

JOURNAL
OF
ANIMAL PRODUCTION
OF THE
UNITED ARAB REPUBLIC

J. ANIM. PROD. U.A.R.

VOLUME I

NUMBER 2

1961

Edited by the Egyptian Society of Animal Production
Published by the Science Council
In Collaboration with the National Research Centre

DIFFERENTIAL GROWTH AND CARCASS CHARACTERISTICS IN THE GIZA RABBIT

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SUMMARY

This investigation was undertaken during 1957-1958 season to study the nature of growth in Giza rabbits and its relationship to the best time of marketing or meat composition.

563 rabbits were used from the Experimental Farm of the Animal and Poultry Breeding Department, Faculty of Agriculture, Cairo University. The major results arrived at can be summarized in the following.

The average body weight was nearly two, three and four times the initial 30-days weight at 60, 90 and 150 days of age respectively. After weaning, the growth rate and the daily gain were 72 % and 13 grams respectively when they sharply decreased to 32 % and 9 grams, in respective order, between 60-90 days of age, afterwhich they decreased steadily till 150 days of age.

The development process of the Giza rabbit goes faster in the longitudinal than in the depth trend of the body. The relative increase in the length of the animal's body and its quarters could be a good indication for yielding a high carcass percentage.

The percentage of carcass weight to the live weight was about 50 % at 90 days of age. This stage is the best time for yielding an economic value of carcass percentage.

The vital organs used for maintenance of life develop first, while the parts used for meat production such as loin, hind quarters, thorax and shoulders develop later.

The percentage of water and ash in the carcass decreased gradually with advancing age, while the percentage of intermuscular fat increased progressively. The percentage of carcass protein was nearly constant at the different ages.

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INTRODUCTION

It is accepted that rabbit raising in our country could be one of the tools to increase the average farmer's income and to be a good source for meat production, either for the owner himself or for the total meat market at large. However, the nature of growth in rabbit has not been clearly studied in relation to the best time of marketing or meat consumption. A test of the successive interrelationships between the growth response, body measurements, meat yield and carcass constitution will help in planning out a good scheme for rabbit production and consumption.

REVIEW OF LITERATURE

The growth rate is not the same for all parts of the body. There is a special trend causing a growth gradient between different parts or tissues. Early in life, the vital organs used for maintenance of life, such as offals, develop at a greater rate than the parts used for production, i.e. fat, muscle and udder. The valuable parts for meat production such as the loin, pelvis, thorax and shoulder are late developing parts (Huxley, 1932; Hammond, 1932 and Kheir El-Din, 1950). On the other hand, Fangauf and Immenkamp (1938) reported that the small breeds of rabbits have better carcass yields than the larger breeds. At earlier ages, the carcass weights were significantly heavier in males than in females, but later they became heavier in females because of their higher fat contents (Wilson and McCartney, 1940). Podhardsky (1948) reported that the head, bones, intestines and the contents of intestines decreased greatly with advancing age, while the stomach did not show such a noticeable decrease. Moreover, there was a greater increase in the flesh than in the skin.

In pigs, after birth the loin makes the most growth, followed by the pelvis and thorax, then the neck and lastly the head (McMeckan, 1940).

MATERIALS AND METHODS

This investigation was carried out on Giza rabbits, an improved local breed owned by the Department of Animal Production, Faculty of

Agriculture, Cairo University. Births dealt with were obtained from January till March 1958. Berseem was used as green ration, while the dry ration was composed of 50 % barley and 50 % wheat bran. Weaning was done at four weeks of age. Rabbits were weighed and measured at 30-days intervals till the end of the experiment at 150 days after birth. The body measurements taken could be described as follows :

1. Body length, beginning from the second cervical vertebra to the commencement of the tail.
2. Fore-limb length, beginning from the withers to the carpus.
3. Hind-limb length, beginning from the sacrum to the tarsus.
4. Head length, beginning from the second cervical vertebra to the muzzle.
5. Thorax girth, surrounding the thorax.
6. Abdominal (Lumbar) girth, surrounding the trunk at the lumbar region.

