Egypt. J. Anim. Prod. **14**, No. 1, pp. 111-128 (1974).

Meat Production from Ducks at Different Ages

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Five males and five females of Pekin ducks at hatch and of 1, 2, 3, 4, 5, 6, 9 and 12 methods of age were used to study the effect of age and sex on growth, meat production and related characters. The following results were obtained :

1. The eviscerated carcas percentage increased with the rise in body weight until the attainment of sexual maturity, when it decreased on the sixth and ninth months of age. The females exceeded the males in this character.

2. The legs, being limbs of locomotion matured as early as one month of age. The wings and breast showed their highest growth at 3 to 5 months of age. The breast of females exceeded that of the males. The back and pelvis seems to be the earliest maturing parts as no changes were observed in their proportional weight all over the study.

3. Fleshed tissues followed a similar course of growth as body weight as it matured on the fifth month of age. Giblets percentage matured as early as the third month of age. The females exceeded males in the giblets relative weights. The abdominal fat increased with the maturity of body weight at four months of age and females exceeded males. Edible portions reached the highest increase on the fifth month of age and the females exceeded the males. The bones attained maturity as early as the third month of age and males exceeded females.

4. Body length and circumferance showed the same trend like body and carcass percentages as they may be taken as a criterion for these characters. Body depth increased rapidly during the first two months, then slowly afterwards. Shank, femur and tibia reached their highest length as early as the third month of age in both sexes.

5. Body circumference was the most accurate criterion which was correlated with body and carsass percentages at all ages. Shank length was highly correlated with early body growth until two months of age. Femur length can be considered as a criterion for body and carcass growth and at the attainment of sexual maturity. Body depth is an accurate criterion for adult ducks for evaluating body and carcass weight.

Although meat production from ducks represents a good part of poultry meats yet little research had covered this point. This study investigate some of the basic knowledge of meat production from ducks at different ages.

Material and Methods

Five males and five females of Pekin ducks at hatch 1,2,3,4,5,6,9 and 12 months of age were used. To eliminate the effect of season, ducks were hatched at one month interval and at the end of the year all the ages were available and the required number summing up 80 individulas were seperated from the stock for the slaughter test. One individual from both sexes from each age was examined each three days. The experimental birds were kept in open pens where half of their area was water pools and housed in wooden houses.

The ducklings were brooded in portable wooden brooders heated by kerosene lamps, when required until 8 weeks of age. During the brooding period, the ducklings were fed a standard starting ration of 20% total protein for 4 weeks, then they were fed a standard rearing ration of 16% total protein for other 4 weeks. Afterwards, the ducks were fed on a ration containing 23% rice bran, 20% wheat bran, 30% cottonseed meal, 25% barely, 1.5% calcium carbonate and 0.5% salt. Grain mixture made of equal parts of maize and wheat was given beside the previous ration during the breeding season. Animal protein was supplied as liquid blood and skim milk. Green food was supplied as Egyptian clover during winter and chopped green maize leaves during summer.

The birds were weighed early in the morning before feeding. They were sacrificed by a transverse throat cut. The birds were plucked, eviscerated and weighed. Body length, depth, and circumference and shank length were measured in centimetres on the dressed bird. The carcass was the live weight of birds minus blood, feathers, shanks, head and viscera. The carcass of each bird was cut into four parts including the limbs, breast, legs and pelvic with the back. After weighing each part, it was fleshed and the meat and bone were separated and weighed. Meat includes the muscles and all types of experimental fat tissues. The length of the femur and tibia bones were measured in centimeters. Giblets weight was obtained by adding the weights of liver, empty gizzard, spleen, kidneys and heart. Also, edible portion was obtained by adding the weights of meat, giblets, abdominal fat and reproductive organs either for males or females. During the course of dessiction wet towels were used to cover the carcass and the organs to minimize evaporation. All weights were in grams.

Analysis of variance was used for studying the variation due to age and sex. Also, correlation coefficients were worked out between body and carcas, weights on the one hand and body and bone measurements on the other. The statistical methods used were those suggested by Snedecor (1957). The differences were considered significant (x) when the level of probability was 95% while it was considered highly significant when the level of probability was 99%.

