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EFFECT OF RESTRICTED FEED INTAKE ON GROWTH AND SLAUGHTER TEST FOR RABBITS

By

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Three treatments of two groups each, were investigated to compare the effect of restricted feed intakes upon growth and carcass quality of rabbits. The study included 87 rabbits, 6 weeks old of cross-bred (Giant Flander × Baladi) divided into 6 groups in two experiments. Three respresentative rabbits from each treatment in Exp. II were slaughtered for caracass quality at 6, 12 and 16 weeks old.

The results showed that the medium level of full-feed (ca.90% full-feed)' slightly affected the live wieght gain and the efficiency of starch value utilization. But the low level of full-feed (ca. 77 — 80% full-feed), showed remarkable differences than full-feed. The low percentage of mortality appeared to favour full-feeding to avoid high mortality rates with other treatments. Further confirmation under various environmental conditions seems to be needed.

The carcass composition for full-feed level was superior to those for restricted-feed levels at 12 and 16 weeks old. As the rabbit grows up, the percentage dressed wieght and boneless meat appeared to increase. On dry matter basis, the ash content of the boneless meat was practically nearly the same in all treatments. Differences were markedly show for protein and fat contents. Samples containing higher fat had lower protein contents.

Feeding cost represents approximately 70 per cent of rabbits production. Therefore, any attempt to reduce the feeding cost might increase the net profit of the rabbit keeper. Decreasing feeding cost could be achieved, either, by using cheap feeds or reducing the amount of food intake to an economical level without affecting the producing.

Titus, 1955, indicated that it was difficult to take advantage of the fact that poultry food was utilized more efficiently at levels of intake between 50 and 70 per cent of full-feed but mortality rate tended to be higher with restriction. Therefore, in the practical production of chickens for meat, it would not be safe to feed at a level of 50 to 70% of full-feed even though a greater gain per unit weight of feed was obtained.

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Present literature showed little information about rabbits in this field. Therefore, it was desirable to carry out the present work to study the effect of feeding level including restriction on growth and carcass quality.

Materials and Methods

The experimental work was similar to that described by Radwan, 1968 and Aboul-Seoud *et al.*, under publication, 1968, other than the following respect : The present work was undertaken at Barrage Poultry Farm (Gezeenet El-Sheer), Animal Production Department, Ministry of Agriculture, U.A.R., from March to May, 1963, for Expt. I and from January to April, 1964, for Expt. II. Three treatments with rabbits were conducted to study the effect of restricted-feed intakes upon growth and carcass quality of rabbits. The study included 87 rabbits, 6 weeks old of cross-bred (Giant Flander × Baladi Red), a graded-up breed which is almost Giant Flander.

The experimental rabbits were divided into 6 groups as shown in Table 1. Rabbits were fed on green clover and concentrates, Ration No. 1 for Expt. I and Ration No. 2 for Expt. II.

Each food in the diet provided 50 per cent of the daily starch value (S.V.). The feeding treatments were as follows :

Treatment 1.—Full-feed, providing 50% of the S. V. from green clover and 50% of it from the cnocentrates, assuming at first an average of 10% starch value for green clover.

Treatment 2—About 85% of full-feed level.

Treatment 3.—About 70% of full-feed level.

The feeding levels were adjusted during the experiments after determining the moisture content in the clover and calculating the starch value (S. V. % = 0.5 dry matter % + 1, after Sultan *et. al.*, 1966. The practical levels were 100, 89 and 77% for treat. 1, 2 and 3 respectively in Expt. 1, and 100, 90 and 86% for treat. 1, 2 and 3 respectively in Expt II.

Slaughter test was carried out in Expt. II on three representative rabbits from each of Group 5, 10 and 11 at 12 and 16 weeks old. Three rabbits were slaughtered at 6 weeks old for initial body carcass. The boneless meat of the main body (front parts, chest, loin and hind parts) was analysed by using conventional methods of analysis (A.O.A.C., 1955).

Results and Discussion

I.—*Growth studies* :

Average initial and final live weights :

Table 1, shows the average initial and final live weights and their standard error, S.E. Owing to the differences in the initial live weight of

the different groups, the percentage of their final live weight to the initial one was calculated and found to be 152, 157 and 134 for Groups 3, 8 and 9 respectively (Expt. I); the values were 176, 171 and 142 for Groups 5, 10 and 11 respectively (Expt. II). Those values for the mean live weight of the initial one increased nearly the same for the full-feed and 85% full-feed treatments in each experiment; but they were markedly low with more restriction of food. The values for the total relative growth rate per cent (Table 1) had the same trend as the values for the percentage increase of the final live weight to the initial one (the latter quals 100 + the former).