A piece of string was used to take the measurements and then it was spread and measured against a ruler. Weights and measurements were taken to the nearest gram and centimeter respectively.

Six representative individuals were slaughtered before the morning meal at 30-days intervals beginning at 30 days old till the age of 150 days. The live weight of each rabbit was recorded. Skinning was carried out by removing the skin attached to fore-feet, hind-feet and the tail. The head including the ears was severed at the second cervical vertebra. The stomach was weighed after emptying its contents. The offals (liver, heart, kidneys and lungs and trachea) were weighed separately. After recording the weight of the empty carcass, it was cut into 4 parts. The first cut was made at the withers separating the shoulders from the trunk, the second was just behind the last rib separating the chest, the third was performed at the pelvis separating the loin region from the thighs. Fat was removed from each part and weighed altogether. The meat and bone of each part were weighed separately.

Meat of the four parts of each rabbit was minced and mixed thoroughly by a food chopper. Estimation of moisture, protein, crude fat and ash was carried out according to Official Methods (1950). Statistical analysis was done according to Snedecor (1959).

RESULTS AND DISCUSSION

1. *Body measurements :*

The live weight of the rabbits progressively increased with age. The average body weight was nearly two, three and four times the initial 30-days weight at 60, 90 and 150 days of age respectively (Table 1).

TABLE 1

Average body weight, relative body weights compared to their values at 30 days of age, relative growth rate and daily gain in Giza rabbits at different ages.

Age in days	No.	Av. body wt. (Gms.)	Relative body wt. %	Relative growth rate%	Daily gain (Gms)
30	563	348 ± 7	100		
60	244	341 ± 18	213	72	13.4
90	237	1019 ± 33	293	32	9.3
120	186	1226 ± 45	353	19	6.9
150	154	1371 ± 51	394	11	4.8

Figures represent the mean ± the standard error.

On the other hand, growth rate and daily gain decreased with advancing age. After weaning, the growth rate and the daily gain were 72 % and 13 grams respectively, while they sharply decreased to 32 % and 9 grams in respective order during the period from 60-90 days of age. A relatively steady decrease followed this stage. From these results, it seems profitable to finish with the Giza rabbit for meat at 3-4 months of age, after which the relative growth rate and body gain become very slow to compensate for the feed and managerial costs. Moreover, the body weight at this stage ranged between 3-5 pounds, and this is a suitable weight for rabbit consumers in the local market.

The average values of the different measurements of the body such as body length, fore limb length, hind limb length, head length, thorax girth and lumber girth, followed the same trend of the average body weight in increasing with age (Table 2). The percentage increase of

TABLE 2

The average measurements of body in Giza rabbits at different ages.

Age in days	No.	Body length (Cms.)	Fore-limb length (Cms.)	Hind-limb length (Cms.)	Head length (Cms.)	Thorax girth (Cms.)	Lumber girth (Cms.)
30	563	21	11	14	10	15	15
60	244	27	15	18	12	19	19
90	237	31	17	20	13	21	21
120	186	33	18	22	14	22	23
150	154	34	20	23	15	24	24

body length and both thorax and lumber girth indicated that the development process goes faster in the longitudinal than in the depth trend. The fore-limb showed the highest percentage increase while the increase was nearly the same in the length of body and hind limb. Head length showed the least increase. These results could be explained by the findings of Hammond (1932) who stated that, in general, a wave of growth begins at the anterior trunk region and spreads backwards, at the meantime other secondary waves start at the limb extremities and pass upwards. These waves meet at the thoraco-lumber function region.

The «b» values of the average body weight on average body length were 13.8, 59.4, 76.7, 108.3 and 123.4 at the five monthly tests respectively. It is obvious that one unit increase in body length was met with small increase in body weight in young animals than in adult ones. These results could be explained by the fact that increase of weight is not merely due to an increase in length but it is a product of increase in both length and circumference. In other words, increase in weight opposite to one centimeter increase in length is augmented by the greater girth in the case of old animals than in the young.