Results and Discussion

Eviscerated carcass

Weights increased gradually throughout the experimental period except at 12 months of age (Table 1). Relative weight increased until the fifth month of age when slight changes were observed afterwards. Ducks exceeded drakes in eviscerated carcass perecentage. However, Snyder (1962) found that drakes were heavier than ducks in relative eviscerated weight. Sex differences in eviscerated percentage were highly significant (Table 1). This difference is partially attributed to the deposition of fat in females especially in adult ages.

Wings

The weight of wings meat increased gradually throughout the experimental period excluding the slight decrease on the twelfth month of age (Table 2). The most rapid increase in absolute and relative weight occurred during the first five months of age when also the mature weight of the body was acheived. Wings meat percentage showed slight and flactuating increase after the third month of age. Age differences in this respect were highly significant, while sex differences were not significant (Table 2). Wings bones followed the same trend of the absolute and relative weights of wings meat (Table2). The total weights of meat and bones of the wings also showed similar trend like that observed in wings bones or meat either for the absolute or the relative weights (Table 2).

Breast

Gradual increase in absolute breast meat weight was observed until the ninth month of age with a slight decrease on the twelfth month (Table 3). The percentage of breast meat increased until five months of age when also mature body weight was acheived and no appreciable changes were observed afterwards. Age and sex differences in the percentage of breast meat were highly significant (Table 3). In general, ducks had heavier absolute and relative breast meat weight than drakes, which is a natural phenomenon in most of the binds. The absolute weight of the breast bones increased all over the study with the highest increase during the first three months of age. Bone percentage in breast fluctuated without any trend all over the experimental period. It seems that bone percentage in breast did not change greatly during the first year of age that means that these bones had been matured as early as the ducklings were one month old. However, age differences in breast bones percentages were highly significant, meanwhile sex differences were not significant in this respect. The total weight of the breast meat and bones increased rapidly throughout the first three months, then slow increase was observed afterwards. Bone percentage was almost constant, while meat percentage was changing, accordingly the trend observed in the total breast percentage was the same like that of breast meat percentage. The breast percentage of the females exceeded that of the males as the fat and muscle tissues in the breast of the females are normally more than in the males.

Legs

The meat of legs increased in absolute weight gradually until they reached their maximum on the fourth month of age (Table 4). Afterwards, no appreciable changes were observed. At the meantime, the percentage of legs meat reached their highest values on the second month of age and no appreciable changes were observed onwards. Age differences in legs meat percentages were highly significant. Meanwhile, sex differences in legs meat percentage were not significant. The bones of legs absolute weight showed rapid increase throughout the first two months of age, then increased slowly onwards irrespective some slight fluctuations. The highest increase in bones relative weight was on the second month of age, then a slight decrease was observed on the third month that continued until the end of the experiment with almost the same values. Age differences in bones percentage were highly significant meanwhile, sex differences were not significant. The legs showed the rapid increase in absolute and relative weights during the first two months of age. Afterwards, the legs absolute weight increased gradually whilest the percentage of legs decreased after three months of age and remained almost constant on the subsequent ages. As the legs are locomotive organs, they mature early in life as they are of vital importance for the ducklings from the beginning of their life.

TABLE 1.—**Body weight, eviscerated weight and percentages of Pekin ducks**

Age in months	Body wt.		Evisc. wt.		Evisc. %	
	Male	Female	Male	Female	Male	Female
1	193	309	91.6	186.2	47.4	60.2
2	479	465	268.4	241.7	56.0	62.0
3	1005	1130	606.3	717.0	60.3	63.4
4	1737	1571	1090.3	1044.8	62.3	66.5
5	2125	1807	1390.2	1184.4	65.4	65.5
6	2407	2091	1476.9	1334.1	61.1	63.8
9	2397	2150	1479.4	1379.1	61.7	64.1
12	2001	1936	1282.0	1246.5	65.1	64.4

F value for body wt.

Between ages = 170.71 ××
Between sexes= 4.83 ×
Interaction = 1.38

F value for eviscerated %.

