دراسة على تركيب الجسم فى الدواجن

١ ـ استخدام الامينوبنزين لتعيين نسبة الرطوبة فى الجسم

٢ ـ العلاقة بين مكونات الذبيحة فى الدواجن

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الملخص

تمت الدراسة على ١٤ ديكا ، ١٤ دجاجة من نوع الدقى ٤ فى سن ٢١ أسبوعا وفى التجربة الأولى تم محاولة استخدام الامينوبنزين لتعيين الرطوبة فى الجسم الحى وتم حقن ٢ سم٣ من محلول ١٠٪ فى كل ديك أو دجاجة وتبين أن عينة الدم المأخوذة بعد ساعة من الحقن تعطى نتائج مماثلة لكمية الرطوبة الحقيقية المحسوبة بطريقة التحليل الفعلى .

وفى التجربة الثانية تبين وجود ارتباط عكسى بين الدهن والرطوبة ويمكن استخدام نسبة الرطوبة فى تعيين نسبة الدهن وذلك باستخدام المعادلتين الآتيتين :

نسبة الدهن = ٣٢ر٠٣١٦ ـ ٣٨٥٠ر٠ × نسبة الرطوبة (فى الديوك)

نسبة الدهن = ٣٩ر٦٤٩٣ ـ ٤٥٣٨ر٠ × نسبة الرطوبة (فى الدجاج)

ونسبة البروتين يمكن حسابها باستخدام نسبته الثابتة فى الجسم الخالى من الدهن والرطوبة (٧٧ر٣٤٪ فى الديوك ، ٧٨ر٢٨٪ فى الدجاج) أو النسبة الثانية للبروتين والدهن مجتمعين فى الجسم الخالى من الرطوبة (٨١ر٧١٪ فى الديوك ، ٨٣ر٩٧٪ فى الدجاج).

وقد تبين من النتائج عدم وجود اختلافات بين تركيب الجسم فى الديوك أو الدجاج ما عدا فى نسبة الرطوبة للدهن .

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A STUDY ON BODY COMPOSITION IN FOWL

1 APPLICATION OF AMINO BENZENE DILUTION TECHNIQUE FOR THE ESTIMATION OF BODY WATER CONTENT

2 SOME RELATIONSHIPS AMONG THE MAJOR CHEMICAL COMPONENTS OF FOWL CARCASS

(With 3 tables)

by

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SUMMARY

The study was done on 14 cocks and 14 hens of the Dokki 4 bread 21 weeks of age. The first trial was conducted to atte mpt the application of amino benzene dilution method in the estimation of body water content. Two mls. of amino benzene (10)% were injected in each cock or hen, then 1 ml. of blood was taken after ½ or 1 hour from the injection estimated moisture values from samples taken after one hour from injection showed a high degree of accuracy. It is concluded that taking blood samples after half an hour is not enough for uniform distribution of amino benzene in the body fluids.

The second trial was conducted to study the relationships between the major components of the fowl carsass. It was found that there is an inverse linear relationship between fat and water, and fat can be estimated from water content using the linear equations $Y = 33.0316 - 0.3850 \times$ (in cocks) and $Y = 39.6493 - 0.4538 \times$ (in hens). The body protein can be estimated using its constant percent in the fat free dry carcass (77.34% in cocks and 78.28% in hens) or the constancy of the combined protein and fat value in dry carcass (81.71% in cocks and 3.97% in hens). The results showed that there is no sex difference except in the H_2O : fat ratio

INTRODUCTION

The increase demand of the processor for broilers of uniform size and composition has stimulated interest in considering not only weight gain and feed efficiency, but also the carcass composition.

The obvious limitation of the slaughter and chemical analysis, apart from being laborious, is that data on a given animal can be obtained only once, although what is most desired is information on its changing body composition as a result of the ration fed.

BANDER AND MILLER (1953 b) demonstrated that body nitrogen water of the rat was related to age and only carcass H_2O was required to determine not protein value (NPV). DONALDSON, COMBS, AND ROMASER, (1956) ; RAND, KUMMEROW AND SCOTT (1957), SPRJNG and WIKINSON (1957), and UMMERS and FISHER (1965) have noted that specific changes in total body composition of chicken were chiefly in the ratio of moisture to fat while the protein level remaining relatively constant. COMBS AND ROBEL (1962), SUMINERS and FISHER (1961), found that carcass water : nitrogen ratios were slightly affected despite considerable variation in nitrogen and fat content of the carcass on various diets.

It was cited by REID ET AL(1955)that the protein and fat contribute almost all of the energy value of the body, and carbohydrate generally constitute less than 0,5P of the bovine body and therefore can be disregarded. DONALDSON ET AL (1956) determined the protein content of chick carcass by difference, assuming a constant carbohydrate content of 0.5%.