The correlation between body length and carcass weight was found to be highly significant ($r=0.852$). It could be stated that a great increase in animal's body length is a good indication for yielding a high carcass percentage.

2. Carcass characteristics :

The average weight of the carcass and its percentage to the live weight increased progressively with age (Table 3). The daily gain of live weight

TABLE 3
Relative weight of carcass to the live weight and relative weights of body parts to the carcass weight in Giza rabbit.

Age in days	Av. Live weight (Gms.)	Average carcass weight (Gms.)	Carcass to live weight %	Percentage of body parts to carcass weight %			
				Shoulders	Thorax	Loin	Hind quarters
30	348	150	43.1	16.6	20.4	22.5	40.5
60	849	375	44.2	14.9	21.4	21.2	42.5
90	1404	686	48.9	15.2	20.7	23.6	40.5
120	1649	828	50.2	15.4	22.3	22.2	40.4
150	1825	947	51.9	15.7	22.4	23.0	38.9

and carcass weight showed a high value during the period of 60-90 days of age. The absolute difference in grams between the daily gains in the live and carcass weights was very large during this period and decreased gradually with increasing age (Fig. 1). This may be due to the fast developing viscera during this young age, so the large portions of daily weight increase are mainly in viscera and not in carcass.

The weight of each part of the carcass increased with increasing age (Table 4). At any age, the heaviest part of the carcass that represented the biggest part of the edible carcass was the hind quarters followed by the loin, thorax and the shoulders. In spite of the difference in actual weight of each part at successive ages, the percentage of each one to the carcass weight was nearly constant during the experimental period.