Between Ages = 40.01 ××
Between Sexes = 7.51 ××
Interaction = 1.36

TABLE 2. Average absolute and relative weights of wings meat and bones.

Items	Age in months	Males		Females		F value
		wt.	Rel.wt.	wt.	Rel.wt.	
Wings meat .	1	1.7	0.9	2.5	0.8	*Wings meat* %
	2	6.1	1.3	5.9	1.3	Between ages
	3	40.0	4.0	59.6	5.3	= 107.30**
	4	90.0	5.2	89.4	5.7	Between sexes
	5	115.6	5.4	110.8	6.1	= 0.96
	6	132.2	5.5	120.0	5.7	Interaction
	9	142.8	6.0	120.8	4.8	= 3.07**
	12	126.4	6.3	113.6	5.9	
Wings bones .	1	1.5	0.8	3.3	1.1	*Wings bones* %
	2	3.7	0.8	4.5	1.0	Between ages
	3	30.2	3.0	42.2	3.7	= 20.31**
	4	47.2	2.7	37.2	2.4	Between sexes
	5	51.4	2.4	42.2	2.3	= 0.11
	6	52.4	2.2	47.2	2.3	Interaction
	9	61.8	2.6	53.0	2.5	= 0.78
	12	53.6	2.7	49.4	2.6	
Total	1	3.2	1.7	5.8	1.9	
	2	9.8	3.1	10.4	2.3	
	3	70.2	7.0	101.8	9.0	
	4	137.2	7.9	126.6	8.1	
	5	167.0	7.8	153.0	8.5	
	6	184.6	7.7	167.2	8.0	
	9	204.6	8.5	155.8	7.3	
	12	180.0	9.0	163.0	8.4	

TABLE 3. Average absolute and relative weights of breast meat and bones

Items	Age in months	Males		Females		F value
		wt.	Rel. wt.	wt.	Rel. wt.	
Breast meat	1	7.4	3.8	17.6	5.7	*Breast meat %*
	2	21.8	4.6	20.8	4.6	Between ages = 100.28**
	3	61.0	6.1	103.8	9.2	Between sexes = 8.99**
	4	224.4	12.9	204.6	13.0	
	5	372.0	17.4	321.0	17.8	
	6	378.6	15.7	356.2	17.0	Interaction = 1.67
	9	358.0	14.9	387.0	18.0	
	12	305.0	15.2	289.6	15.0	
Beast bone	1	4.4	1.8	6.0	1.9	*Breast bone %*
	2	7.0	1.5	7.6	1.7	Between ages = 3.68**
	3	22.6	2.3	29.0	2.6	
	4	33.4	2.0	27.8	1.8	Between sexes = 0.20
	5	37.6	1.8	31.0	1.7	
	6	44.6	1.9	38.0	1.8	Interaction = 0.82
	9	44.6	1.9	50.4	2.3	
	12	47.8	2.4	44.2	2.3	
Total	1	11.7	5.6	23.6	7.6	
	2	28.8	6.0	28.4	6.3	
	3	83.6	8.3	132.8	11.8	
	4	259.8	15.0	232.4	14.8	
	5	409.6	19.2	252.0	19.5	
	6	423.2	17.6	394.2	18.9	
	9	402.6	16.8	437.4	20.3	
	12	352.8	17.8	373.8	17.3	

