Der Tropenlandwirt, Zeitschrift für die Landwirtschaft in den Tropen und Subtropen,
95. Jahrgang, April 1994, S. 5 – 16

The effect of duration of severe feed restriction on growth performance, carcass traits and meat quality of growing rabbits

Einfluß der restriktiven Fütterung auf die Marktleistung, den Schlachtkörperwert und die Fleischqualität beim Mastkaninchen

by A.M.A. Osman[1] and E.S. Tawfik[2]

1 Introduction

Feed cost comprises approximately 70% of the total cost of rabbit production. Therefore, efforts should be done to minimize the feed cost to increase the net profit. Decreasing feeding cost could be achieved by using cheap feeds or improving feed efficiency of the common feed.

Feeding techniques with possible impacts on improving feed efficiency include restricting energy and protein intake, limiting the time of access to feed and quantative feed restriction. Restricting the time of access to feed of rabbits may prevent feed wastage and possible overfeeding. It is easy to be repeated under practical conditions and takes advantage of ability to compensate in growth by better utilization of feed ingredients.

ABOU-RAYA et al. (1970) indicated that the medium level of full-feed (ca. 90% full-feed) slightly affected the live weight gain and the efficiency of feed utilization, but the low level of full-feed (ca. 77-80% full-feed) showed remarkable differences to full feed. They reported also that mortality percentage was lower and carcass composition was superior for full-feed level over those for restricted-feed levels at 12 and 16 weeks old.

1 Dr. A.M.A. Osman, Dept. of Animal Production, University of Minia (Egypt)
2 Prof. Dr. E.S. Tawfik, Fachgebiet Tierproduktion , Fachbereich 11, Universität, Gesamthochschule Kassel, Steinstraße 19, D-37213 Witzenhausen

SZENDRÖ and LACZA-SZABO (1986) showed that reducing daily eating time down to 9 hours of growing rabbits (from 4-12 weeks of age) had reduced daily feed intake by 15% and improved feed conversion by 13% without changing the average daily gain.

Therefore this study was carried out to determine the effects of the duration of severe feed restriction and age on growth performance, carcass traits and meat quality of growing rabbits.

2 Materials and methods

The present work was carried out at the Poultry Farm, Animal Production Dept., Faculty of Agriculture, Minia University, Egypt. The environmental temperature and relative humidity throughout the experimental period fluctuated between 17-20 C^{o} and 48-60% respectively. Forty male California rabbits of 6 weeks old were used in this study. The rabbits were divided into four treatments of 10 rabbits each. The average initial body weight of different treatments was approximately similar. Each treatment had five replicates of two rabbits each. Each replicate was housed in a separate hutch. The rabbits were fed a commercially pelleted diet of 17.7% protein and 2895 M.E./kg. feed. The duration of severe restriction (6/18 hours with/without access to feed) lasted for zero, 2, 3 and 4 weeks followed by ad-libitum feeding up to the end of the experimental period (12 weeks) for treatments 1, 2, 3 and 4 respectively. The rabbits were fed from 8 a.m. to 2 p.m. during the restricted period. At the end of the feeding period the feeders were removed and returned next morning. Rabbits in all treatments had full access to drinking water. Average body weight, body weight gain, feed consumption, cumulative feed conversion and mortality were recorded and calculated weekly up to the 18th week of age for each individual replicate. At 14 and 18 weeks of age four representative rabbits from each treatment were starved for about 16 hours, individually weighed, slaughtered, skinned and eviscerated. Eviscerated carcasses with giblets (liver, kidneys and heart) and without head were individually weighed and dressing percentage was calculated (eviscerated carcass + liver + heart + kidneys in relation to pre-slaughter weight). Eviscerated carcasses were cut up to hindquarters, loin and forequarters with chest. The different cuts, giblets and abdominal fat were each weighed and related to the carcass weight as a percentage. The right side of the loin- and hindquarter muscles from each carcass were removed to evaluate the physical characters of the meat. The pH-value was measured after 15 minutes from slaughtering (pH_1), then the samples were kept in plastic bags and stored in a refrigerator at +4^{o} C for 24 hours, then the pH-value was measured again (pH_2). After that the samples were frozen at -15^{o}C until required for further evaluations. For measuring final pH-value (after storage), meat brightness, juice holding capacity and cooking loss, the frozen samples were left to thaw in a refrigerator at +4^{o}C for 24 hours without removing them from the plastic bags. The pH-value was measured directly using pH-meter 650-Knicke Company, Germany. Meat brightness was measured by colour brightness-meter (Göfo-Meter) from E-Schutt Company, Germany. To determine the juice holding capacity a piece of 0.3 g muscle from each individual meat sample was put on filter paper (previously held over saturated Kcl solution in a dessicator) and pressed between two glass plates for five minutes according to GRAU and HAMM method (1957). The areas of meat and meat juice were estimated by the axis method according to HOFMANN (1982). The juice holding capacity was calculated from the following formula:

Juice holding capacity (W.H.C.) = meat's area/total area x 100.

For estimated cooking loss, a sample of about 25 g muscle was placed in a polyethylene bag, then tightly closed and boiled for 25 minutes. Then, the samples were removed from the water, left to reach room temperature, dried with filter paper and re-weighed to calculate the cooking loss as a percentage from the initial weight.

The statistical analyses were carried out according to SAS programm (1988) utilizing the following model:

$$Y_{ijk} = \mu + D_i + A_j + (DA)_{ij} + e_{ijk}$$

where

Y_{ijk} = observed value of the concerned trait
μ = overall mean for the concerned trait
D_i = the fixed effect due to duration of severe restriction $_i$
A_j = the fixed effect due to age $_j$
$(DA)_{ij}$ = The interaction effect between duration of severe restriction $_i$ and age $_j$
eijk = random error

3 Results and discussion

3.1 Growth performance

The growth performance figures of the growing rabbits are presented in table (1). Rabbits in treatment 2 which was restricted only for 2 weeks, recorded higher body weight and daily gain than other treatments at 14 and 18 weeks of age, but the differences among treatments were not significant. Body weights were 2.252, 2.330, 2.045 and 2.095 kg. at 14 weeks of age for treatment 1, 2, 3 and 4 respectively. The corresponding figures at 18 weeks old were 2.700, 2.978, 2.440 and 2.703 kg. Daily gain had also the same trend as body weight. Rabbits in treatment 2 which eat 6 hours daily for two weeks gained more than those eating ad-lib. by 5.23 and 13.72% at 14 and 18 weeks of age respectively. Rabbits in treatment 3 and 4 which eat 6 hours daily for 3 and 4 weeks respectively, gained less than the control treatment by 12.97 and 9.34% at 14 weeks old.

Tab. 1: Least squares means + SE of performance of growing rabits in different treatments

Item		Treatments 1	2	3	4	
Initial weight	(kg)	0.646±0.018	0.641±0.018	0.640±0.018	0.640±0.018	NS
7-14 weeks old						
Body weight	(kg)	2.252±0.043	2.330±0.043	2.045±0.430	2.095±0.043	NS
Daily gain	(g)	28.680±0.770	30.180±0.770	24.960±0.770	26.000±0.770	NS
Daily feed intake	(g)	115.580[a]±2.460	111.200[b]±2.460	92.680[c]±2.460	97.080[c]±2.460	**
Feed conversion :1		4.070±0.080	3.720±0.080	3.730±0.080	3.740±0.080	NS
Mortality	(pieces)	0.0	1.0	0.0	0.0	NS
7-18 weeks old						
Body weight	(kg)	2.700±0.080	2.978±0.080	2.440±0.080	2.703±0.080	NS
Daily gain	(g)	22.600±0.840	25.700±0.840	19.740±0.840	22.600±0.840	NS
Daily feed intake	(g)	117.480[a]±2.420	118.080[a]±2.420	98.460[b]±2.420	105.900[b]±2.420	**
Feed conversion :1		5.280±0.130	4.630±0.130	5.030±0.130	4.740±0.130	NS
Mortality	(pieces)	0.0	1.0	0.0	0.0	NS

