International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.8, No.2, pp 887-896, 2015

Effect of Chemical Composition of Diet (Crude Protein and Metabolic Energy) on Growth Performance and Carcass Specifications of Turkeys under local Condition

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Abstract: This study aimed to specify the optimal fattening diet for turkey birds under the local conditions. The experiments have been Carried out on private farms between 1/4/2014 and 4/8/2014.1050 turkey birds of Big6 hybrid strain related to the BUT (British United Turkey) have been examined in two major groups (Male and Female). Each one consisted of seven nutritional groups of 150 birds for each (75 males +75 female) distributed in three replicates. The studied birds have been fed according to a tripartite regime (1-4,5-12 and 13-18 weeks of age). Each phase consisted of seven different diets concerning the metabolic energy (ME) and the crude protein(CP) as the following: (I: + 10% CP), (II: +5% ME),(III: + 5% ME and+10% CP), (IV: control), (V: reduced CP ratio by5%),(VI: reduced ME by 5%,(VII: reduced ME and CP ratio by 5 %). The chemical analysis of some raw materials as used in these mixtures was carried out, samples were taken from (corn, soybean meal, and fish meal) according to us chemical analysis methods (AOAC,2000)[22]. At the end of the experiment, three birds were selected from each replicate for processing to determine carcass yield and its parts (Carcass yield, breast meat, thighs, drumsticks, Viscera (Heart – Gizzard – Liver).

Key words: Turkey birds, Metabolic Energy, Crude Protein, Carcass Quality.

Introduction:

Turkey "*Meleagris gallopavo*" is a very important part of poultry for its economic benefits[1,2]. Many studies consider that feeding diets account an important share of the production cost, and the poultry industry has suffered more than any other livestock industry as a result of that problem arising from inadequate supply of feeding diets[3,4,5,6]. Many studies in the Department of Animal Production at Damascus University focused on the economic composition of feeding diets[7,8]. Turkey meat production ranks second to chicken in Syria now. Turkey birds have high dressing percentage as can be up to 84% compared with 52% in the sheep[9]. The cost of nutrition in turkey meat production may be much more important than in chicken feeding diets because of its high price as it contains high content of crude protein. [10] found no evidence of an optimum ME:CP ratio but that both ME and CP were important predictors of broiler performance. In contrast,[11] and [12]suggested that Amino Acid (AA) requirements should be expressed as a proportion of the dietary ME concentration. This was based on evidence that poultry adjusted their feed intake to differences in the dietary ME density to maintain a constant ME intake[11,13]. The observations of the present study are similar to[14] who concluded that modern broilers selected for rapid growth do not regulate voluntary feed Intake to achieve energy balance. This altered ability of broilers to adjust feed intake due to differences in ME density of the diet was postulated to result from continued selection for rapid juvenile growth rates, which may have altered hypothalamic mechanisms that regulate feed intake in broilers[15,16].[17]and[18] found that adding methionine and lysine to low-protein starter turkey rations improved performance, but not to the same level as higher protein diets. Turkeys fed low protein diets

that were low in methionine and lysine, had slower weight gain, decreased feed consumption, inferior feed utilization, and higher carcass fat content than turkeys fed diets containing NRC-recommended levels of these nutrients[19]. The biochemical efficiency to deposit body lipid is greatest for dietary lipids, intermediate for carbohydrates and lowest for dietary protein[20]. The goal of this research is to identify the optimal fattening diets for turkeys, and thus achieve the economic target through obtaining low fat-content carcasses and selecting the lowest percentage of energy which must be provided in turkey feeding diets.

Material and Methods:

The experiments have been Carried out on private farms between 1/4/2014 and 4/8/2014.1050 turkey birds of Big6hybridstrainrelated to the accession of BUT (British United Turkey) have been examined in two major groups (Male and Female). Each one consisted of seven nutritional groups of 150 birds for each (75 males +75 female) distributed in three replicates, 25 birds in each. The studied birds have been fed according to a tripartite regime in three phases: (1-4, 5-12 and 13-18 weeks of age). Each phase consisted of seven different dietary blends concerning the metabolic energy (ME) and the crude protein (CP) as the following: (I: +10% CP), (II: +5% ME),(III: +5% ME and+10% CP), (IV: control), (V: reduced CP ratio by5%), (VI: reduced ME by 5% ,(VII: reduced ME and CP ratio by 5 %). The metabolic energy content was estimated from equations published by[21] (Table2,3). The lighting (L) was a continuous 24-hour (L) in the first three days, and then it was reduced to 22-hour (L) to 2-hour darkness (D) and so until the second week of life. After the second week until week (12) an intermittent lighting was used as the following program :(16L:2D :3L:3D). The diets and water were available freely.