TABLE 4. Average absolute and relative weights of legs meat and bones

Items	Age in months	Males		Females		F value
		wt.	Rel. wt.	wt.	Rel. wt.	
Legs meat	1	24.0	12.4	45.2	14.6	*Legs meat %*
	2	77.2	16.1	77.2	15.8	Between ages = 125.90**
	3	153.0	15.2	170.4	15.1	
	4	273.4	13.7	201.0	12.8	Between sexes = 0.91
	5	263.2	12.3	247.6	13.7	
	6	287.6	12.0	287.2	13.7	Interaction = 2.42
	9	270.4	11.3	286.4	11.9	
	12	247.6	12.4	259.8	13.4	
Legs bones .	1	7.2	3.7	11.0	3.6	*Legs bones %*
	2	19.4	4.1	22.0	5.0	Between ages = 71.03**
	3	29.4	3.0	27.8	2.5	
	4	26.2	1.5	23.8	1.5	Between sexes = 0.15
	5	27.3	1.3	21.2	1.2	
	6	31.6	1.3	28.6	1.4	Interaction = 1.61
	9	47.0	2.0	33.4	1.6	
	12	32.0	1.6	30.6	1.6	
Total . . .	1	31.2	16.1	56.2	18.2	
	2	96.6	20.2	93.2	20.8	
	3	182.4	18.2	198.2	17.5	
	4	299.6	15.2	224.2	14.3	
	5	290.5	13.6	268.8	14.9	
	6	319.2	13.3	315.8	15.1	
	9	317.4	13.2	289.8	13.5	
	12	279.6	14.0	290.4	15.0	

Back and pelvis

The absolute and relative weight of back and pelvis meat increased gradually allover the different ages except for values at 12 months of age (Table 5). Age differences in the relative weight of back and pelvis meat were highly significant, while sex differences were not significant. It seems that the building of meat in this part of body is a late phenomenon as most of the meat in this part is composed of fat and this tissue is normally formed at a later stage than any other tissue. The absolute weight of back and pelvis bones followed the same trend of the absolute weight of meat in these parts. However, the percent age of bones were high until the third month, then decreased on the fourth month and remained approximately constant onwards. As bone tissue normally mature at early ages, the bone percentage of these parts matured as early as the third month of age and age differences in this respect was highly significant while sex differences were not significant. The total weight of back and pelvis meat and bones increased gradually until nine months of age then showed an obvious decrease on the twelfth month. However, the percentage of back and pelvis was relatively constant all over the first year of life with slight fluctuations. There were no sex differences in both absolute and relative weights.

Proportional growth of body parts

The period of greatest relative growth rate of body parts varied according to the nature of each part. The legs being limbs of locomotion and is needed from the beginning of life matured as early as possible at one month of age or earlier. Accordingly, their size decreased later as other body parts increased in their proportion on the expense of legs portion. These other parts are supposed to be the less maturing parts, as found in the wings and breast. In general the ducks are from the migratory types of birds, and although these ducks were domesticated from long time age, some of the initial habits still remaining and affects their characteristics. The wings and breast being of vital importance for this habit showed their highest relative weights as late as the third month in wings and fifth month in breast as the migration occurs only after sexual maturity and this normally occurs at 5 or 6 months of age. The back and pelvis seems to be the earliest maturing parts of the body as no appreciable changes were observed in their relative weights all over the experimental period (Tables 2, 3, 4 and 5).

Total meat

The absolute weights of total meat or flesh that included muscles, fat and skin increased until the sixth month of age (Table 6), whilst the relative weight increased until the fifth month and no appreciable changes occurred afterwards. It seems that the fleshed tissues followed a similar course of growth as body weight. So, it is profitable for duck raisers in Egypt to market Pekin ducks for meat production on the fourth month, as no further gain can be obtained after this age. The incidental increase that occurs after that age is attributed to the deposition of fat especially in females and this normally costs more than the formation of muscles.

TABLE 5. Average absolute and relative weights of back and pelvis meat and bones.

Items	Age in months	Males		Females		F value
		wt.	Rel. wt.	wt.	Rel. wt.	
Back and pelvis meat	1	8.1	4.2	13.1	4.2	Back and pelvis meat %
	2	20.9	4.4	23.0	5.1	
	3	30.5	3.0	36.5	3.2	Between ages = 7.88**
	4	84.4	4.9	80.6	5.1	
	5	134.8	6.3	96.6	5.4	Between sexes = 0.15
	6	148.8	6.2	104.8	5.0	
	9	149.3	6.2	121.6	5.7	Interaction = 0.52
	12	126.6	6.3	117.6	6.1	
Back and pelvis bones	1	11.3	5.9	16.4	5.3	Back and pelvis meat %
	2	20.9	4.4	23.6	5.1	
	3	56.3	5.6	55.8	4.9	Between ages = 35.17**
	4	46.4	2.7	40.0	2.6	
	5	54.0	2.5	45.0	2.5	Between sexes = 1.38
	6	56.2	2.3	52.0	2.5	
	9	71.4	3.0	61.2	2.9	Interaction = 1.21
	12	57.4	2.9	56.4	2.9	
Total . . .	1	19.5	10.1	29.5	9.5	
	2	41.8	8.7	46.0	10.2	
	3	86.8	8.6	92.3	8.2	
	4	130.8	7.5	120.6	7.7	
	5	188.8	8.9	141.6	7.8	
	6	205.0	8.5	156.8	7.5	
	9	220.7	9.2	182.8	8.5	
	12	184.0	9.2	174.0	9.0	

