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Comparative Study of Thigh Muscles and Bones Conformation and Some Carcass Traits of Local vs. Imported Turkey Strain

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Abstract: Four males and four females of each of imported BUT-9 and local strain of turkey were slaughtered at marketing age, to study live body weight, som carcass traits, in addition to drumstick's bones at Tibia region "Nazarian bones[2]" which radiography and chemically analyzed for fat-free bone parameters. The results indicated that BUT-9 revealed higher ($p<0.05$) live body weight, ready to cook carcass weight percent (dressing percent), breast weight and percent, left drum-stick weight and percent as compared with local strain of turkey. BUT-9 strain also significantly ($p<0.05$) had more number of drum-stick's muscles, tibia weight and width, drum-stick's thickness and width and drum-stick's bones percent. However, local strain had significantly ($p<0.05$) more drumsticks bones "Nazarian bones" while BUT-9 had no Nazarian bones in their drum-stick's muscles. Males had more ($p<0.05$) live body weight, neck, drum-stick's width, length and tibia length, breast weight, width and depth and shank weight as a percent of live body weight. As compared with fibula there were no significant differences between those bones and fibula for dry matter, phosphorus and magnesium percents, while a significant ($p<0.05$) differences were noticed for ash and calcium. But fat percent didn't show any significant differences between Nazarian bones themselves but were noticed with fibula. Sex had no significant effect on bone parameters except for males turkey bones which had more ($p<0.05$) dry matter than females.

Key words: Turkey strains, drum-sticks muscles, drum-sticks bones, Nazarian bones

INTRODUCTION

A turkey's skeleton comprises about 5 % of its total body weight with strong well developed muscles running the length of the leg (Stu Keck, 2004). The market for turkey product has rapidly changed from 1980-1998 as the demand within European Union increased (300%). Furthermore the interest in further processed products increased. This part of industry demands larger pieces than does the traditional turkey market, which leads to a specialized turkey production to satisfy different markets by utilizing the biological diversity within turkeys (Brenoe and Kolstad, 2000). Strain, sex and feeding strategies may influence carcass quality and composition, which in turn may be utilized to meet different market demands. Nestor *et al*. (2001) mentioned that genetic variation in carcass traits and body shape in turkey has received little attention. Barbour and Lilburn (1996) compared important carcass parts of the two strains of Nicholas and hybrid toms, they found heavier weight of pectoral's major and tibia, plus associated muscles, as well as higher relative weights of pectoral's major in the hybrid toms at 72 and 82 d. Development of muscles and bones were studied by Brenoe and Kolstad (2000) using 4-12 wk old two commercial strains of turkeys (BUT-9 and Nicholas) of both sexes. Their results indicated that meat proportion increased and bone percentage decreased significantly throughout the experimental period for both strains and sexes. BUT-9 tended to have a higher percentage of meat than did Nicholas, while Nicholas strain of turkey showed lower bone percentage than BUT-9. They concluded that BUT-9 males should be preferred, since males gained significantly higher body weight and had higher meat percentage from 8 wk of age, males of late ages should be used in production to satisfy the market for high slaughter weights with large pieces of meat, while females should be slaughtered at lower live weights because females had a higher meat percentage at young ages compared with males. Nestor *et al*. (2001) reciprocally crossed pure line (F) of turkeys with two commercial large-bodies lines (A and B) breeders. They noticed that inheritance effect on body weight, drum-stick muscles and tibiotarsal bones came more from the F line. Relative to commercial lines the (F) line body weight was less, with less leg muscling and larger leg bones.

However, consumers barbeque turkey drum-sticks as well as breast muscles, but drum-sticks may contain many longitudinal bones embedded inside drum-sticks muscles known as "Nazarian bones" varying in numbers ranging from 17-19 bones in local Iraqi domestic turkey and about 11-12 and 6-9 bones in American heavy and light turkey strains respectively (Taha, 2004).