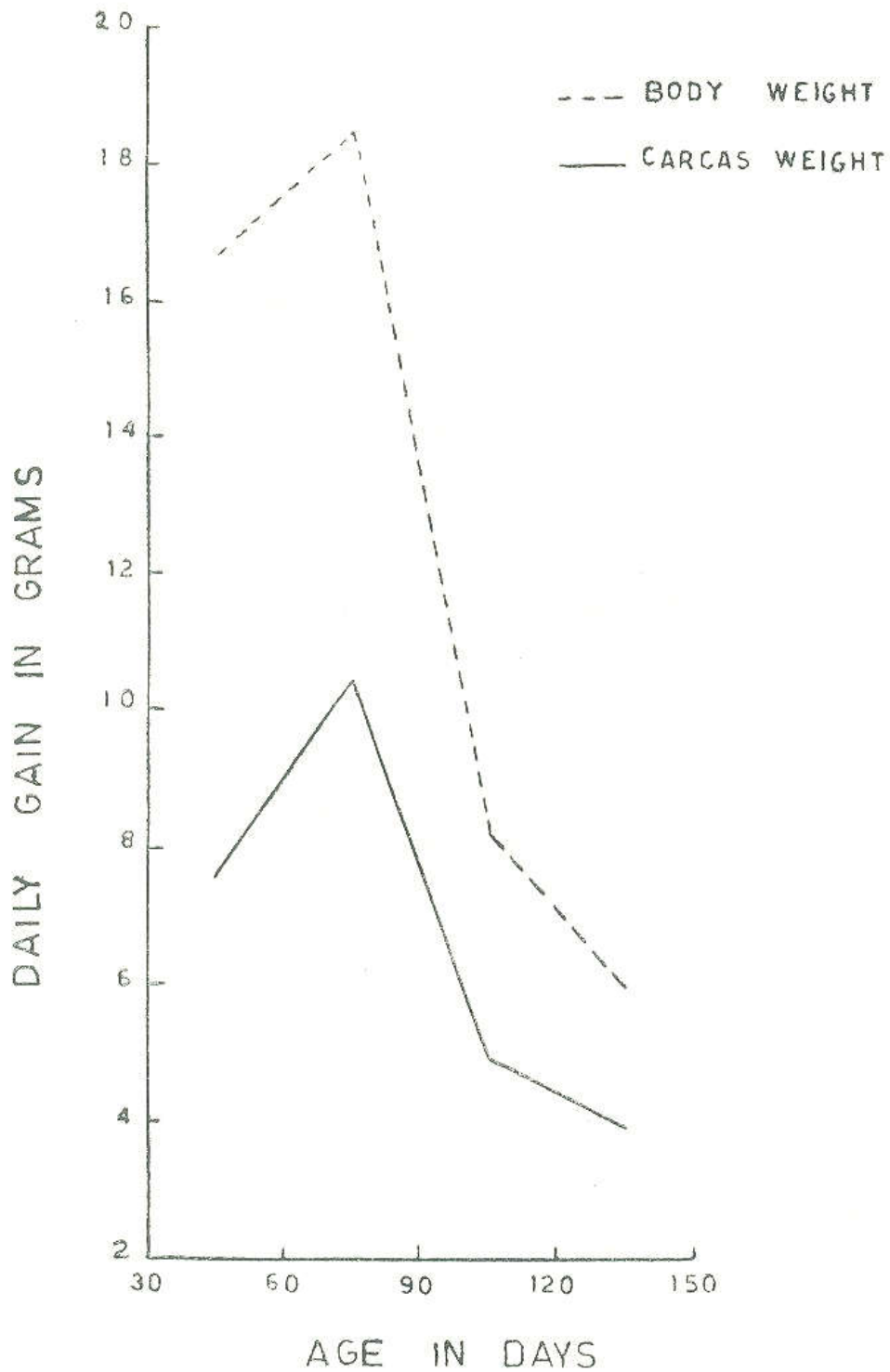


FIG. 1.—Effect of Age on Daily Gain of the Live and Carcass Weights in Giza Rabbits at Different Ages.

The percentage of meat was highest in the loin and lowest in the thorax, while it was in between in the hind quarters and shoulders (Table 4). The weight of meat, bone and fat of the whole carcass increased

TABLE 4

The average weight of carcass and its parts and the relative weights of meat and bones in Giza rabbit.

Items	Age in days	Average weight (Gms.)	Relative weight Percentage		
			Meat	Bones	Fat
Carcass	60	375	80	16	4
	90	686	82	13	5
	120	828	83	12	5
	150	947	82	12	6
Shoulders	60	52	82	18	—
	90	104	83	18	—
	120	133	85	15	—
	150	149	82	18	—
Thorax	60	80	76	25	—
	90	142	81	19	—
	120	184	80	20	—
	150	212	81	19	—
Loin	60	79	88	12	—
	90	162	91	9	—
	120	184	91	9	—
	150	218	90	11	—
Hind quarters.....	60	159	77	23	—
	90	278	86	14	—
	120	327	85	15	—
	150	368	86	14	—

progressively with age. The relative weight of meat in the carcass was nearly stable while that of bone decreased and fat increased with advancing age. These results are in agreement with the findings of McMeckan (1940) who stated that at the early stages of life bone makes most growth followed by muscles, while fat attains its maximum rate of growth much later.

As the carcass percentage is affected by the weight of head, skin, viscera and blood, it is of interest to discuss their pattern of growth herein. The average weight of the head and skin + feet increased with advancing age while its percentage to the live weight decreased between 30 and 60 days of age, and became almost constant after that (Table 5). The relative daily gain in head weight was high from 30-90 days of age, then it decreased afterwards. It could be concluded that the head and skin + feet develop rapidly at an early age (Table 6).

From the same tables, it is obvious that the average weight of the offals (liver, heart, kidneys, lungs + trachea, bladder and spleen) increased with age, while their percentage to live weight was almost constant during the period from 30-150 days of age. Their relative daily gain was very high at the age of 30-60 days, then dropped greatly after this period. From the previous results, it could be stated that the organs which are most essential to life were earlier in their development than other organs.