The chemical analysis of some raw materials as used in these mixtures was carried out, samples were taken from (corn, soybean meal, and fish meal) in the Laboratory of Animal Nutrition, College of Agriculture, University of AL-Baath according to us chemical analysis methods[22], then the rest of the data completed according to American tables to the needs of poultry food [21] (Table1).

Birds and feeding diets were weighed in the 4th, 12th, 16th, and 18th weeks individually to determine weight gain (WG), Feed intake (FI) and Feed Conversion Ratio (FCR) (Table4). At the end of the experiment, three birds were selected from each replicate for processing to determine carcass yield and its parts. Turkeys were processed at the slaughter-house. Feed was withdrawn for 12h before slaughter and turkeys were weighed individually to get the live weight. After chilling process, the carcasses were placed on ice for 5h and separated into parts. Carcass yield, breast meat, thighs, drumsticks, Viscera (Heart–Gizzard– Liver) were recorded. Abdominal fat was removed and weighed. The indicators have been calculated as a percentage of live body weight (%) (Table 5).

Results and Discussion:

The results in (table 4) showed that increasing the crude protein contentby10% has decreased the live body weight for male and female turkeys compared to control Significantly($P\leq0.05$),While the increased metabolic energy level has increased the average live weight Significantly for the male ($p\leq0.05$) and not significantly ($P\geq0.05$) for the female compared to the control. This observation was in agreement with reports by [23] in that the increased metabolic energy levels increase the body weight and the feed conversion ratio. It also improves the average live weight for male in Group (III) (+5% ME and +10% P), but this improvement was not significant compared to the control ($P\geq0.05$), while the improvement was significantly for female except 18 weeks of age ($P\geq0.05$).

The average weight decreased significantly ($P\geq0.05$) in both male and female in groups (V and VI) but it was not significant at the end of fattening period. This observation was in agreement with reports by [24]. That the decreased effect of energy in the final stage may be due to the increase in the ability of the digestive system as the bird becomes older. It was also noticed that live body weight for male and female has decreased in group (VII) significantly. These results were in agreement with reports by [25] that the chicks fed diets of lowest CP and ME content had significantly poor body weight gain and FCR.

From Table(4),feed consumption decreased for both male and female significantly ($P\leq0.05$) in group (I), and increased not significantly (18 weeks of age) in the groups (II,III,V,VI) as compared to the control. This observation was in agreement with reports by [24] that high energy increases feed consumption, but the impact of energy was not Significant in feed consumption, weight increase and the efficiency of feed conversion compared with the control as it is prevalent in recent years, the idea that the quantity consumed by the bird must be regular to match the bird's energy needs. While, Feed consumption has increased significantly for male and

female in group (VII) (-5% ME,-5%P). This is consistent with what[26] found where the feed consumption increases with lower dietary content of energy and protein in the diet.

Feed Conversion Ratio (FC) for male and female in group (I) was higher than control (P≤0.05), and better than for male (P≤0.05) in group (II), and (P≥0.05) in group (III) at the final period, also better for female in group (II) (P≥0.05), and in group (III) than the control. (FC) in groups (V.VI.VII) were higher than control. This is consistent with what [27,28,29] found that the reduction of crude protein in the feed mixture reduces the food efficiency.

The results in (Table 4) showed that mortality rate of birds during the experimental period were not influenced by Levels of (ME) and (CP) (Table 4).

The increase of protein level (+10%) led to a decreased dressing percentage in male and female in group (I) compared to control (P≤0.05) because of low body weight (BW) (Table 5), while Increasing the (ME) level in group (II), and increasing the (ME and CP) in group (III) led to increased dressing percentage in male and female in these groups significantly compared to the control. Meanwhile, Decreasing the CP level (-5%), ME (-5 %), (ME and CP -5%) led to a decreased dressing percentage in male and female in group (V,VI, and VII) respectively compared to control (P≤0.05) (Table 5). From data of (Table 5) the best Percentage of breast meat growth was in group (I) (+10% CP) for both male and female in this group, and the worst was in group (VII). But the best percentage of thigh and drumstick were in groups (II, III) compared to the same percentage in other groups. The increased protein level (+10%) led to a decreased abdominal fat percentage in male and female in group (I) compared to control (P≤0.05). This was confirmed by[30] that Carcass fat and visceral fat is reduced, especially when using high levels of protein. While the increased (ME) level in group (II), led to increased abdominal fat percentage not significantly in male (P≥0.05) but significantly in female (P≤0.05) compared to the control. The same results in group (II) were observed in the third group. But reduced (ME), (CP) and (ME +CP) caused decreased abdominal fat percentage significantly compared to the control (Table 5).

