Egypt. J. Anim. Prod. 23, No. 1-2 pp. 113-118 (1983)

Studies on Fatty Liver Production from Aged Geese and Ducks. II. Fatty Acid Composition of Liver and some Chemical Aspects

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A TOTAL of 51 aged male and female birds from three breeds (Pekin,Saudani and Geese)were divided at random into two treatment groups. The first group was force-fed dry maize for a period of 28 days and the second group was fed *ad libitum* for the same duration.

Results obtained could be summarized in the following:

(a) Force-fed Saudani ducks were the only birds that have developed fatty liver. The colour of the liver in crammed Saudani was raw sienna while in crammed Pekin and geese it was reddish brown.

(b) The response of birds to cramming differed markedly. Saudani force — fed ducks deposited the highest amounts of fats under the skin, in muscle, around the viscera and in liver.

(c) Force-feeding did not change the order of level of major fatty acids of liver fat but it did increae the percentage of fatty acids belonging to C-18 series, particuraty oleic acid,in the steatic liver fats.

Cramming of geese and ducks is done by hand and whole dry maize is usually used in Egypt. The duration of cramming period is about one month. This Egyptian method of cramming is said to be efficient in the production of fatty carcasses.

Force feeding of broiler geese and ducks was the subject of numerous studies.

This study has been undertaken to test possible response of aged local geese and ducks (Pekin and Saudani) to force feeding for fatty liver production.

Material and Methods

Fifty one male and female birds derived from the poultry Research farm of the faculty of Agriculture, Cairo University were used in this study. The

birds were included Pekin ducks, Saudani ducks and Egyptian geese. Birds of each species were divided at random into two treatment groups.

Those of the first groupwere force-fed while those occured in second group were fed *ad - lib.* to serve as control. More details were mentioned by Salem *et al.* (1983).

By the end of the feeding trials the birds were slaughtered. A sample from the right lobe of the liver of each bird was removed and freezed till chemical analyses. A sample from the left pectoralis major muscle (skin free) was removed and freezed for chemical assays.

For the determination of dry matter, total lipids and ash the standard methods (AOAC, 1970) were used.

The fatty acids obtained from liver samples of each bird was carried out according to Mc Ginnis and Dugan (1965) with gas liquid chromatogram.

The statistical analysis was carried out according Snedecor and Cochran (1967).

Results and Discussion

(A) Some chemical aspects of pecrotalis major

Sex was without significant influence on the moisture, fat and ash, as shown in (Table 1). Percentage of fat in muscle was affected neither by sex nor species, however, was influenced by treatment.

TABLE 1. **Percentage of moisture, ash and fat in muscle as influenced by sex, treatment and species.**

	Number	Mean ± SE (%)		
		Moisture	Fat	Ash
Overall mean . .	51	68.8 ± 0.27	12.26 ± 0.53	4.86 ± 0.26
Females	23	68.57 ± 0.44	12.37 ± 0.49	4.98 ± 0.20
Males	28	68.19 ± 0.35	12.15 ± 0.91	4.73 ± 0.44
Force-fed	23	67.58 ± 0.41**	13.93 ± 0.74**	4.93 ± 0.22
Ad-libitum . .	28	69.19 ± 0.33**	10.60 ± 0.63**	4.78 ± 0.44
Pekin	17	69.60 ± 0.39a	12.62 ± 0.95a	4.85 ± 0.14a
Saudani.	15	67.91 ± 0.61b	10.94 ± 0.75a	4.71 ± 0.38a
Geese	19	67.62 ± 0.36b	13.22 ± 0.95a	5.02 ± 0.27a

a,b the same letters differ from each other non-significantly,otherwise they differ at $P<0.01$.
** $P\leq 0.01$.

(B) The development of fatty liver

Three criteria were taken, colour, weight of liver(Table 2) and percentage of fat in hepatic tissue (Table 3). Force-fed saudani ducks were the only birds that have developed fatty liver. The colour of the liver was raw sienna and in other groups it was reddish brown. The average weight of liver in crammed Saudani ducks was 222 2 g against 56 07g for the *ad-lib.* Saudani. The weight of crammed Saudani liver was reported by Stasko and Kadlecik (1974) and higher than Stasko and Pobis (1972), Leclerco *et al.* (1973) and Marai and Yamani (1974) Concerning the percentage of fat in hepatic tissue, it was shown that the saudani force-fed group have the highest percentage 73 92% meanwhile Saudani *ad - lib.* group have the lowest 14 43%.

TABLE 2. **Weight of liver as influenced by sex, treatment and species.**

Classification	Number	Mean ± SE (g)
Overall mean	51	82.66 ± 10.55
Females	23	79.10 ± 16.60
Males	28	86.23 ± 1 .82
Force-fed	23	113.88 ± 21.75**
Ad-libitum	28	51.45 ± 4 15**
Pekin	17	41.73 ± 3 65 a
Saudani	15	139 14 ± 24.77 b
Geese	19	67.13 ± 4 56 c

Means within species having different letters differe from each other at P<0 01.