The objectives of the current study were to evaluate the drum-stick bones conformation of the local and imported

(BUT-9) turkey strains and to investigate ways of improving drum-stick muscles quality of local strain.

MATERIALS AND METHODS

The experiment was conducted at the Agriculture Research and Education Center (AREC) of American University of Beirut, located about 80 km from Beirut, Lebanon, by using four male and four female turkeys of each of imported BUT-9 and local labanies strain were housed in two separate movable cages, (90.5 × 191.5 × 171.0 cm) at an elevation of 15 cm from the ground. The birds were fed a high protein broiler starter ration (20% crude protein) formulated according to NRC (1984) for one week before slaughtering at market weights of 2500 and 5000 gm for female and male birds of local strain to study the different carcass and bone measurements. Another group of four male and four female turkeys of imported British United Turkey (BUT-9) strain were obtained from a commercial turkey breeder and reared under similar conditions for additional six weeks to reach the market weight of 4000 and 5500 gm for the females and males respectively. The birds were then slaughtered and the same carcass and bone measurement parameters, as those of the local strain, were taken.

The measurements included live body weight, ready to cook carcass weight (Dressing percent) and cut-up parts (drum-stick, thigh, breast, wings, neck, head and shanks) as percent live body weight. The measurements also included the drum-stick weight, length, width, thickness and number of muscles and bones (tibia, fibula and Nazarian bones) along with the breast weight, length, width and depth and keel bone length. Carcasses dissection was performed according to the method described by Hahn and Spindler (2002).

Radiography study included X-ray on drum-sticks, to expose the shape and position of Nazarian bones. The bones were later chemically analyzed for dried fat-free bone parameters that included dry-matter, ash (Calcium and Phosphorus), magnesium and fat percents (A.O.A.C., 1970).

The data were analyzed statistically with the GLM of SAS software (SAS, 1992) for factorial design of experiment to study the effect of strain and sex of turkey and their interactions and with CRD for Nazarian bones and fibula parameters. Least Square Means (LSM) were separated using Duncan's new multiple range test and Standard Error of Means (SEM) for each measurements studied.

RESULTS AND DISCUSSION

The imported turkey (BUT-9) strain revealed higher ($p<0.05$) live body weight and ready to cook carcass weight percent vs. the local strain by 1076 gm and 5.3% for live body weight and ready to cook carcass weight respectively, Table 1. These results agree with Brenoe and Kolstad (2000) who said that BUT-9 commercial strain had more body weight as compared with Nicholas. Turkey males showed more ($p<0.05$) live body weight than females with a difference of (1761 gm), while sex had no significant ($p>0.05$) effect on ready to cook carcass weight percent that was may be due to BUT-9 females get more meat gain during early ages than males (Brenoe and Kolstad, 2000), so the same reason could be right for local female strain of turkey. However, interaction of strain and sex of turkey showed no significant ($p>0.05$) effect on live body weight or ready to cook carcass weight percent respectively.

BUT-9 strain contributed more ($p<0.05$) breast weight percent than the local strain leading to a difference of 5.6 % between the two strains on leg weight percent leading that growing turkeys concentrate the fleshing of meat in breast more than legs, while sex of turkey had no significant ($p>0.05$) effect on both of breast and leg percent measurements. So as the interaction between strain and sex showed no significant ($p>0.05$) effect on those measurements, Table 1. Meanwhile, the same results were obtained from statistical analysis of the breast and left drum-stick measurements data (Table 1) contributed that BUT-9 strain gave more ($p<0.05$) breast weight and left drum-stick weight with a difference of 490 gm and 69.4 gm as compared with the local strain respectively. Turkey males for both strains revealed more ($p<0.05$) breast and left drum-stick weight than females, while there were no significant ($p>0.05$) effect of interaction between strain and sex of turkey on both measurements, Table 1.