TABLE 1.—AVERAGE LIVE WEIGHT, LIVE WEIGHT GAIN AND RELATIVE GROWTH RATE PER CENT OF GROWING RABBITS AGED FROM 6 TO 13 WEEKS OLD BEING FED ON DIFFERENT LEVELS OF STARCH VALUE INTAKE.

Expt. No.	Group No.	No. of rabbits	Initial weight (6 weeks old)		Final weight (13 weeks old)		Total gain	R.G.R.*	Total mortality rate
			Range of Wt.	Av. Wt.* ±S.E.	Range of Wt.	Av. Wt. ±S.E.			
			g.	g.	g.	g.	g.	%	%
Treatment 1.—Full-feed :									
I	3	10	(515-661)	582 ±14.5	(755-1104)	884 ±49.3	302	52	20
II	5	21	(478-577)	527 ±10.7	(720-1135)	930 ±32.8	403	76	14
Treatment 2.—85% full-feed									
I	8	9	(445-621)	517 ±20.9	(681-964)	814 ±46.2	297	57	44
II	10	21	(131-569)	500 ± 9.2	(770-920)	857 ±21.8	357	71	57
Treatment 3.—70% full-feed									
I	9	8	(511-710)	596 ±23.6	(707-973)	797 ±60.8	201	34	50
II	11	18	(453-686)	575 ±13.2	(708-967)	818 ±43.1	243	42	50

* Av. Wt. = Average of Weigth.

* R.G.R. = Relative growth rate.

Live weight gain :

The values of the total live weight gain during the experimental period, Table 1, were 302, 297 and 201 g. for Groups, 3, 8 and 9 respectively (Expt. I), and 403, 357 and 243 g. for Group 5, 10 and 11 respectively (Expt. II). The gain for medium and low level of intake was 98 and 66% of that of full-feed level in Expt. I. Practically, nearly the same gain was obtained by medium level, but the low level retarded growth. Similarly, the percentage values for gain for full-feed level in Expt. II were 89 for medium level and 60 for the low level one, showing that the reduction in the level of S.V. intake to ca. 10% than the full-feed (Group 5), decreased the gain with nearly the same percentage. When the reduction in S.V. intake continued to ca. 14% (Group 11), the gain was decreased to ca. 40%.

Food consumption :

Table 2, shows the food consumption per rabbit during the whole experimental period from 6 to 13 weeks old. The same table shows the experimental total starch value (S.V.) consumption per rabbit during the whole experimental period. It was 1200, 1066 and 929 g. Group 3, 8 and 9 respectively (Expt. I), the respective S.V. consumption among the groups from full-feed being 100, 89 and 77. The values for Expt. II were 100, 90 and 86 for Group 5, 10 and 11 respectively.

The nutritive rations from the practical food consumption data were 1.5.06, 1.4.82 and 1.4.85 for Group 3, 8 and 9 respectively (Expt. 1). Similarly in Expt. II the values for nutritive rations were 1:4.60, 1:4.24 and 1:4.61 for Group 5, 10 and 11 respectively. The rations in Expt. I and II were within the range that is recommended by Templeton, 1939, which lies between 1:5.00 and 1:3.75.

Efficiency of starch value utilization :

The total efficiency of S.V. utilization (taken as the ratio between the live weight gain and the amount of S.V. intake) were 1.3.97, 1.3.59 and 1:4.62 for Group 3, 8 and 9 respectively (Expt. I). It could be shown that the reduction of 11% in full-feed for the S.V. intake, maintained nearly the same gain as full-feed level, producing higher efficiency of S.V. utilization. But the reduction of 23% of the full-feed reduced the gain by 34% of the full-feed level, and the efficiency of S.V. utilization markedly decreased. These data, indicated that the full-feed level would increase feeding cost without marked increase in gain of growing rabbits.

In Expt. II the efficiency of S.V. intake were 1:3.23, 1:3.29 and 1:4.61 for Group 5, 10 and 11 respectively. It was shown that the reduction in full-fed level of S.V. intake by 14% (Group 11), decreased the efficiency of S.V. utilization as the gain was 40% less than full-feed. But the reduction in full-feed by 10% reduced the gain by 10% from full-feed but keeping the same efficiency of feed utilization.

Protein conversion :

The crude protein conversion was calculated as the live weight gain obtained per unit crude protein (C.P.) consumed. Table 2, shows the total values for C.P. conversion among the different groups ; showing the highest value for both Groups 5 and 10 (1.19). The two groups of low feed level had the same and the lowest values for C.P. conversion (0.88), owing to the retardation of growth.