Giblets

Age differences in giblets percentages were highly significant, while sex differences were not significant (Table 6) . Giblets meat weight increased gradually until they attained a high value at four months of age, while the maximum weight was at six months of age. However, the relative weights were high until the third month of age then showed a slight decrease on subsequent ages. In chickens also, no age difference was observed in giblets after the fifth month of age (Hafez, 1955).

Abdominal fat

Age differences in abdominal percent were highly significant (Table 6). The absolute and relative weights of the abdominal fat were low throughout the first three months of age, and as body matures at the fourth month the abdominal fat began to incease in both absolute and relative weight. This indicates that keeping the ducks for meat production after the fourth month is expensive as most of the food-stuffs are converted to fat more than flesh after this age as discussed previously. The abdominal fat attained its maximum absolute and relative weight on the fifth and sixth month and remained almost constant afterwards. Sex differences in the abdominal fat percentage were highly significant . The degree of fat deposition in females clearly exceeds that of males. In the sexually matured birds, estrogen secretion by the ovary raises the level of fatty materials in the blood (Lorenz *et al.*, 1938) which enables the birds to deposit extensive quantities of fats in the body.

Edible portions

The absolute and relative weights of edible portions increased gradually with advancement of age until the fourth month, reached the highest weight on the fifth and sixth months of age, then began to decrease steadily on subsequent ages (Table 6). Age differences in edible portions relative weights were highly significant. In chickens, total edible meat increase in weight with the advancement of age until body maturity that ranges from five to seven months of age (Harshaw and Rector, 1940, Jull *et al.*, 1943; Anghui, 1951 Newell, 1954; Badreldin *et al.*, 1961). Edible percentage was somewhat and significantly higher in females than in males in all the ages. In other studies concerning ducks, edible percentages of females overgrow that of the males only at ten weeks of age and no sex differences can be observed afterwards (Snyder, 1962).

Total bones

Total bones absolute weight increased with the advancement of age until the ninth month of age then decreased again on the subsequent age (Table 6). However, the total bones relative weight were higher on the first three months then decreased gradually, as they attained the lowest weight on the fifth and sixth months of age. In general, the bones attain their maturity as early as the third month, being the first tissue to mature. In chickens, the skeletal

TABLE 6. **Average absolute and relative weights of total meat, giblets, fat edible portions and total bones.**