BUT-9 strain revealed more ($p<0.05$) left drum-stick weight percent than the local strain, while no significant effect ($p>0.05$) of strain on thigh weight percent, leading that the meat fleshing were concentrated on the drum-sticks of the BUT-9 strain vs. the local strain which get less meat fleshing in the drum-sticks. However not the sex and nor the interaction between strain and sex showed any significant ($p>0.05$) effect on left drum-sticks or thigh weight percent, Table 2.

Strain and sex of turkey each separately didn't show any significant ($p>0.05$) effect on drum-sticks edible meat weight percent, while interaction between strain and sex had significant ($p<0.05$) effect that BUT-9 males revealed low drum-stick edible meat percent as compared even with BUT-9 females or local males or females turkey, Table 4. BUT-9 had more ($p<0.05$) drum-stick bones as estimated by 2.67%, may be that explain why the BUT-9 females had less edible meat percent. However, neither the sex nor interaction between strain and sex showed any significant ($p>0.05$) effect on drum-stick bones percent, Table 2.

Science number of drum-stick muscles were more ($p<0.05$) in BUT-9 (17.75) vs. (14) muscle in drum-stick of local strain, BUT-9 had no Nazarian bones ($p<0.05$) vs. (18) bones found in drum-stick of local turkey. In spite of BUT-9 had no Nazarian bones, But still had more

Table 1: The effect of strain and sex of turkey on live body weight and cut-up parts measurements

Treatments	Live body weight (gm)	% from live body weight								
		Ready to cook	Legs	Breast	Wings	Neck	Back	Head	Drum-sticks	Thighs weight
Strain										
BUT9	4979[a]	77.1[a]	20.1[a]	27.0[a]	9.78[a]	4.39[a]	13.8[a]	1.81[b]	9.99[a]	10.1[a]
Local	3903[b]	71.8[b]	19.3[a]	21.4[b]	7.97[b]	4.32[a]	14.1[a]	2.76[a]	9.18[b]	10.1[a]
SEM	298	1.08	0.29	0.54	0.422	0.197	0.40	0.193	0.233	0.19
Sex										
Female	3560[b]	73.5[a]	19.6[a]	24.5[a]	9.40[a]	3.95[b]	14.9[a]	2.33[a]	9.48[a]	10.1[a]
Male	5321[a]	75.5[a]	19.8[a]	24.6[a]	8.35[a]	4.76[a]	13.1[b]	2.24[a]	9.69[a]	10.1[a]
SEM	298	1.08	0.29	0.54	0.422	0.197	0.40	0.193	0.233	0.19
Probability values										
Variable Strain	0.0253	0.0048	0.0801	0.0001	0.0104	0.8128	0.6396	0.0047	0.0293	0.8368
Sex	0.0013	0.2258	0.6154	0.3550	0.1036	0.0139	0.0092	0.7511	0.5281	0.9857
Strain × Sex	0.1440	0.0997	0.8354	0.1474	0.4697	0.6682	0.5524	0.3451	0.5234	0.2976

[a-b]Means within a column in each character with no common superscript differ significantly (p<0.05)

Table 2: The effect of breed and sex of turkey on drum-stick, tibia bone and breast measurements