** = p≤0.01; * = p≤0.05; NS = p>0.05

At 18 weeks old, rabbits had compensated the depression on daily gain and became similar to the control group. The depression in daily gain was attributed to the reduction in daily feed intake with increasing the duration of feed restriction. In spite of the insignificant differences in body weight and daily gain among different treatments, there were highly significant differences (p≤0.0l) in daily feed intake. The reduction in daily feed intake represented 3.79, 19.81 and 16.01% from the ad-libitum treatment at 14 weeks old for treatment 2,3 and 4 respectively. With advancing age (18 weeks old), daily feed intake in treatment 2 was approximately similar to the control treatment, but in the other treatments (3 and 4) were less by 16.19 and 9.86% respectively than the control treatment.

Increasing the duration of feed restriction more than 2 weeks (treatment 3 and 4) had no further improvement in feed conversion. The values at 14 weeks old were 4.07, 3.72, 3,73 and 3.74 for treatments 1, 2, 3 and 4 respectively. The corresponding values at 18 weeks old were 5.28, 4.63, 5.03 and 4.74. The optimum feed conversion was observ.d in treatment 2 at both ages, but the differences among treatments were insignificant.

Concerning the mortality figures, it appears that mortality was not due to treatments and the figures were within the normal limit.

These results are in agreement with the findings of SZENDRÖ and LACZA-SZABO (1986). They reported that reducing daily eating time down to 9 hours from 4 to 12 weeks old had reduced daily feed intake by 6 to 15% but feed conversion was improved by 7 to 13%, while daily gain was practically unchanged in growing rabbits. ABOU-RAYA et al. (1970) also reported that the medium level of full-feed (ca. 90% full-feed) slightly affected the live weight gain and the efficiency of feed utilization, but the low level of full-feed (ca. 77-80% full feed) showed remarkable differences than full-feeding in growing rabbits.

3.2 Carcass traits

Data in table (2) indicated that treatment (2) was superior in starved body weight at 14 and 18 weeks old, but the differences among treatments were insignificant. There was a significant difference ($p \leq 0.05$) in carcass weight between treatment 2 and 4 at 14 weeks of age, while the difference at 18 weeks of age was insignificant. Dressing percentage was insignificantly decreased with increasing the duration of severe feed restriction at 14 weeks of age. At 18th week of age there was no certain trend for the dressing percentage, although treatment 4 realized the highest figure, 59.37%. Dressing percentage at 14 weeks of age was 55.78, 55.61, 54.16 and 53.81% for treatments 1, 2, 3 and 4 respectively. The corresponding figures at 18 weeks of age were 57.94, 58.10, 57.60 and 59.37%.

Carcass cut-up parts were not significantly influenced by increasing the duration of severe feed restriction. Treatment (2) had higher hindquarter percentage, but lower forequarter percentage than other treatments at 14 or 18 weeks old. Loin percentage decreased with increasing the duration of severe feed restriction at 14 weeks of age, while it was increased with increasing the duration of restriction up to 3 weeks (treatment 3 and 4) at 18 weeks old. Giblets percentage increased with increasing the duration of feed restriction at 14 weeks old. A similar trend was also observed at 18 weeks of age except treatment 3. As expected abdominal fat percentage decreased with increasing the duration of feed restriction at 14 weeks of age, the opposite was observed at 18 weeks old but the values remained lower than the control treatment. Head percentage had irregular trend with increasing the duration of severe feed restriction at 14 and 18 weeks old.

The age had a significant effect ($p \leq 0.01$) on starved body weight, carcass weight, dressing percentage, loin percentage, giblets percentage, abdominal fat percentage and head percentage. With prolongation of the fattening period from 14 to 18 weeks of age dressing percentage, loin percentage and abdominal fat percentage were increased ($p \leq 0.01$) while giblets percentage and head percentage were decreased ($p \leq 0.01$). Hindquarter percentage and forequarter percentage were insignificantly decreased with increasing slaughter age. The effect of interaction between the duration of severe feed restriction and age on the above mentioned carcass traits was not significant.