Conclusions:

In conclusion, the results of this experiment indicate that increasing the energy level by 5% in the diets of male turkeys had a positive impact on all the studied productivity indicators, while maintaining the balance of ME/CP rate gave positive results among female turkeys. The increased metabolic energy level led to better carcass traits (percentage of breast meat, thigh, and drumstick) for the male and female turkeys, but the increase of crude portion gives the worst carcass traits compared to the control. While increasing the crude protein level led to better breast meat growth. The level of abdominal fat percentage was not affected by increasing metabolic energy level in the diets of male turkeys.

In general: from data of carcass specifications, turkeys have high dressing percentage, high percentage of breast meat which is the most importance economic part in the carcass of the poultry, and the percentage of abdominal fat is low, thus achieve the desire of the market and consumer to the sacrifices of high quality and low fat. So turkey birds (B.U.T) (Big 6) adapted with the Syrian local environment and gave good results, so, we recommend expanding production of turkey birds, which could be adopted as part of the intensive care programs under local environmental conditions.

Table 1.Chemical Analyzed Nutrient Composition of ingredients.

Item	Corn	Soyabean Meal	Fish Meal
Energy (ME) (Kcal/Kg)	**3421**	**2230**	**2970**
Crude protein,%	**8.85**	**43.5**	**61**
Crude Fat,%	**4.2**	**1.7**	**8**
Crude Fiber, %	**1.8**	**6.2**	**1**
Calcium, %	**0.03**	**0.33**	**6**
Phosphorus,%	**0.29**	**0.42**	**3**
Methionine, %	**0.18**	**0.67**	**1.8**
Cysteine, %	**0.2**	**0.84**	**0.6**
Lysine,%	**0.26**	**3.3**	**6**
Linoleic acid,%	**1.9**	**0.4**	**0.23**
Dry Matter,%	**87.1**	**90.3**	**91**
Ash,%	**6.7**	**1.1**	**24**

Table 2. Composition and nutrients contents of the diets from 1 to 4 , and 5 to 12 wk of age.

Ingredient	(1-4) weeks of Age							(5-12) weeks of Age						
	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
Corn	41.10	47.62	38.51	48.36	49.93	40.20	41.76	49.29	58.79	53.76	50.8	51.55	42.29	45.19
Soyabean Meal (44%)	44.95	37.09	43.63	40.65	42.30	46.98	47.54	47.19	33.82	35.57	39.96	36.22	38.49	35.31
Fish Meal(61%)	10	10.30	11.32	7.70	4	2.91	-	-	4.45	7.73	-	-	-	-
Sunflower Oil	1.20	2.24	4	-	-	-	-	-	-	0.66	-	-	-	-
Wheat Bran	-	-	-	-	-	5.8	6.08	-	-	-	5.33	8.25	15	15
Limestone	2	1.97	1.79	2.30	2.35	2.32	2.40	2.11	2	1.53	1.9	2	2.1	2
Dicalcium Phosphat	-	-	-	0.20	0.57	0.94	1.17	0.49	0.15	-	0.95	0.74	1	1.18
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.40	0.4	0.25	0.25	0.4	0.4	0.4	0.4
DL-Methionine	-	0.03	-	0.04	0.1	0.10	0.15	0.02	0.04	-	0.06	0.1	0.1	0.15
Lysine	-	-	-	-	-	-	-	-	-	-	0.1	0.24	0.12	0.27
Vitamin Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mineral Mix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Choline Chloride (50%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculated Analysis														
ME(Kcal)	2758.2	2896.1	2896.1	2758.3	2758.3	2620.7	2620.9	2747.7	2883.3	2883.3	2746	2747.4	2617.9	2646.2
CP(%)	29.58	26.9	29.57	26.9	25.55	26.9	25.55	25.2	22.9	25.2	22.9	21.76	22.9	21.76
Me/p	93.2	107.7	97.9	102.6	107.9	97.4	102.6	109	126	114.4	120	126.2	114.3	121.6
Fat (%)	3.8	5.04	6.55	2.73	2.62	2.44	2.37	2.44	2.94	3.56	2.64	2.73	2.64	2.72
Fibers (%)	3.57	3.22	3.38	3.35	3.54	3.91	3.99	3.82	3.21	3.21	3.7	3.62	3.91	3.77
Choline%	0.19	0.17	0.19	0.17	0.17	0.18	0.17	0.17	0.15	0.16	0.15	0.15	0.16	0.15
Lysine%	2	1.81	1.9	1.79	1.62	1.74	1.6	1.61	1.5	1.57	1.51	1.54	1.51	1.57
Methionine	0.58	0.57	0.6	0.57	0.56	0.58	0.58	0.46	0.47	0.48	0.46	0.46	0.49	0.5
Cysteine	0.52	0.47	0.51	0.47	0.47	0.48	0.47	0.48	0.41	0.44	0.42	0.39	0.39	0.4

Table 3. Composition and nutrients contents of the diets from 13 to 18 wk of age.