The average weight of the alimentary canal (intestine, cecum and stomach) increased with advancing age. However, its percentage to the live weight reached its maximum development at the age of 60 days then it began to decrease with age (Table 5). The relative daily gain of each part of the alimentary canal reached its maximum gaining during the period of 30-60 days of age, after which it gradually decreased (Table 6). It could also be indicated that the cecum was the first part of the alimentary canal which developed rapidly after weaning. Moreover, the high increase in the daily gain and the percentage of the cecum and intestines to live weight during the period of 30-60 days of age, could be explained by the change of diet before and after weaning. Before weaning, the stomach is the site of food digestion, which is mainly the mother's milk. This food is well digestible and easily absorbable, and consequently small volume of intestines is sufficient. After weaning, the ration contains a large quantity of fiber which is not easily digested except in the cecum and intestines. Therefore, the rate of development in these organs is bound to enlarge in volume and in function, especially the cecum.

TABLE 5
Mean and relative weights of the different organs of the body to the live weight
in Giza rabbits at different ages.

Items	Age in Days											
	30		60		90		120		150			
	Av. wt. gms.	Rel. wt. %	Av. wt. gms.	Rel. wt. %	Av. wt. gms.	Rel. wt. %	Av. wt. gms.	Rel. wt. %	Av. wt. gms.	Rel. wt. %	Av. wt. gms.	Rel. wt. %
Head	40.7	11.4	59.6	7.0	80.8	5.6	69.5	5.8	407.8	5.9		
Skin + feet	65.9	19.0	150.4	17.7	234.5	16.7	238.0	14.4	270.0	14.8		
Liver	11.5	3.3	36.9	4.3	51.5	3.7	53.0	3.2	53.7	2.9		
Kidneys	3.7	1.1	9.1	1.1	12.8	0.9	13.9	0.8	14.1	0.8		
Heart	1.5	0.4	3.7	0.4	4.3	0.3	5.4	0.3	6.0	0.3		
Lungs + trachea	2.3	0.7	8.6	1.0	10.5	0.7	11.1	0.7	11.1	0.7		
Spleen	0.3	0.1	1.0	0.1	1.8	0.1	2.0	0.1	2.4	0.1		
Bladder	0.4	0.1	1.2	0.1	1.3	0.1	2.3	0.1	2.6	0.1		
Intestines	24.3	7.0	74.8	8.8	79.2	4.9	97.8	5.9	98.3	4.3		
Cecum	19.3	5.6	116.3	13.7	131.5	9.4	132.0	7.8	134.3	7.4		
Stomach	3.4	1.0	14.5	1.7	20.7	1.5	22.3	1.4	22.8	1.1		

3. Chemical contents of the carcass :

The percentage of carcass water and ash decreased gradually with increasing age while the percentage of carcass fat increased progressively.

TABLE 6

Relative daily gain of the head, skin + feet and other organs of the body to the initial weight of each period in Giza rabbits (%).

Items	Age in Days			
	30-60	60-90	90-120	120-150
Head.	1.47	1.01	0.62	0.41
Skin + feet	4.25	1.86	0.04	0.46
Liver.	7.00	1.36	0.97	0.38
Kidneys	5.41	0.11	0.31	0.05
Heart	4.67	0.54	0.93	0.37
Lungs + trachea	8.69	0.70	0.19	—
Spleen	6.67	3.00	3.89	0.50
Bladder	7.50	0.25	2.30	0.43
Intestines.	7.00	0.13	0.76	0.02
Cecum	16.58	0.43	—	0.06
Stomach	11.76	1.38	0.24	0.09

It was also found that the percentage of carcass protein was nearly constant, at the different ages (Table 7). These results could be explained

TABLE 7

The percentage of carcass moisture, protein, fat and ash in the Giza rabbit at different ages.

Age in days	Items			
	Moisture	Protein	Fat	Ash
90	74.0	21.3	4.2	1.4
120	73.0	18.9	7.7	1.3
150	70.5	21.5	9.2	1.2

by the findings of Fowler (1958) who reported that the decrease in the percentage of carcass water was associated with an increase in the percentage of carcass fat with increasing age. This may be due to the decrease of extra-cellular water as the animals advance in age.

PRACTICAL APPLICATION

Results of this study indicate high correlations between most of the body measurements and body weight. The length of body and loin circumference showed the highest relation. Phenotypic selection of rabbits for meat purposes could adopt a useful and practical measure of this fact. The average farmer lacks the means for weighing, but he could easily judge the selected body measurements. The high correlation between the live body weight and the meat yield of its carcass makes this handy measure more useful.