Regarding the methods of estimation for body composition COMB AND ROBEL (1962), Summer et al (1965), SUMMERS AND FI HER (1961) have shown that the method of BENDER AND MILLER (1953 b) to estimate carcass nitrogen from carcass water content may be used in the chicken with a high degree of accuracy. SUMMERS ET AL (1965) also found that, it is feasible to determine fat contents of cercasses from the estimated protein values using the following equation :

$$\text{Percent carcass fat} = \frac{K\ W - P \times 100}{W}$$

Where K = a determined constant (fat + protein as a ratio of dry weight).

P = gm of carcass protein and w = dry weight of carcass.

In the method illustrated by Reid & coworkers (1955), the following equation was given for calculating fat content from the measured water in the cattle :
$Y = 355.88 + 0.355 \times - 202.91 \log x$.

where Y = fat content (percent) and x = water content (percent) The protein and ash contents were calculated from the finding that the fat free dry body contains 80.3 percent of protein and 19.7 percent of ash. Also it was cited by HAROLD (1958) that there are a highly correlated inverse linear relationship between water and fat content of the chicken body.

With the advent of simplified dilution techinques in vivo, estimation of body composition has become more common-place including studies on several domesticated mammmalian species. HAROL (1958) mentioned a modified method for the application or the antipyrine dilution technique ro the hen Louis et al (1965) found that when amino benzene is injected in the blood, it is uniformaly distributed in the body fluids in a time varying in man, pou ltry ond rats after $^1/_2$—1 hour. WALTER ET AL (1963) mentioned that the toxicity of amino benzne begins to appear when the level exceeds 4.5 gm in th blood and body fluids.

Theobjectives of this investigation were:

a—To attempt the application of amino benzene dilution technique to measure the water content of the body in fowl.

b—To examine the relationships existing between th major chemical components of the fowl carcass.

c—To study the infleunce of sex upon the relationships among body components.

d—To attempt to quantitate these relationships for application to nutritional experiments.

Fourteen cocks and fourteen hens (Dokki 4) of 17 weeks old were experimented on. They were fed for a month on a dry mash composed of: yellow corn, 72 parts, wheat bran, 10 parts, cottenseed meal, 10 parts; Fish meal, 1 part; blood meal, 3 parts; bone meal 2 parts; clacium carbonate, 2 parts; common salt, 0.5 part; mineral mixture, 0.5 part; AD- 0.5 part; and yeast 0.5 part.

A ter 29 days from the start of the experiment each cock or hen was injected intravenously by 2 ml of amino benzene solution (10 gm in 100 ml saline solution) One ml of blood was taken from each cock of hen after ½ hour and another sample after 1 hour to ensure uniform distribution of the amino benzene in the different body fluids. Another 1 Vogel methed (1957 was used to dter mine the amino benzene conentration in blood. Th body water conetnt was calculated according to the equation

$$\text{The bony water content } \frac{\text{Mg gf amino benzede injected } x_1}{\text{mg\% of amino benzine in the blood sample}}$$

To convert the whole blood data, a value of 87% water for the chicken was used (Harold, 1958).

Twelve hours prior to the termination of the experiment, birds were deprived of feed (but not water), then weighed and killed using chloroform inhalation The carcasses w re dried in hot air oven at 105°C to the degree of easy grinding A ter the primary dryness the carcasses were weighed and samples taken and dried again at 105°C till constant weight Moisture values were obtained by difference between the line weight before killing and the final dried. w ight. Samples w re taken for the determination of body protein and fat using kjeldahl and Soxhlet procedures. All chemical determinations were carried out in duplicates.

Statistical procedures used in this study were taken from Snedecor (1956)

Trial 1 :

Statistical analysis showed that the estimated mositure conetnt by using blood samples taken 1 hour after the amino benzene injection agree very closely with determined values as the correlation coefficient (r) rangedform 0.941 in males to 0.924 in females. While the moisture values estimated from the ½ hour samples were far less tan the determined values. This showed that uniform distribution of amino benzene was achieved in fowl at 1 hour after injection (a finding which confiims what was mentioned by Louis et al, 1965), and the estimated mositure showed high degree of accuracy.

Trial 2 :

Statistical analysis of the determined values for water content and fat content of the male carcasses showed significant negative corrleation (r W0. 647 The fat showed or significant linear regression on water content as the t value was 2.953 at 5% level of probability, and the fat content can be estimated from the determined water content using the following regression equation.

TABLE 1. **A comparison between the determined (D) and estimated (E) moisture content percent using the amino benzene dilution technique.**

	Mlesa			Females		
	D	E_I	E	D	E_I	E_2
Mean . .	71.65	59.05	71.95	69.17	55.81	69.99
S D . .	2.52	—	2.10	2.08	—	1.44
S E. . .	0.67	—	0.56	0.56	—	0.39
r . . .		—	0.941		—	0.924

Where E_I : Is the estimated moisture content from blood samples taken at ½ hour after amino benzene injection.

E_2 : The estimated moisture using blood samples taken at 1 hour after amino benzine injection.

