in the same row with the same superscripts are statistically not significant (P< 0.05).

4. DISCUSSION

The present study showed a significant interaction between dietary fat source and level abdominal fat pad chemical composition except dry matter were not significant affected by dietary fat inclusion. Dietary fat source revealed no significant influence on abdominal fat pad chemical composition. Dietary fat course irrespective the source only significantly influenced ether extract of abdominal fat pad composition. Chemical analysis of carcass revealed no significant interaction between dietary fat source and level on moisture, dry matter, crude protein, and nitrogen free extract content and induced significant influence on ether extract and ash content of carcass. The present findings were in line with Crespo and E. Esteve-Garcia (2001) who noted that level and type of fat had not significantly influenced dry matter and protein contents of thighs and breasts [7]. Dietary fat source provoke no significant effect among all chemical analysis measured. The results were disagreement with Newman et al (2002), and Ozdogan and Aksit (2003) who observed that in birds fed fish oil and sunflower oil diets had significantly higher water contents of breast muscle (P<0·05), and reported that the ash contents of the thigh (P < 0.05) and breast (P < 0.01) meats were found to be significantly different as a result of feeding different fats [3] thus, the present result in agreement with Ozdogan, and M. Aksit (2003) who reported that the effect of feeding different fat sources on the protein content of thigh and breast meat was not significant [3]. Dietary fat increasing levels induced significant effect only on ether extract among all carcass biochemistry character measured. The present study result was disagreement with Zakaria (2013) who stated a significant difference was shown in meat analysis such as DM, fat and ash% with the different levels of fat and forms of feed [4]. The present study revealed significant interaction between dietary fat source and levels on broiler serum biochemical parameters measured albumin and total protein. This finding was agreement with Mohammed and Horniakova (2012) who reported significant effect of different fat source and levels on serum protein. Sunflower oil showed high numerical increase but not significant on serum albumin and total protein [6]. It was in agreement with Omenka and Anyasor (2010) who concluded that there was no significant difference (P>0.05) in plasma-protein and muscle protein content between the treatment groups [5], Burlikowska et al (2010) who stated that there was no significant influence of the dietary fat sources on the content of serum total protein and albumin [8]. Dietary fat

increment induced no significant influence on serum biochemical parameters measured here. This finding was consistent with Malakian et al (2010) stated that total serum protein concentration not significantly affect by different sunflower seed levels inclusion [9]. The present result was in agreement with Ragab and Osman A. M. R (unpublished) indicated insignificant effects of high energy diets on serum constituents except that total protein (P≤0.01) had significant effect. This result is evidence of the equalized intensification of protein metabolism in the bodies of the experimental broilers. In the available literature there are no data concerning the influence of dietary fat sources on the protein metabolism indices in the blood of broiler chickens.

Experiment II: Physical feed restriction induced no significant effect on abdominal fat pad, carcass and broiler serum chemical analysis. This result were similar to that of Santoso (2001) who stated that meat moisture and protein were not significantly affected, while ash was significantly higher in restricted birds [10]. The present result disagrees with Rajman et al (2006) who reported that feed restriction-induced decrease on plasma protein and albumin concentrations [11], Sahraei and Hossein (2012) stated that with increasing of physical feed restrictions severity, the carcass dry mater percent decrease in 20, 30 or 40 % levels of feed restrictions, carcass ether extract (fat percent) in 30 and 40 % levels of feed restrictions and increase of carcass crude protein percent increased by 20, 30 or 40 % levels of feed restrictions (P<0.01), whereas no significant difference observed in ash percent of carcass (P>0.05) [12].

Experiment III: Abdominal fat pad, carcass, and broiler serum chemical analysis showed no significant differences, in nitrogen free extract, and ash in the abdominal fat pad and carcass meat respectively. Only broiler serum dry matter was odd which revealed significant difference. The present results were in line with Liebbrandt et al (1975) who reported that carcass protein, and ash decreased linearly as energy level was increased. Ether extract was not significantly affected by the treatments [13]. Velu et al (1971) reported rise in the percentage of body protein and water [14]. Clawson et al (1962) stated that there were no significant differences in carcass moisture, and ether extract of lonigissmus muscle [15].