Treatments	left Drum-stick					Tibia			Drum-stick	Breast		
	Weight (gm)	Thickness (cm.)	Width (cm.)	No. of Muscles	No. of Bones*	Weight (%)	Length (cm.)	Width (cm.)	Bones (%)	Weight (gm)	Width (cm.)	Length (cm.)
Breed												
BUT9	246.7[a]	4.304[a]	8.025[a]	17.75[a]	00.00[b]	23.30[a]	18.14[a]	1.126[a]	23.30[a]	1343[a]	12.86[a]	24.2[a]
Local	177.4[b]	3.356[b]	6.586[b]	14.00[b]	18.00[a]	18.26[b]	17.80[b]	0.858[b]	20.63[b]	835[b]	6.85[b]	25.0[a]
SEM	12.59	0.1202	0.2538	0.191	0.197	0.684	0.381	0.0400	0.754	83.0	0.234	1.14
Sex												
Female	172.3[b]	3.673[a]	6.351[b]	16.13[a]	17.75[a]	20.14[a]	16.78[b]	0.931[a]	21.29[a]	874.0[b]	9.59[b]	24.1[a]
Male	251.8[a]	3.988[a]	8.260[a]	15.63[a]	18.25[a]	21.43[a]	19.16[a]	1.053[a]	22.64[a]	1303[a]	10.12[a]	25.1[a]
SEM	12.59	0.1202	0.2538	0.191	0.197	0.684	0.381	0.0400	0.754	83.0	0.234	1.14
Probability values												
Variable												
Breed	0.0021	0.0001	0.0019	0.0001	0.0001	0.0002	0.7646	0.0005	0.0275	0.0010	0.001	0.6079
Sex	0.0008	0.0887	0.0002	0.0888	0.4744	0.2078	0.0021	0.0534	0.2296	0.0033	0.1363	0.5669
Breed × Sex	0.1097	0.8516	0.1138	0.0888	0.4744	0.2935	0.0870	0.9483	0.3670	0.2146	0.9409	0.9879

[a-b]Means within a column in each character with no common superscript differ significantly (p<0.05). *:(Nazarian bones)

(p<0.05) drum-stick bones percent than the local strain and that was due to heaviest (p<0.05) tibia bone weight percent in BUT-9 as compared with the local strain. However, effect of sex and interactions between strain and sex of turkey were not significant (p>0.05) on the number of drum-sticks muscles or bones or even on tibia weight percent (Table 2).

BUT-9 showed a significant (p<0.05) increase in breast and drum-stick thickness, width and tibia width (Tables 2 and 3), while local strain revealed more drum-sticks length than BUT-9 strain. Strain had no significant (p>0.05) effect on breast length, depth, tibia length and keel length respectively. Males showed more (p<0.05) parameters measurements for breast weight width and depth and drum-sticks width and length, while sex had no significant (p>0.05) effect on breast length, drum-sticks thickness and tibia width. However, effect of interactions of strain and sex were found for breast depth, that local males had more (p<0.05) depth as compared with the BUT-9 males and females or even the local female. Also interaction between strain and sex were noticed for drum-sticks length that local males also showed more (p<0.05) drum-sticks length vs. the BUT-9 males and females or local female. Also noticed an interaction of strain and sex on keel length that the local female had significantly (p<0.05) minimum keel length as compared with the local males or BUT-9 males and females. Local males had longest keel but not significant with BUT-9 male or female keel length, Table 3. Another significant (p<0.05) increase were shown in BUT-9 males for shank weight as a percent of live body weight as compared with BUT-9 females or local males or females (Table 3).

BUT-9 strain had significantly (p<0.05) more wings weight percent as compared with local strain with a difference of (1.81%). However, strain had no significant (p>0.05) effect on percent weight of neck and back, (Table 1). Males had more (p<0.05) neck weight percent than females, while females showed more (p<0.05) back weight percent than males. However, sex had no significant effect (p>0.05) on weight percent of wings, (Table 1). From the analysis presented in Table 2, there were no (p>0.05) interactions between strain and sex were noticed for weight percent of wings, neck and back measurements.

Nazarian bones were a small thin bone with no bone marrow embedded inside and along the drum-sticks muscles; they were different in shape and numbers

Table 3: The effect of strain and sex and their interaction of turkey on cut-up parts, drum-stick and breast measurements