S D : Standard deviation.
S E : Standard error.
r : Correlation coefficient.

where Y = percent of fat content X= percent of water content.

In the females statistical analysis showed highly significant negative correlation (r = 0.780) between water and fat content. The linear regression of fat on water was highly significant (t = 3.99) and can be expressed by the equation

$$Y = 39.6493 - 0.4538 \; X.$$

The fat values estimated from water content depending on the inverse relationship between them and using the respective regression equation showed a high degree of accuracy as the coefficient of correlation between the determined and estimated values was highly significant (0.786 in males and 0.714 in females) This confirms the reliability of using the method illustrated by Reid et al (1955)

TABLE 2. A comparison between the determined (D) and estimated (E) fat content percent male and female carcasses (wet basis) using the respective regression equation.

	Males		Females	
	D	E	D	E
Mean	5.44	5.44	8.26	8.26
S D	1.496	0.993	1.308	0.942
S E.	0.400	0.270	0.350	0.252
r		0.647		0.780

TABLE 3. A comparison between the determined (D) and estimated (E) protein values percent (Wet basis).

	Males			Females		
	D	*E	***E_2	D	E_1	E_2
Mean .	17.67	17.67	17.63	17.73	17.72	17.73
S D . .	1.602	0.888	0.803	2.117	1.190	1.079
S E. . .	0.43	0.237	0.215	0.566	0.318	0.288
r		0.900**	0.899**		0.575*	0.575*

* Significant correlation between the estimated and determined values.
** Highly significant correlation.

Calculating the water = nitrogenratios, it wasfound thatitis nota constant value andwhen the average was usedfor the estimation of protein from the water content, the estimated values showed negative correlation with the determined ones. This means that what was mentioned by Comb and Robel (1962), Sumoners et al (1965) and Summers and Fisher (1961) concerning the eliability of using the method of Bender and Miller in estimating protein from water content, can be only used in chickens less than 21 weeks in age.

The protein percent in the fat free dry carcasses was calculated and was found to be relatively constant (Reid et al, 1955). The average value (77.34% in males and 78.28% in females) was used in the estimation of protein. The estimated protein values showed significant correlation to the determfned ones,

The percentage of the combined fat and protein on dry basis was found to be relatively constant and the averages (81.71%) in males and 83.97% in females) were used to estimate the protein content using estimated fat from moisture content. The estimated values showed significant correlation to the determined values and this confirms the method of Summers et al (1965).

The following table shows comparison between the determined protein values in males and females, and the estimated values using the constancy of protein percentage in the fat free dry carcass (E_1), and the constancy of the value for the combined fat and protein in the dry carcass (E_2) Statistical analysis showed that the two methods for protein estimation have the same degree of accuracy.

The chemical analysis of male and female carcasses showed that the percentage of protein and ash are relatively constant and the sex difference is chiefip due to the change in the ratio of mositure to fat, due to their inverse relationshiy as it is clear from the following table.

Itis concluded from this work that moisture content can be estimated using the amino benzine dilution technique

As mentioned before the method illustrated for cattle reported by REID COWORKERS (1955) which was based on the recognition that a highly predictable inverse relationship exists between the concentrations of water and fat in the body and that in the fat free water free body the proportions of protein and ash remain constant.

The linear regression of fat on water content is expressed by regression equations and used to estimate fat from the estimated water content values

The regression equation in cocks is $Y = 33.0316 - 0.3850\,x$

The regression equation in hens is $Y = 39.6493 - 0.4538x$ where Y is the fat ontent and x is the water content.

After fat estimation the protein can be estimated by using its constant croportion in the fat free dry carcass which was found to be 77.34% in males and 78.28% in females.

TABLE 4. Average percentages of major chemical components of male and female carcasses (Wet basis).

	Male Carcasses	Female Carcasses
Moisture% . .	71.65 + 0.67	69.17 + 0.56
Protein % . .	17.73 + 0.57	17.67 + 0.43
Fat %.	5.44 + 0.40	8.26 + 0.35
*Ash% . . .	4.68	4.40

* Calculated by difference (carbohydrate considered to be 0.5% Donaldson et al, 1956 and Reid et al, 1955).

As mentioned by SUMMERS ET AL (1965) and SUMMERS and FISHER (1961) the combined quantity of fat and protein in the dry carcass was caluclated and found to be relatively constant (average in males 81.71% and in females 83.97%). These values were used also to estimate the protein content (wet baiss) of the carcass using the estimated fat values applying the follcwing modified equation.

$$\text{percent carcass protein (wet basis)} = \frac{\text{kw-F}}{\text{wt}} X\, 100$$

where K= determined constant (fat+protein as a ratio of dry weight) W= dry wt. of carcass F = gm of carcass fat wt = net weight of the carcass.

Ash can be estimated from the constancy of its ratio to the fat free dry carcass which was found to be 22.66% in cocks and 21.72% in females. Or it can be estimated by difference considering the carbohydrate content to be 0.5%.

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