Items	Age in months	Males		Females		F value
		wt.	Rel. wt.	wt.	Rel. wt.	
Total meat . .	1	41.3	21.3	78.3	25.3	
	2	126.0	27.3	120.9	26.8	
	3	284.5	28.3	370.3	32.8	
	4	636.2	36.6	575.6	36.7	
	5	885.6	41.5	776.0	39.9	
	6	947.2	39.4	868.2	41.5	
	9	920.5	38.4	867.8	40.4	
	12	805.6	40.3	780.6	40.3	
Giblets	1	22.3	11.5	34.7	11.2	*Giblets%*
	2	56.1	11.7	53.5	11.5	Between ages
	3	103.8	10.3	96.0	8.5	= 42.79**
	4	149.9	8.6	133.3	8.5	Between sexes
	5	148.0	7.0	125.8	7.0	= 0.00
	6	159.2	6.6	149.6	7.2	Interaction = 1.67
	9	147.4	6.2	150.4	7.0	
	12	142.2	7.1	151.5	7.9	
Fat	1	0.2	0.10	4.8	1.54	*Fat %*
	2	1.9	0.39	3.0	0.66	Between ages
	3	2.6	0.26	6.6	0.58	= 10.89**
	4	15.4	0.89	13.7	0.87	Between sexes
	5	26.4	1.24	32.6	1.80	= 15.16**
	6	30.3	1.26	40.3	1.93	Interaction = 0.57
	9	7·8	0.32	26.2	1.22	
	12	11.9	0.59	30.3	1.57	
Edible Portions	1	78.9	40.8	145.9	47.2	*Edible portions*
	2	218.3	47.0	206.1	43.0	Between ages
	3	470.2	44.8	541.0	47.9	= 46.17**
	4	915.6	52.7	824.1	52.5	Between sexes
	5	1277.4	58.2	1066.9	59.0	= 4.37*
	6	1368.9	56.9	1250.7	59.8	Interaction = 2.90
	9	1330.3	55.5	1216.2	56.6	
	12	1111.9	55.6	1011.8	52.3	
Total Bones . .	1	24.4	12.2	36.7	11.9	
	2	51.0	10.7	57.0	12.8	
	3	138.5	13.8	114.8	13.7	
	4	155.2	8.9	128.8	8.2	
	5	170.3	8.0	139.4	7.7	
	6	184.8	7.7	165.8	7.9	
	9	224.8	9.4	198.0	9.2	
	12	190.8	9.5	180.6	9.3	

system mature early in life and its growth ceases earlier than does the growth of the body (Jaap and Penquite, 1938). Also, the variability in skeletal growth during the gorwing period is relatively much less than the variability in body weight (Schneider and Dunn, 1924).

Body length

It increased gradually and highly significantly until the end of study (Tables 7 & 8). It attains maturity as early as the fourth month of age. There were highly significant sex differences in body length. The females excelled the males during the first two months, then the males exceeded the females on the subsequent ages. This trend of variation in body length was also observed in body weight, eviscerated carcass and meat percentages. It can be concluded that body length may be taken as a criterion for body growth and meat production characteristics. It showes the same trend in age and sex like body weight and other meat characters.

Body depth

It increased gradually and highly significantly throughtout the ages of the experiment (Table 7 & 8). The males slightly exceeded the females in body depth in adult ages but sex differences were not significant. In turkeys, males exceed, females in body depth (El-Ibiary and Jull, 1947).

Body circumference

Age differences in body circumference at breast region were highly significant(Table 8). The increase in body circumference was very rapid until the fifth month of age and it seemed to be constant afterwards (Table 7). This was almost the same developmental trend of variation observed in body weight, eviscerated carcass and meat percentages. Accordingly, it seems that the circumference of body at breast region can also give a criterion for measuring the egree of development of total meat and breast fleshing than any other body measuremets as found in this study or what was found also by Lasely (1949). No sex differences were observed in this character.

Shank length

Age differences in shank length were highly significant (Table 8). Shank length increased rapidly and attained its mature size as early as the third month of age and no appreciable changes were observed afterwards (Table7.) It seems that shanks are of the earliest maturing parts of the skeletal system as found in this study or in others. (Connally *et al.*, 1941 and, Jaap, 1941 and 1947). No sex differences were observed in this character.

Femur and tibia length

Femur and tibia growth followed the same trend like that observed in shank growth, as they attained their mature length on the third month of age (Table7) and no appreciable differences were observed onwards. Age differences in

femur and tibia length were highly significant (Table 8). Although, males excelled relatively females in femur and tibia lengths sex differences were statistically not significant.