From the results obtained on body development, carcass parts and meat analysis, it is advisable to slaughter rabbits at 90 days of age. Figures on rate of growth and daily gains are to the best interest of the breeders at this age. Further delay in the time of marketing will lead to an increased feeding bill without any beneficial improvement in the carcass qualities and meat production. The rabbit at such age weighs about one kilogram and this is quite a suitable weight for cooking as well as for the buying ability of the average consumer.

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الملخص

دراسة عن النمو وصفات الذبيحة في أرانب « الجيزة الأبيض »

أجرى هذا البحث بمركز أبحاث الدواجن بكلية الزراعة جامعة القاهرة خلال سنة ١٩٥٨ وكان الهدف من دراسة طبيعة نمو الجسم وبعض المقاييس المختلفة في الأرانب الجيزة الأبيض وعلاقة ذلك بنسبة النضاف في الذبائح وصفات اللحم في الأعمار المختلفة . وقد شملت التجربة ٥٦٣ فرداً ابتداء من عمر الفطام بعد شهر من الولادة حتى عمر ٥ شهور . ويمكن تلخيص أهم النتائج التي أدى إليها البحث فيما يلي :

١ - كان وزن الجسم عند عمر شهرين وثلاثة وخمسة شهور على الترتيب يساوى الضعف وثلاثة وأربعة أمثال وزن الفطام . وعلى حين كانت سرعة النمو ٧٢٪ خلال الشهر الثاني من العمر فإنها انخفضت إلى ٣٢٪ خلال الشهر الخامس . وكذلك انخفض معدل الزيادة اليومية خلال نفس الفترات من ١٣ جراماً إلى ٩ جرامات . وبعد عمر ثلاثة شهور انخفضت سرعة النمو ومعدل الزيادة اليومية تدريجياً حتى نهاية التجربة .

٢ - كانت المقاييس الطولية للجسم تزيد بسرعة أكبر من المقاييس المحيطية . كما كان هناك تلازم موجب بين طول الجسم وطول أرباعه مع وزن الجسم ووزن الذبيحة .

٣ - كانت النسبة المثوية للذبيحة إلى الوزن الحى عند عمر ١ ، ٢ ، ٣ ، ٤ ، ٥ شهور هى على الترتيب ٤٣ ، ٤٤ ، ٤٩ ، ٥٠ ، ٥٢٪ ومع اعتبار عوامل التكلفة الاقتصادية يعتبر عمر ٣ شهور هو أنسب الأعمار لتسويق هذه الأرانب للذبح .

٤ - كانت نسبة الزيادة في أعضاء الجسم الحيوية كالقلب والرئتين مرتفعة في الأعمار المبكرة بينما تأخرت عنها سرعة نمو الأعضاء المكونة للحم أساساً كالأرباع الخلفية والقطن .

٥ - كانت نسبة وزن الأرباع الخلفية والقطن والصدر والأرباع الأمامية ثابتة تقريباً بالنسبة لوزن الذبائح في الأعمار المختلفة السابقة . وكانت الأرباع الخلفية وحدها تحتل حوالى ٤٠٪ والقطن حوالى ٢٢٪ من وزن الذبيحة .

٦ - كانت نسبة اللحم في الذبيحة عند عمر ثلاثة شهور وبعده حوالى ٨٢٪ ونسبة العظم حوالى ١٣٪ ونسبة الدهن حوالى ٥٪ ، وكان القطن هو أعلى أجزاء الذبيحة في نسبة اللحم .

٧ - كانت نسبة الرطوبة والبروتين والدهن والرماد في لحم الذبيحة حوالى ٧٤ ، ٢١,٥ ، ١,٥٪ على الترتيب عند عمر ٣ شهور . وتتقدم العمر قلت نسبياً الرطوبة وزادت نسبة الدهن بما يقارب الفرق بينما ظلت نسبة البروتين والرماد ثابتة تقريباً .