Treatments	Drum - stick length (cm.)	Drum-stick edible meat (%)	Shanks (%) of LBWT	Breast depth (cm.)	Keel length (cm.)
Strain					
BUT9	17.9^{b}	66.4^{a}	3.60^{a}	9.12^{a}	14.1^{a}
Local	19.1^{a}	68.8^{a}	2.75^{b}	9.61^{a}	13.2^{a}
SEM	0.39	0.93	0.072	0.430	0.36
Sex					
Female	17.2^{b}	67.7^{a}	2.99^{b}	7.66^{b}	12.6^{b}
Male	19.9^{a}	67.4^{a}	3.46^{a}	11.07^{a}	14.6^{a}
SEM	0.39	0.93	0.072	0.430	0.36
Strain × Sex					
BUT9 Female	17.4^{b}	68.6^{a}	3.08^{b}	8.26$^{b\,c}$	13.9^{a}
BUT9 Male	18.5^{b}	64.1^{b}	4.13^{a}	9.97^{b}	14.3^{a}
Local Female	17.3^{b}	68.2^{a}	2.91^{bc}	7.05^{c}	11.4^{b}
Local Male	21.3^{a}	70.8^{a}	2.60^{c}	12.17^{a}	15.09^{a}
SEM	0.55	1.19	0.102	0.608	0.51
			Probability values		
Variable					
Strain	0.0356	0.0851	0.0001	0.4304	0.0960
Sex	0.0012	0.8303	0.0034	0.0001	0.0020
Strain × Sex	0.0286	0.0075	0.0001	0.0161	0.0073

$^{a-c}$Means within a column in each character with no common superscript differ significantly ($p<0.05$)

Table 4: Effect of Nazarian bone shapes on fibula and bone minerals contents

	% of bone minerals on fat-free dry matter basis					
Treatments	Dry matter	Ash	Calcium	Phosphorus	Magnesium	FAT %
Bone Shapes						
Spoon	88.97^{a}	53.81^{c}	15.24^{bc}	10.62^{a}	0.276^{a}	2.74^{b}
Fork	88.76^{a}	56.59^{abc}	14.00^{c}	9.99^{a}	0.316^{a}	1.51^{b}
Side hook	89.98^{a}	54.25^{bc}	20.14^{a}	10.95^{a}	0.318^{a}	7.16^{b}
Thin flat	89.17^{a}	56.58^{abc}	18.91^{a}	11.55^{a}	0.316^{a}	2.01^{b}
One side flat	90.11^{a}	57.99^{ab}	17.46^{a}	10.68^{a}	0.307^{a}	4.00^{b}
Pin	88.84^{a}	56.38^{abc}	15.89^{bc}	10.33^{a}	0.286^{a}	3.14^{b}
Thick flat	88.10^{a}	54.41^{bc}	15.26^{bc}	9.40^{a}	0.300^{a}	2.98^{b}
Fibula	90.46^{a}	59.92^{a}	15.45^{bc}	10.69^{a}	0.332^{a}	15.36^{a}
SEM	0.996	1.070	0.827	0.828	0.0156	1.791
			Probability values			
Variables						
Bone Shapes	0.7065	0.0417	0.0088	0.7424	0.3263	0.0084

$^{a-b}$Means within a column in each character with no common superscript differ significantly ($p < 0.05$)

(Taha, 2004). Sometimes were counted as tendons while some of them counted as bones (Hahn and Spindler, 2002). However, the current study emphasize that those were bones clearly shown at X-ray examination of the BUT-9 and local males and females drum-sticks and laboratory bone analyses (Table 4) according to the Nazarian bone shapes as compared with the fibula bones the analysis revealed that there were a significant ($p<0.05$) differences in calcium content of those bones resulting that hook like, thin flat and one side flat bones had more calcium percent vs. the other bones and fibula. However, calcium percent of those bones were ranged from 14-20.14% as compared with fibula bones (15.45 %). Also there was significant ($p<0.05$) differences of Nazarian bones for their ach percent content, fibula had more ash percent (59.92%) as compared with spoon like bones (53.81%) but still not that large differences. Ash ranged between 57.00-53.81% in Nazarian bones only. It was noticed that there were no significant ($p<0.05$) differences in bone content of dry matter, phosphorus and magnesium percent as compared with fibula bones. Nazarian bones with their different shapes didn't show any significant ($p>0.05$) differences in fat percent content, but as compared with fibulas bones, fibula had a high percent of fat which is significantly ($p<0.05$) different from those bones.