Tab. 2: Least squares means + SE of carcass traits of growing rabbits as influenced by different treatments and ages

Item	Week	treatment 1	treatment 2	treatment 3	treatment 4		age (week)	
Starved body wt (g)	14	2143.75±89.94	2256.25±45.98	2083.75±024.70	1937.50±077.53	NS	2105.31^{b}±41.50	**
	18	2696.25±87.31	2996.25±35.44	2640.00±105.97	2867.50±230.52	NS	2800.00^{a}±70.61	
Carcass wt. (g)	14	1197.10^{ab}±61.20	1254.05^{a}±20.75	1128.13^{ab}±017.19	1041.55^{b}±032.50	*	1155.21^{b}±26.38	**
	18	1561.68±46.60	1741.30±40.40	1518.63±051.95	1696.38±113.25	NS	1629.49^{a}±39.12	
Dressing (%)	14	55.78±00.57	55.61±00.82	54.16±001.01	53.81±000.52	NS	54.84^{b}±00.40	**
	18	57.94±00.31	58.10±00.84	57.60±001.32	59.37±000.92	NS	58.25^{a}±00.45	
Hindquarter (%)	14	34.95±00.75	34.43±00.67	34.18±000.85	34.34±000.46	NS	34.28±00.31	NS
	18	33.95±01.42	34.01±00.42	33.17±000.85	33.09±000.79	NS	33.56±00.34	
Forequarter (%)	14	35.96±00.87	35.74±01.08	36.48±000.52	36.45±000.43	NS	36.15±00.35	NS
	18	35.39±00.32	35.12±00.50	35.45±000.34	35.45±000.41	NS	35.39±00.19	
Loin (%)	14	19.30±00.71	18.95±00.54	19.14±000.73	19.17±000.33	NS	19.14^{b}±00.27	**
	18	20.55±00.65	21.14±00.39	21.50±000.52	21.49±000.92	NS	21.17^{a}±00.31	
Giblets (%)	14	6.33±00.35	6.75±00.27	7.21±000.27	7.24±000.36	NS	6.88^{a}±00.17	**
	18	4.77±00.21	4.89±00.37	5.06±000.30	4.75±000.13	NS	4.87±00.12	
Abdominal fat (%)	14	4.23±00.72	4.14±00.30	3.00±000.41	2.81±000.25	NS	3.54^{b}±00.26	**
	18	5.35±01.04	4.48±00.67	4.83±000.88	5.08±000.31	NS	5.02^{a}±00.35	
Head (%)	14	10.64±00.14	10.83±00.26	10.66±000.22	11.05±000.53	NS	10.80^{a}±00.09	**
	18	10.68±00.57	9.70±00.22	10.44±000.35	9.31±000.38	NS	10.03^{b}±00.23	

** = $p \leq 0.01$; * = $p \leq 0.05$; NS = $p < 0.05$

These results agree with the findings of ABOU-RAYA et al. (1970), RAO et al (1978), LUKEFAHR et al (1983) and BAUMIER and RETAILLEAU (1988). They reported that dressing percentage and carcass cut-up parts of growing rabbits were increased with increasing age.

Tab. 3: The correlation coefficients among carcass traits of growing rabbits

		2	3	4	5	6	7	8	9
1) Live body weight		0.98	0.56	0.56	-0.17	-0.35	0.51	-0.53	-0.77
2) Carcass weight			0.69	0.59	-0.23	-0.35	0.58	-0.58	-0.82
3) Dressing	%			0.53	-0.37	-0.26	0.66	-0.56	-0.76
4) Loin	%				-0.27	-0.63	0.25	-0.26	-0.63
5) Hindquarter	%					-0.26	-0.70	0.41	-0.16
6) Forequarter	%						-0.09	0.19	0.26
7) Abdominal fat	%							-0.57	-0.54
8) Head	%								0.31
9) Giblets	%								