Ingredient	(13-18) weeks of age						
	I	II	III	IV	V	VI	VII
Corn	68.1	72.23	66.41	69.31	70	61.16	63.29
Soyabean Meal (44%)	26.75	22.74	27.79	21.5	19	20.18	17.92
Fish Meal (61%)	-	-	-	-	-	-	-
Sunflower Oil	-	1.75	2.83	-	-	-	-
Wheat Bran	2.1	-	-	5.84	7.4	15	15
Limestone	1.75	1.73	1.78	1.72	1.8	1.7	1.69
Dicalcium Phosphat	0.3	0.4	0.25	0.4	0.45	0.7	0.8
Salt	0.4	0.4	0.4	0.4	0.4	0.4	0.4
DL-Methionine	0.05	0.07	0.04	0.1	0.1	0.11	0.13
Lysine	0.05	0.15	-	0.2	0.25	0.25	0.27
Vitamin Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mineral Mix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Choline Chloride (50%)	-	0.03	-	0.03	0.1	-	-
Calculated Analysis							
ME(Kcal)	2977.8	3126.9	3126.8	2977.8	2977.2	2855.1	2877.5
CP(%)	18.2	16.5	18.2	16.5	15.7	16.5	15.7
Me/p	163.6	189.4	171.8	180	189.3	172.6	182.8
Fat (%)	3.07	4.87	5.7	3.2	3.26	3.21	3.28
Fibers (%)	3.07	2.81	3.00	2.96	2.91	3.18	3.1
Choline%	0.12	0.12	0.12	0.12	0.15	0.11	0.11
Lysine%	1.05	1.02	1.02	1.03	1.04	1.02	1
Methionine	0.37	0.37	0.37	0.38	0.37	0.37	0.38
Cysteine	0.34	0.32	0.35	0.3	0.29	0.28	0.26

Table 4. Body Weight (BW) (Kg), Feed Consumption (FC), Feed Conversion Ratio (FCR), and Mortality (%)

Age (weeks)	Sex	I		II		III		IV		V		VI		VII		L.S.D*
		Live Body Weight (Kg)														
Day 1 (g)	♂	54.49 a		54.31 a		54.14 a		54.45 a		54.37 a		54.30 a		54.51 a		–
	♀															
12	♂	A 8.67 b		A 9.85 c		A 9.77 ac		A 9.69 ae		A 9.44 d		A 9.56 e		A 8.13 f		0.15
	♀	B 5.52 b		B 6.20 ac		B 6.26 c		B 6.11 a		B 5.91 d		B 5.98 d		B 5.11 e		0.09
	L.S.D	0.14		0.03		0.14		0.14		0.14		0.14		0.02		
16	♂	A 13.67 b		A 15.43 c		A 15.04 a		A 14.86 a		A 14.55 d		A 14.70 ad		A 12.84 f		0.24
	♀	B 8.95 b		B 10.30 ac		B 10.38 c		B 10.22 a		B 9.97 d		B 10.16 e		B 8.43 f		0.10
	L.S.D	0.11		0.03		0.09		0.08		0.25		0.28		0.06		
18	♂	A 15.68 b		A 18.40 c		A 18.13 ac		A 17.90 ad		A 17.50 d		A 17.61 d		A 15.11 f		0.42
	♀	B 9.79 b		B 11.14 a		B 11.27 a		B 11.00 ac		B 10.60 c		B 10.70 ed		B 9.20 f		0.41
	L.S.D	0.26		0.09		0.26		0.04		0.34		0.14		0.17		
Feed Consumption (Kg/bird)																
(12-1)	♂	A 16.48 b		A 17.00 a		A 16.93 a		A 16.90 a		A 17.19 d		A 17.26 d		A 18.93 e		0.13
	♀	B 10.49 b		B 10.77 a		B 10.87 a		B 10.84 a		B 11.10 d		B 11.13 d		B 12.11 e		0.11
	L.S.D	0.07		0.07		0.03		0.02		0.04		0.01		0.02		
(18-1)	♂	A 35.92 b		A 37.96 a		A 37.86 a		A 37.78 a		A 38.33 a		A 38.40 a		A 40.46 c		0.63
	♀	B 22.57 b		B 23.34 a		B 23.53 a		B 23.40 a		B 23.75 a		B 23.83 a		B 24.71 c		0.45
	L.S.D	0.04		0.04		0.01		0.02		0.03		0.03		0.01		
		Feed Conversion Ratio														