Experiment Iv: The present results showed no significant differences among biochemical traits of abdominal fat pad, carcass, and broiler serum. This finding were inconsistent with Holsheimer (1979) who stated a significant decrease in carcass protein content [16], Zhao et al (2009) who concluded that the breed differences were increased in the starter period and decreased for carcass chemical composition [17], Wyllie et al (1969) resulted that water and protein contents increased and fat content decreased with increasing protein levels; differences in ash values among treatments were not significant [18]. The present result was agreed with Kamran et al (2004) who concluded that composition of breast meat (crude protein, and ether extract) un-changed [19]. This result may due to fact that the chemical composition of poultry meat has been shown to be concomitant to species, breed, muscle type, age, and method of processing of carcasses.

5. CONCLUSION

Generally we can conclude that dietary fat source and level and physical feed restriction significantly only affect ether extract, ash and nitrogen free extract whilst revealed no significant effect among all carcass and serum chemical analysis parameters. Calorie to protein ration significantly affect abdominal fat pad moisture and dry matter whereas no significant effect on carcass and serum chemical analysis traits. Phase feeding treatments had no effect on all abdominal fat pad, carcass and serum chemical studied traits.

6. REFERENCES

1. Newman Ronald E, Wayne L. Bryden, Eva Fleck, John R. Ashes, William A. Buttemer, Leonard H. Storlien and Jeffery A. Downing. Dietary n-3 and n-6 fatty acids alter avian metabolism: metabolism and abdominal fat deposition (2002); British Journal of Nutrition 88: 11–18. https://www.ncbi.nlm.nih.gov/pubmed/12117423.
2. Mona S. Ragab and Osman A.M.R. Effect of feeding high dietary energy levels on productive performance of broiler chicks during the finisher period (2008); Egypt. Poult. Sci. Vol (28) (III): (799-814). http://www.epsaegypt.com/pdf/2008_september/799-814.pdf.
3. Ozdogan M. and M. Aks¸it. Effect of feeds containing different fats on carcass and blood parameters of broilers (2003); Poultry Science Association, Inc. https://academic.oup.com/japr/article/12/3/251/757169/Effects-of-Feeds-Containing-Different-Fats-on.
4. Zakaria .H A, A. Hammad, A. Alfataftah and H. H. Titi. Replacing soybean Oil in the finisher phase with different levels of dry protected plant fat and two forms of feed and their effect on performance, carcass quality and blood parameters of broilers (2013); International J. of poult. Sci. 12(1): 37–44. http://free-journal.umm.ac.id/files/file/Replacing%20Soybean%20Oil%20in%20the%20Finisher%20Phase%20with%20Different%20Levels%20of%20Dry%20Protected%20Plant%20Fat%20and%20Two%20Forms%20of%20Feed%20and%20their%20Effect%20on%20Performance,%20Carcass%20Quality%20and%20Blood%20Parameters%20of%20Broilers.pdf.
5. Omenka RO and Anyasor GN. Vegetable-based feed formulation on poultry meat quality (2010); Afr. J. of Food Agr. Nut. Ans development. 10(1): 2001- 2011. https://tspace.library.utoronto.ca/bitstream/1807/55568/1/nd10005.pdf.
6. Mohammed H. A., E. Hornaikova. Effect of using saturated fats in broiler diet on carcass performance (2012); Journal of Microbiology, Biotechnology and Food Sciences. 3: 309-322. https://academic.oup.com/ps/article/91/1/215/1598663/The-effect-of-different-dietary-levels-of-rapeseed.
7. Crespo, N., and E.Esteve-Garcia, E. Dietary fatty acid profile modifies abdominal fat deposition in broiler chickens (2001); Poult. Sci. 80: 71-78. https://oup.silverchair-cdn.com/oup/backfile/Content_public/Journal/ps/80/1/10.1093/ps/80.1.71/2/poultrysci80-

0071.pdf?Expires=1498088810&Signature=FHKXQtUqvnYERy6eo3NiDhO54LR9YhLy50G85rnab8eP~OuGn4qO3WoT182yyo5YfVvjy8GIkGiixEL~7cXkvPVlZraOhXcc7zAd9snmHo0A~~OmhZns3GBxb1QJKn90m8to1ilRpKUV4adpOMNaAbmKnixwwAYbJPTRxdf9zhQDZFedVnjf2G9ra5t3hEgQvHYP0Pl7JUg~18MoxEedWxgU3z7scBEuIU0GezssgB2JI-aP2kFd7EqNmKWVMC8dgUTXJRw3Rmdaa4Vr2Gb4PtZYjlb5Ye7gUL93Lk1be2zY5Qe85CWBR2g~MKqkUZ7byVFlMnmpaQkYXR~vm3TwzQ__&Key-Pair-Id=APKAIUCZBIA4LVPAVW3Q.