Mortality rate :

The total mortality rate percentage (Table 1) for full-feed treatment was less than half those for both restricted-feed treatments.

TABLE 2.—TOTAL FOOD, STARCH VALUE, CRUDE PROTEIN AND DIGESTIBLE CRUDE PROTEIN INTAKE PER EXPERIMENTAL RABBIT DURING THE WHOLE EXPERIMENTAL PERIOD FROM 6 TO 13 WEEKS OLD.

Expt. No.	Group No.	Total food consumption per rabbit					Total S.V. utilization	Total crude protein conversion
		Clover	Concentrates	S.V.*	C.P. †	D.C.P. §		
		kg.	g.	g.	g.	g.	l.	
Treatment 1.—full-feed :								
I	3	7.243	833	1200	295.9	223.6	3.97	1.02
II	5	8.496	878	1301	339.4	263.6	3.23	1.19
Treatment 2.—85% Full-feed								
I	8	6.952	638	1066	261.6	198.0	3.59	1.13
II	10	7.705	763	1173	300.0	233.3	3.29	1.19
Treatment 3.—70% Full-feed								
I	9	6.040	558	929	228.3	172.2	4.62	0.88
II	11	7.028	708	1119	274.7	213.3	4.61	0.88

* S .V. = Starch value.

* C.P. = Crude protein.

§ D.C.P. = Digestible crude protein.

II.—*Effect of full-feed — versus restricted intakes on carcass quality and analysis of boneless meat at certain ages for growing rabbits :*

Some of the definitions used for slaughter technique are described by aboul-Seoud *et. al.* (unpublished data, 1968).

(Table 3a), shows the average carcass quality for growing rabbits at different ages. The body parts were expressed as percentage of live weight and as times initial weight.

At 6 weeks old (initial age), the boneless meat represented ca. one third of the live weight. The edible organs (liver, kidneys and heart) represented a small part not exceeding 5%. The offals percentage (47%) were nearly half of the live weight.

At 12 weeks old, the results of the carcass quality, (Table 3a) indicated that the full-feed (Group 5) was superior to restricted-feed levels, either 90% full-feed (Group 10) or 86% full-feed (Group 11). The 90% full-feed was relatively better than 86% full-feed. Under the experimental conditions, it appeared that the feeding treatment slightly affected the percentage of body parts to average live weight at 12 weeks old, while the average live weight was greatly affected.

At 12 weeks old, the results of the carcass quality, (Table 3a) indicated 12 weeks (the growth data for the period from 13th to 16th weeks old were mentioned by Radwan, 1968. The full-feed produced the highest live weight (1157 g.). The restricted-feed produced less live weight, but the difference between 86 and 80% full-feed at 16 weeks (for Group 10 and 11 respectively), was apparently reversed. It might be due to the choice of the three rabbits slaughtered in Group 10 which were lower in live weight than the average of the group.

Although 80% full-feed produced higher live weight than 86% full-feed, both treatments produced practically the same dressed weight and boneless meat. The differences among the treatments at 16 weeks appeared to be relatively not of great magnitude when compared with the similar differences at 12 weeks old.

The percentage of dressed weight at 16 weeks old as well as that of boneless meat were fairly higher than that at 12 weeks old. Therefore, as the rabbits grew up, the percentage dressed weight and boneless meat appeared to increase. This would enable us to get more chance to choose the suitable and more economical marketing age.

The comparison among the treatments could be also clarified when results of body parts were taken as percentage of their initial parts, (Table 3a). The relative values based on live weight were not quite the same as those based on dressed weight and boneless meat.

For further information and breeder's interest (Table 3 b), (for minor parts) show the average weights for liver, kidneys, heart, head, neck and total skin, limbs and tail for the three groups at different ages. Little variations were obtained among the percentage of minor parts from the live weight for different treatments at different ages.

TABLE 3 (*a*).—MAJOR BODY PARTS IN SLAUGHTERED RABBITS FOR DIFFERENT TREATMENT AT DIFFERENT AGES (AVERAGE 3 RABBITS FOR EACH TREATMENT).