(12-1)	♂	A	1.907	b	A	1.736	c		1.743	c	A	1.752	ac	A	1.831	d	A	1.814	e	A	2.343	f	0.02
	♀	B	1.921	b	B	1.760	c		1.750	d	B	1.786	a	B	1.889	e	B	1.876	f	B	2.397	g	0.01
	L.S.D		0.01			0.01			–			0.01			0.03			0.01			0.01		
(18-1)	♂		2.300	b	A	2. 077	c		2.094	d		2.107	ad		2.202	e		2.187	e		2.687	f	0.02
	♀		2.320	b	B	2.106	ac		2.099	c		2.137	a		2.256	e		2.241	e		2.710	f	0.04
	L.S.D		–			0.01			–			–			–			–			–		
		Mortality (%)																					
18	♂		12.00	a		10.67	a		9.34	a		9.30	a		8.00	a		8.00	a		8.00	a	
	♀		9.33	a		6.67	a		4.00	a		8.00	a		7.00	a		5.34	a		6.67	a	

***Similar characters within the same line indicate (no significant difference).**

***A,B between male and female.**

Table 5. Carcass specifications in 18 weeks of age (%).

Index (%)	Sex	I		II		III	IV	V	VI	VII	L.S.D
Percentage of body weight before slaughter	♂	100									
	♀										
Percentage of Carcass weight without internal organs(with abdominal fat)	♂	A 83.01	b A	83.47 c	A	83.27 d	A 83.14	a A 82.81	e A 82.91	f A 82.75	g 0.06
	♀	B 82.65	b B	82.86 c	B	82.95 d	B 82.79	a B 82.72	e B 82.76	f B 8.53	g 0.03
	L.S.D 5%	0.13		0.04		0.03	0.02	0.02	0.04	0.07	
Dressing Percentage	♂	A 82.25	b A	82.66 c	A	82.58 d	A 82.47	a A 82.35	e A 82.38	f A 82.16	g 0.03
	♀	B 81.58	b B	81.79 c	B	81.86 d	B 81.69	a B 81.63	e B 81.68	f B 81.49	g 0.03
	L.S.D 5%	0.04		0.04		0.03	0.02	0.03	0.05	0.03	
Breast	♂	A 26.45	bd A	26.33 ca	A	26.39 dc	A 26.29	a A 26.17	e A 26.21	e A 26.01	f 0.07
	♀	B 26.65	b B	26.52 c	B	26.59 d	B 26.45	a B 26.27	e B 26.36	f B 26.18	g 0.02
	L.S.D 5%	0.04		0.02		0.03	0.04	0.02	0.04	0.02	
Thigh	♂	A 9.42	b A	9.66 c	A	9.57 a	A 9.53	a A 9.46	db A 9.49	d A 9.24	e 0.05
	♀	B 8.60	b B	8.85 c	B	8.94 d	B 8.79	a B 8.69	e B 8.73	f B 8.48	g 0.02
	L.S.D 5%	0.04		0.04		0.03	0.02	0.04	0.03	0.06	
Drumstick	♂	A 9.33	b A	9.60 c	A	9.54 a	A 9.50	a A 9.37	db A 9.41	d A 9.16	e 0.05
	♀	B 8.52	b B	8.79 c	B	8.85 d	B 8.72	a B 8.60	e B 8.67	f B 8.40	g 0.03
	L.S.D 5%	0.04		0.10		0.05	0.02	0.04	0.03	0.04	
Viscera (Heart – Gizzard – Liver)	♂	A 1.75	a A	1.79 b		1.75 a	A 1.72	a A 1.66	c A 1.75	a A 1.82	d 0.04
	♀	B 1.58	b B	1.66 ac		1.71 d	B 1.65	af B 1.60	eb B 1.61	fb B 1.64	aef 0.05
	L.S.D 5%	0.08		0.04		—	0.04	0.06	0.05	0.06	
Abdominal Fat	♂	0.76	b	0.82 a		0.80 a	0.78	a 0.68	c 0.66	c 0.64	c 0.06
	♀	0.78	b	0.89 c		0.87 c	0.82	a 0.71	d 0.69	d e 0.67	e 0.03

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