TABLE 7. Age and sex differences in body measurements (cm)

Items	Age in months								
	At hatch	1	2	3	4	5	6	9	12
Body length									
Male	7.5	13.1	17.0	23.2	26.4	27.5	29.2	31.3	28.9
Female	7.8	14.1	18.4	22.7	25.4	22.5	27.3	29.0	25.8
Average	7.7	13.6	17.7	23.0	25.9	27.0	28.2	30.2	27.4
Body depth									
Male	2.1	3.9	5.0	7.7	8.9	9.5	10.0	10.0	10.6
Female	2.0	3.6	5.3	8.0	8.3	9.2	9.9	9.6	9.6
Average	2.1	3.8	5.2	7.9	8.6	9.4	10.0	9.8	10.1
Body circumference									
Male	7.1	12.1	16.1	23.1	24.5	31.8	31.8	30.4	30.6
Female	7.6	14.1	16.6	24.8	23.0	30.1	31.1	30.1	30.3
Average	7.4	13.1	16.4	23.9	27.8	31.0	31.4	30.3	30.5
Shank length									
Male	2.4	3.3	4.3	5.3	5.6	5.4	5.7	5.8	5.8
Female	2.2	4.0	4.6	5.3	5.0	4.7	5.5	6.0	5.6
Average	2.3	3.7	4.5	5.3	5.3	5.1	5.6	5.9	5.7
Tibia length									
Male	—	6.1	8.5	10.5	10.2	10.6	11.3	11.2	10.7
Female	—	6.7	8.4	9.8	10.4	9.6	10.3	10.7	10.2
Average	—	6.4	8.4	10.2	10.3	10.1	10.8	11.0	10.5
Femur length									
Male	—	3.1	4.8	6.2	7.5	6.4	6.6	6.7	6.5
Female	—	3.9	4.7	5.9	6.3	5.8	6.2	6.5	6.4
Average	—	3.5	4.8	6.0	6.9	6.1	6.4	6.6	6.4

TABLE 8. Analysis of variance for body measurements as influenced by different ages and sexes

Items	Source of variation	d.f.	Sum of squares	Mean squares	F value
Body length	Age	8	4690.87	586.36	291.63**
	Sex	1	14.24	14.24	7.08**
	Interaction	8	44.06	5.51	2.74**
Body depth	Age	8	714.89	89.36	249.06**
	Sex	1	1.25	1.25	3.48
	Interaction	8	3.75	0.47	1.31
Body circumference	Age	8	6506.51	813.31	395.16**
	Sex	1	0.04	0.04	0.02
	Interaction	8	32.30	4.04	1.96
Shank length . . .	Age	8	110.12	13.77	63.32**
	Sex	1	0.19	0.19	0.87
	Interaction	8	4.70	0.59	2.70*
Tibia length	Age	8	164.06	20.51	19.2**
	Sex	1	2.85	2.85	2.7
	Interaction	8	5.75	0.74	0.7
Femur length . . .	Age	7	90.53	11.32	23.62**
	Sex	1	1.48	1.48	3.09
	Interaction	7	2.26	0.28	0.59

** Highly significant.

* Significant.

Interrelationships

Body length was associated with body and carcass weight at four months of age and for the total average (Table 9) which enable the using of this character as a criterion for body and carcass weights. Body depth was correlated with body and eviscerated carcass weights at two, four and twelve months of age. It can be concluded that body depth is a good criterion for body and eviscerated carcass weights at the early ages during the period of rapid growth and also at mature ages. However, body depth seems to be more associated with eviscerated carcass than body weight. Also Jaap and Penquite (1938)

concluded that body depth is one of the most accurate criterion for evaluating body conformation in chickens. Body circumference was highly correlated with body and eviscerated carcass weights almost for all the ages of the experiment. Accordingly, it seems that body circumference may be the most accurate criterion for evaluating body and carcass weights at any age in ducks.

TABLE 9. Correlation coefficients between body weight and eviscerated carcass weight and body measurements.