Nazarian bones content ranged from (88.10-90.11%), (9.40-10.95%), (0.276-0.318%) and 1.51-7.16%) for dry matter, phosphorus and magnesium respectively.

There was no strain effect because BUT-9 had no Nazarian bones, while sex showed of local turkey showed the only significant ($p<0.05$) effect on dry matter percent, that females had significantly higher dry matter percent wether in the presence of fibula or without fibula, (Table 5). However sex had no significant ($p>0.05$) on ash, calcium, phosphorus, magnesium and fat percents

Table 5: Effect of sex on Nazarian bones with or without fibula minerals content

	% of bone minerals on fat-free dry matter basis					
Treatments	Dry matter	Ash	Calcium	Phosphorus	Magnesium	FAT %
With fibula						
Sex						
Females	90.19[a]	55.62[a]	16.44[a]	10.22[a]	0.299[a]	5.903[a]
Males	88.40[b]	56.86[a]	16.63[a]	10.83[a]	0.314[a]	3.820[a]
SEM	0.378	0.804	0.804	0.369	0.0083	1.7087
			Probability values			
Variable						
Sex	0.0017	0.2909	0.8692	0.2617	0.1973	0.4033
Without fibula						
Sex						
Females	89.94[a]	55.32[a]	16.44[a]	10.06[a]	0.295[a]	3.983[a]
Males	88.33[b]	56.11[a]	16.95[a]	10.95[a]	0.311[a]	2.741[a]
SEM	0.309	0.649	0.892	0.394	0.0086	0.813
			Probability values			
Variable						
Sex	0.0031	0.4088	0.6914	0.1371	0.2202	0.3014

[a-b]Means within a column in each character with no common superscript differ significantly ($p<0.05$)

of Nazarian bones wether with fibula or without fibula been in statistical analysis.

Conclusions: 1-BUT-9 had more live body weight and ready to cook carcass weight percent. 2-BUT-9 had more breast weight and width, drum-stick weight, percent, thickness and width, tibia weight, number of muscles, shank and wings weight percent. 3-According to the results of radiography and chemical analyses of Nazarian bones as compared with the fibula, it was approved that they were definitely bones, which were found in local strain drum-sticks muscles but not in BUT-9. 4-There were no significant differences between Nazarian bones and fibula in dry matter, phosphorus, magnesium and fat percent of the bone content.

REFERENCES

Association of officials Analytical Chemists, 1970. Official Methods of Analysis. 11th Edn. Assn. Offic. Anal. Chemists, Inc., Arlington, VA.

Barbour, G.W. and M.S. Lilburn, 1996. Comparative growth and development of Nicholas and hybrid toms from 16-82 days and effects of protein restriction from 0-59 days on growth on hybrid toms through 125 days of age. Poult. Sci., 75: 790-796.

Brenoe, U.T. and K. Kolstad, 2000. Body composition and development measured repeatedly by computer tomography during growth in two types of turkeys. Poult. Sci., 79: 546-552.

Hahn, G. and M. Spindler, 2002. Method od dissection of turkey carcass. World Poult. Sci. J., 58: 179-197.

National Research Council, 1984. Nutrient requirements of poultry. 8th Rev. Edn. Natl. Acad. Press, Washington, D.C.

Nestor, K.E., J.W. Anderson and S.G. Velleman, 2001. Genetic variation in pure lines and crossing of large- bodied turkey lines. 2-Carcass traits and body shape. Poult. Sci., 80: 1093-1104.

Taha, N.Th., 2004. Study of drum-stick bones conformation between Iraqi local and imported breeds of turkey. Unpublished data.

SAS Institute, 1992. SAS User's Guide: Statistics, Version 5 Edition. SAS Institute, Inc., Cary, NC.

Stu Keck Series, 2004. Wild Turkey #1. Fourth American Species Series. htt://www.bowhunting.net/NA species/wild turkey.html.

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