Age and group No.	Live weight	Slaughtered weight	Dressed weight	boneless meat	Liver, kidneys, and heart	Offals
6 weeks (initial age):						
Parts in grains . . . . (A)	612.0	589.0	238.3	193.3	28.1	287.8
Parts as % L.W. . . (B)	100.00	96.19	38.92	31.57	4.60	47.00
12 weeks old :						
Group 5.- 100%full-feed on 50% clover + 50% concentrates :						
(A)	1017.0	986.0	416.7	335.8	45.5	469.2
(B)	100.00	96.93	40.92	32.97	4.47	46.17
% of initial weight . . . (C)	166	167	175	174	162	163
Group 10.—90% full-feed of Group 5 :						
(A)	820.0	781.0	306.3	229.7	44.4	373.3
(B)	100.00	95.17	37.26	27.90	5.41	45.50
(C)	134	133	129	119	158	130
Group 11.—86% full-feed of Group 5 :						
(A)	683.0	644.0	261.0	215.8	25.5	323.2
(B)	100.00	93.94	37.96	31.37	3.76	47.45
(C)	112	109	110	112	91	112
16 weeks old:						
Group 5.—100%full-feed on 50% clover + 50% concentrates :						
(A)	1157.0	1121.0	526.3	448.3	44.2	488.8
(B)	100.00	96.90	45.32	38.68	3.83	42.34
(C)	189	190	221	232	157	170
Group 10.—86% full-feed of Group 5 :						
(A)	928.0	896.0	393.7	321.2	45.2	405.2
(B)	100.00	196.49	42.34	34.51	4.87	43.34
(C)	152	52	165	166	161	141
Group 11.—80% full-feed of Group 5 :						
(A)	991.0	156.0	394.0	334.2	43.0	468.3
(B)	100.00	996.39	39.65	33.60	4.36	47.27
(C)	162	62	165	173	153	163

TABLE 3 (*b*).—MINOR BODY PARTS IN SLAUGHTERED RABBITS FOR DIFFERENT TREATMENTS AT DIFFERENT AGES (AVERAGE 3 RABBITS FOR EACH TREATMENT), IN EXPT. II EXTENDED TO 16 WEEKS.

Age and group No.		Liver	Kidneys	Heart	Head	Neck	Skin, limbs and tail
Initial age (6 weeks):							
Parts in grams . .	(A)	19.3	6.3	2.5	45.7	12.7	101.0
Parts, % from L.W.	(B)	3.16	1.04	0.41	7.46	2.07	16.50
12 weeks old:							
Group 5	(A)	33.0	8.5	4.0	62.2	20.5	148.0
	(B)	3.24	0.83	0.39	6.48	2.03	14.57
Group 10, ...	(A)	33.7	7.5	3.2	57.2	15.5	126.7
	(B)	4.11	0.92	0.39	6.98	1.87	15.41
Group 11, ...	(A)	16.0	6.7	2.8	56.7	15.0	104.7
	(B)	2.34	1.00	0.42	8.37	1.69	15.36
16 weeks old:							
Group 5, ...	(A)	30.7	9.7	3.8	76.0	21.7	202.0
	(B)	2.65	0.84	0.33	6.61	1.85	17.42
Group 10, ...	(A)	32.0	10.2	3.0	66.0	17.0	138.3
	(B)	3.46	1.09	0.32	7.11	1.83	14.92
Group 11, ...	(A)	30.0	9.7	3.3	73.3	12.7	148.0
	(B)	3.02	0.99	0.35	7.44	1.28	14.97

Proximate analysis of boneless meat for different treatments :

(Table 4) shows the proximate analysis of boneless meat for the different treatments at different ages. The moisture content of boneless meat for full-feed treatment (Group 5) was lower than those for the restricted-feed treatments (Groups 10 and 11). On dry matter basis, the boneless meat at 6 weeks old (initial age), showed lower protein and higher fat contents than at other ages. Generally, values for fat content at different

ages were noticably low than those recorded by other workers (Shafie *et al.*, 1961) at similar ages. This was perhaps due to some variable conditions under which such experiments were undertaken. The ash content was practically nearly the same in all treatments ranging between 5.25 and 6.03. Differences were markedly shown for protein and fat. Samples containing higher fat had lower protein.

Physiological fuel value :

The physiological fuel value was calculated considering it to be 4 k cal. per 1 g. protein or carbohydrates and 9 k cal. per 1 g. fat. The physiological fuel values (Table 4) were different among the treatments without any special trend. It ranged between 758 and 915 K cal./kg. in the fresh meat, the corresponding range being between 3876 and 4051 K cal./kg. in the dry meat.

TABLE 4.—THE AVERAGE PROXIMATE ANALYSIS OF BONELESS MEAT FOR DIFFERENT TREATMENTS AT DIFFERENT AGES IN EXPT. II EXTENDED FOR 16 WEEKS.