Items	Age in months								
	1	2	3	4	5	6	9	12	Total
Body length × . Body weight × .	0.016	0.51	0.32	0.67*	0.34	0.40	0.060	0.30	0.81**
Carcass weight	—0.042	0.53	0.20	0.66*	0.31	0.40	0.45	0.24	0.91
Body depth × . Body weight × .	0.32	0.88**	0.25	0.82**	0.68*	0.28	—0.01**	0.72	0.51
Carcass weight.	0.26	0.88**	0.28	0.76**	0.64	0.41	—0.37	0.71*	0.93**
Body circumference × . . . Body weight × .	0.76**	0.94**	0.74**	0.58	0.90**	0.53	0.60*	0.68*	0.96**
Carcass weight	0.83**	0.89**	0.88**	0.84**	0.85**	0.49	0.64*	0.63*	0.96**
Femur length × Body weight × .	0.63	0.69**	—0.043	0.64*	0.62*	0.74**	0.10	0.020	0.82**
Carcass weight	0.55	0.61	0.01	0.72	0.62	0.79	—0.11	—0.013	0.81**
Tibia length × . Body weight × .	0.74**	0.77**	0.38	—0.22	0.83**	0.51	0.62*	—0.37	0.79**
Carcass weight	0.65*	0.71*	0.23	—0.37	0.78**	0.82**	0.45	—0.47	0.78**
Shank length × Body weight × .	0.72**	0.58*	—0.17	0.0007	0.54	0.42	—0.10	0.32	0.43
Carcass weight	0.68*	0.81**	—0.13	—0.18	0.50	0.30	0.43	0.21	0.02

r at 0.05 = 0.602
at 0.01 = 0.735

Femur length was correlated with body weight throughout the first six months of age except the age of three months. However, its correlation with the eviscerated carcass weight was only significant on the first , fifth and sixth months of age. So, femur length can be considered as a criterion for early body and carcass growth. Tibia length was correlated with body and eviscerated carcass weights at the first, second and fifth months of age. Also, it is correlated significantly with body weight at ninth month of age and with eviscarated carcass at sixth months of age. Tibia lenght can be taken as a criterion for body growth and evisceration quantity during the early ages of life as well as during the period of body maturity. Shank lenght was highly correlated with body and eviscerated carcass weights only at the first two months of age. So, shank length can be used for evaluating body and carcass growth during the period of fast growth.

All the previous measurements were correlated with body and eviscerated carcass weights in all the ages used as a whole (Table 9). These correlations were all significant except the correlations with shank length and the correlation between body depth with body weight. In general, it can be concluded that body circumference is the most accurate criterion for evaluating body and carcass growth in ducks. Also, accurate criteria for body and carcass growth can be taken from shank length at the early ages, from femur length at sexural maturity and from body depth at adult ages.

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انتاج اللحم من البط

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درس انتاج اللحم فى ٥ ذكور و ٥ اناث من البط البكين عند الفقس وعند اعمار ١– ٢– ٣– ٤– ٥– ٦– ٩– ١٢– شهرا ووجد الاتى :

١ – تتزايد نسبة التصافى بتقدم العمر حتى تنضج الطيور جنسيا ثم يقف التزايد ، أو ينقص . ونسبة التصافى فى الاناث اعلى منها فى الذكور .

٢ – تصل الأرجل والافخاذ الى وزن النضج فى عمر شهر بينما يصل الجناح والصدر الى هذا الوزن عند عمر ٣ – ٥ شهور . وصدر الاناث أكبر من الذكور .

٣ – تتزايد نسبة التشافى مع زيادة الجسم فى الوزن الى عمر ٦ شهور حيث تثبت نسبة التشافى . وينضج وزن الكبد والقانصة عند عمر ٣ شهور ونجد أن الاناث لها كبد وقانصة اكبر من الذكور . وتصل نسبة الجزء الماكول الى اعلى قيمة فى عمر ٥ شهـــور . وتعطى الاناث جزء مأكول أكبر من الذكور ولذلك يكون وزن العظام فى الذكور اكبر . والعظام عامة تنضج مبكرة عند عمر ٣ شـــهور .

٤ – يتزايد عمق الجسم بزيادة العمر خلال الشهرين الأول ثم يتناقص هذا التزايد بعد ذلك ويصل طول الساق وعظام الأرجل الى اقصى قيمة فى ٣شهور من العمر .

٥ – محيط الصدر هو أدق مقياس للتنبىء بسرعة النمو ووزن الجسم ونسبة التصافى عند جميع الأعمار ويشاركه فى ذلك طول الساق . ويمكن اتخاذ عمق الجسم مقياس لتقدير نسبة التصافى فى الطيور البالغة .