** P<0.01.

(C) Fatty acid copmosition

Gas-liquid chromatography results obtained are persented in (Table 4). Only six fatty acids deserve major considerations : Oleic > Palmitic > Stearic Linoleic > Palmitoleic > myristic. The order of level obtained is comparable to that presented by Marion *et al.*(1971) for chicken fat and Alonso and Stadelman (1976) for duck fat. The results indicate a sharp rise in the percentage of oleic acid of hepatic ether extracts of force-fed Saudani ducks.

(D) Sites of fat deposition

As shown in Table5,the response of birds to cramming differed markedly. Saudani force-fed ducks deposited the highest amounts of fat under the skin,

TABLE 3. **Percentage of moisture, ash and fat liver as influenced by sex, treatment and species.**

	Number	Mean ± SE (%)		
		Moisture	Fat	Ash
Overall mean . .	51	54.07 + 1.76	34.53 + 2.88	3.04 + 0.16
Females.	23	52.91 + 2.64	39.95 + 4.15**	2.88 + 0.2
Males	28	55.22 + 2.36	29.12 + 3.73**	3.20 + 0.22
Force-fed	23	48.67 + 3.49**	43.91 + 4.92**	2.64 + 0.28**
Ad-libitum . .	28	59.46 + 1.05**	25.17 + 2.74**	3.45 + 0.16**
Pekin	17	59.19 + 1.56 a	33.44 + 3.16 a	3.55 + 0.24 a
Saudani	15	43.01 + 4.84 b	44.17 + 7.93 b	2.28 + 0.35 b
Geese	19	60.01 + 1.07 a	25.99 + 3.08 c	3.29 + 0.18 a

a,b,c the same letters differs from each other non-signicantly, otherwise they differ at $P<0.01$ ** $P<0.01$.

TABLE 4. **Percentage fatty acid distribution in an ether extract of liver tissue.**

Fatty acid	Percentage of concentration					
	Pekin		Saudani		Geese	
	FF	SF	FF	SF	FF	SF
Myristic	0.8	0.3	T	0.6	T	T
palmitic	22.0	21.8	18.7	21.0	34.1	44.2
palmitoleic	2.6	1.0	T	2.1	T	T
Stearic	13.3	13.3	4.9	16.4	6.3	3.3
Oleic	58.7	57.2	76.4	54.5	57.1	49.7
Linoleic.	2.6	6.4	T	5.4	2.4	2.8

FF = Force — fed SF = Self — fed T = Trace

TABLE 5. **Sites of fat deposition in force-fed and self-fed birds.**

Parameter	Pekin		Saudani		Geese	
	SF	FF	SF	FF	SF	FF
Thickness of the skin (mm) . .	4.1	4.6	4.0	6.6	4.7	6.7
Fat in muscle % .	10.9	14.4	8.4	13.5	12.9	13.9
Visceral fat (g) . .	7.5	45.0	3.7	126.8	90.3	222.4
Fat in liver % . .	31.1	35.8	14.4	73.9	30.0	22.0

SF = self-fed FF = Force-fed

in muscle, around the Viscera and in liver. Assuming that like in the pigeon (Goodridge and Ball, 1966 and 1967) the main site of lipogenesis is the liver one can deduce that hepatic lipogenesis in Saudani accurred at a higher rate as compared with pekin and geese. The obvious response of aged Saudani ducks to force-feeding should stimulate future work on this breed.

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انتاج الكبد المسمن من البط والأوز المسمن
٢ ـ الأحماض الدهنية بالكبد وبعض التحليلات الكيماوية ٠

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استعمل فى هذه التجربة ٥١ طيرا من الذكور والاناث المسنة والتى انتهت حياتها الانتاجية ٠ تضمنت الطيور المستعملة البط البكينى والسودانى والأوز المصرى٠ وبعد تقسيم الطيور الى قسمين غذيت طيور القسم الأول تغذية قسرية يدوية (التزغيط) بينما غذيت المجموعة الأخرى حتى الشبع وكان ذلك لمدة ٢٨ يوما٠ ولخصت النتائج المتحصل عليها فى الآتى : ـ

أ ـ لم يتكون الكبد الدهنى الافى البط السودانى المزغط فكان لون الكبد طحينى ووزنة ٢ر٢٢٢ جم وكانت نسبة الدهن به ٩٣ر٧٣٪ وأما لون الكبد فى الأوز والبط البكينى فكان بنى محمر ووزنه صغيرا ٠

ب ـ اختلفت استجابة الأنواع المختبرة من الطيور للتزغيط فيما يختص بأماكن تخزين الدهن ، وفى حالة البط السودانى كان معدل تخزين الدهن تحت الجلد وفى العضلات وحول الأحشاء وفى الكبد عاليا للغايه ٠

ج ـ لم يؤثر التزغيط فى ترتيب الأحماض الدهنيه الأساسية الداخلة فى تكوين دهن الكبد (تبعا لنسبة وجودها)ولكنة رفع بدرجة ملحوظة نسبة الأحماض الدهنية المحتوية على ١٨ ذرة كربون وبالاخص حامض الأوليك كما هو واضح فى حالة البط السودانى ٠