Age and treatment	Moisture	Composition on moisture free basis			Physiological fuel value	
		Protein	Ether extract	Ash	Fresh	Dry
	%	%	%	%	K cal	/kg.
6 weeks old (initial age) :	76.82	97.29	15.27	5.44	1054	4547
12 weeks old :						
Full-feed.—50% clover plus 50% concentrates .	77.28	88.63	5.33	6.03	915	4027
90% full-feed	80.51	88.92	5.39	5.69	787	4038
86% full-feed	80.44	91.87	2.25	5.88	758	3876
16 weeks old :						
Full-feed.—50% clover plus 50% concentrates .	77.70	91.03	3.72	5.25	887	3978
86% full-feed	79.10	90.34	3.77	5.89	823	3938
80% full-feed	78.77	89.16	5.37	5.47	860	4051

Utilization of starch value and digestible crude protein intake based on protein gain in boneless meat :

Comparative studies for the efficiency of S.V. utilization for producing protein (kg. S.V./kg. protein increase in boneless meat) revealed the superiority of full-feed at 12 and 16 weeks old (Table 5). The values of digestible crude protein conversion in the same table revealed also the superiority of full-feed.

TABLE 5.—PROTEIN CONTENT AND ITS GAIN IN BONELESS MEAT FOR SLAUGHTERED RABBITS OF DIFFERENT TREATMENTS AT DIFFERENT AGES (AVERAGE 3 RABBITS FOR EACH TREATMENT) IN EXPT. II. EXTENDED FOR 16 WEEKS.

Item	Group 5	Group 10	Group 11
6 weeks old :			
Initial protein content g. (A)* . . .	35.53	35.53	35 53
12 weeks old :			
Protein content g.	67.63	39.81	38.78
Increase in protein than (A) g. . . .	32.10	4.28	3.25
Kg. S.V./Kg. protein increase . . .	33.72	233.41	291 69
Percentage for protein gain of digestible crude protein intake %	14.63	2.11	1.80
61 weeks old :			
Protein content g.	91.02	60.64	63.26
increase in protein than (A) g. . . .	55.49	25.11	27 73
Kg. S.V./Kg. protein increase . . .	38.13	72.80	61 09
Percentage for protein gain of digestible crude protein intake % . . .	13.53	7.10	8.53

* Protein content = % crude protein × boneless meat in grams.

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تأثير تحديد كمية الغذاء المأكول على النمو واختبارات الذبح فى الأرانب

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الملخص

لقد تم بحث تأثير معاملات تغذية لمستويات محدودة (فى كل منها مجموعتان) على نمو وصفات الذبح للأرانب ، وتشمل الدراسة ٨٧ حيوانا عمرها ست أسابيع أخذت من خليط جيانت فلاندر مع الأرانب من كل معاملة قسمت لست مجاميع فى تجربتين ، وأثناء النمو اختبرت ثلاث أرانب من كل معاملة فى التجربة الثانية لتذبح عند عمر ٦ ، ١٢ ، ١٦ أسبوعا .

وأظهرت النتائج ان معدل الغذاء المتوسط الذى يبلغ نحو ٩٠٪ من مستوى الغذاء القياسى (تجربة الحيوان) تؤثر قليلا فى مقدار زيادة النمو (الوزن المكتسب) وفى الكفاءة التحويلية لطاقة الغذاء على صورة معادل نشا . أما مستوى الغذاء المنخفض (٧٧ ـ ٨٠٪ من المستوى القياسى) فسبب فروق كبيرة عن نتيجة التغذية القياسية ، وكان زيادة النفوق فى التغذية المحددة تدعو لتغذية الأرانب بحريتها تفاديا لارتفاع الوفيات ، ويحتاج الأمر للتحقق من ذلك تحت ظروف بيئية متعددة ، كما وجد أن خواص الذبيحة وتركيبها كان أفضل فى حالة التغذية بحرية الحيوان عنه فى حالتى تحديد الغذاء عند عمر ١٢ أسبوعا و ١٦ أسبوعا ، ووجد أنه كلما تقدم الحيوان فى العمر زادت نسبة التصافى ونسبة التشافى (اللحم بدون عظم) ، كما كانت نسبة الرماد فى المادة الجافة للحم متساوية من الناحية العملية فى جميع المعاملات ولكن وجدت فروق فى نسبة البروتين والدهن فى اللحم ، وكلما زادت نسبة الدهن فى اللحم انخفضت نسبة البروتين .

(١) قسم الانتاج الحيوانى « فرع تغذية الحيوان » بكلية الزراعة ـ جامعة القاهرة ـ ج.ع.م.

(٢) قسم تغذية الدواجن ـ الادارة العامة للانتاج الحيوانى بوزارة الزراعة ـ الدقى ـ ج.ع.م.