8. Burlikowska K., A. Piotrowska and R. Szymeczko. Effect of dietary fat type on performance, biochemical indices and fatty acids profile in the blood serum of broiler chickens (2010); Journal of Animal and Feed Sciences, 19: 440–451. https://www.researchgate.net/profile/Katarzyna_Burlikowska/publication/233387361_Effect_of_dietary_fat_type_on_performance_biochemical_indices_and_fatty_acids_profile_in_the_blood_serum_of_broiler_chickens/links/0fcfd50a0174cbc28e000000.pdf.

9. Malakian. Mahdi. The effect of different levels of full fat sunflower seed on performance of broiler chickens (2010); Agricultural journal 5(3): 190-195. https://www.researchgate.net/profile/Katarzyna_Burlikowska/publication/233387361_Effect_of_dietary_fat_type_on_performance_biochemical_indices_and_fatty_acids_profile_in_the_blood_serum_of_broiler_chickens/links/0fcfd50a0174cbc28e000000.pdf.

10. Santoso U (2001). Effect of early feed restriction on growth, fat accumulation and meat composition in unsexed broiler chickens (2001); Asian-Aus. J. Anim. Sci. 14(11): 11585-11491. https://www.ajas.info/upload/pdf/14-237.pdf.

11. Rajman Marek, Marián Juráni, Dalma Lamošová, Mariana Máčajová, Monika Sedlačková, Ľubor Košťál, Daniela Ježová, Pavel Výboh. The effects of feed restriction on plasma biochemistry in growing meat type chickens (Gallus gallus) (2006); 145(3): 363–371. https://www.researchgate.net/profile/Marek_Rajman/publication/6857447_The_effects_of_feed_restriction_on_plasma_biochemistry_in_growing_meat_type_chickens_Gallus_gallus/links/54535ac80cf2bccc49098791/The-effects-of-feed-restriction-on-plasma-biochemistry-in-growing-meat-type-chickens-Gallus-gallus.pdf.

12. Sahraei Mahmood and Mohammad Hossein Mohammadi hadloo. Effect of quantitative feed restriction in finisher period on carcass traits and broiler chickens performance (2012); Annals of Biological Research 3 (6): 3033-3036. http://eacademic.ju.edu.jo/mohjalal1/Lists/Published%20Research/Attachments/14/pjn2360[1].pdf.

13. Liebbrandi V.D , R.C ewan, V.C Speer and Dean R.Zemmerman. The effect of age and calorie to protein ratio on performance and body composition of baby Pigs (1975); Journal of animal science. 40: 1070-1076. https://dl.sciencesocieties.org/publications/jas/abstracts/40/6/JAN0400061070.

14. Velu J. G., 1 D. H. Baker and H. M. Scott. Protein and energy utilization by chicks fed graded levels of a balanced mixture of crystalline amino acids (1971); J. Nutr.101: 1249-1256. http://jn.nutrition.org/content/101/9/1249.full.pdf.

15. Clawson A. J, T. N. Blumer, W. W. G. Smart, JR. And E. R. Barric. Influence of energy-protein ratio on performance and carcass characteristics of swine (1962); Journal of animal science. 21:62-68. https://dl.sciencesocieties.org/publications/jas/abstracts/21/1/JAN0210010062.

16. Holsheimer . J. P. Performance and carcass composition of male broilers as influenced by phase feeding (1979); Poultry science 59(9): 2060-2064. http://ps.oxfordjournals.org/content/59/9/2060.short.

17. Zhao J. P., J. L. Chen , G. P. Zhao , M. Q. Zheng , R. R. Jiang , and J. Wen. Live performance, carcass composition, and blood metabolite responses to dietary nutrient density in two distinct broiler breeds of male chickens (2009); Poultry Science, 88: 2575–2584. http://ps.oxfordjournals.org/content/88/12/2575.full.

18. Wyllie D., V. C. Speer, R. C. Ewan and V. W. Hays. Effects of starter protein level on performance and body composition of pigs (1969); J ANIM SCI. 29:433-438. https://dl.sciencesocieties.org/publications/jas/abstracts/29/3/JAN0290030433.

19. Kamran, Z – Mirza, M. A. – Haq, A. U – Mahmood, S. Effect of decreasing dietary protein levels with optimum amino acids profile on the performance of broilers (2004); Pakistan Vet. J., vol. 24, 2004, p. 165-168. http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.576.4883.

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