$p \leq 0.05$ $r=0.35$; $p \leq 0.01$ $r=0.45$

The correlation coefficients among carcass traits are presented in table (3). Starved body weight, carcass weight, dressing percentage and loin percentage were closely correlated with each other (r = 0.53 to r = 0.98). The positive association between hot carcass weight and dressing percentage may be due to reduced visceral percentage in heavier rabbits (RAO et al. 1978). Abdominal fat percentage was significantly increased with increasing body weight, carcass weight and dressing percentage (r=0.51 to r=0.66), but the reverse was observed with head percentage (r=-0.53 to r=-0.58) and giblets percentage (r=-0.76 to r=-0.82). Loin % was negatively correlated with forequarter percentage and giblets percentage (r=-0.63). A similar trend was also observed between abdominal fat percentage from one side and hindquarter percentage (r=-0.70), head percentage (r=-0.57) and giblets percentage (r=-0.54) from other side. JÜRGING (1975) and LUKEFAHR et al. (1983) recorded also highly significant correlation between carcass weight, dressing % and carcass cut-up parts weight.

3.3 Meat quality

Data in table (4) indicate that the physical properties of rabbits meat were not influenced by increasing the duration of feed restriction. $pH_{15\ min.}$ values of each loin and hindquarter indicated that the glycolysis process was slow and had similar reduction rate in all treatments at 14 or 18 weeks old. After 24 hours of bleeding out, both loin and hindquarter had pH values of normal meat and were not influenced by different treatments. The pH values after storage showed that the keeping quality of rabbits meat was not affected by increasing the duration of severe feed restriction.

Meat colour (Göfo), water holding capacity and cooking loss percentage of each loin and hindquarter meat were not influenced with increasing the duration of severe feed restriction. The control treatment had the lowest water holding capacity in loin meat at 14 or 18 weeks old. A similar trend was observed in hindquarters at 18th week of age, but at 14 weeks old the control treatment was superior in comparison to the other

Tab. 4: Least squares means + SE of physical characteristics of rabbits' meat as influences by different treatments and ages

Items	Week	Treatment 1	2	3	4		Age	
Loin meat:								
$PH_{15min.}$ value	14	6.59±0.15	6.64±0.08	6.58±0.08	6.74±0.04	NS	6.64±0.05	NS
	18	6.53±0.06	6.56±0.07	6.54±0.04	6.51±0.04	NS	6.53±0.02	
$PH_{24hr.}$ value	14	5.72±0.05	5.66±0.03	5.82±0.15	5.69±0.07	NS	5.72±5.04	NS
	18	5.83±0.03	5.82±0.04	5.80±0.05	5.82±0.07	NS	5.81±0.02	
$PH_{after\ storage}$ value	14	5.59±0.05	5.58±0.04	5.79±0.18	5.66±0.15	NS	5.65^{b}±0.06	**
	18	5.86±0.04	5.88±0.04	5.81±0.09	5.81±0.10	NS	5.84^{a}±0.03	
Colour (Göfo)	14	83.50±2.66	84.75±1.03	81.25±1.03	84.00±2.12	NS	83.38±0.89	NS
	18	83.25±0.48	82.00±2.00	81.50±3.28	82.00±0.91	NS	82.19±0.90	
Water holding capacity	14	21.26±1.36	25.85±4.21	27.64±3.26	25.61±4.72	NS	25.09±1.73	NS
	18	22.25±1.61	26.46±1.84	26.46±3.09	26.51±3.21	NS	25.31±1.22	
Cooking loss %	14	31.31±0.59	32.39±0.96	31.24±1.71	32.30±0.47	NS	31.81±0.49	NS
	18	32.14±0.91	33.35±0.75	32.36±1.03	32.61±0.82	NS	32.62±0.41	
Hindquarter								
$PH_{15min.}$ value	14	6.63±0.10	6.77±0.11	6.80±0.08	6.61±0.10	NS	6.70±0.05	NS
	18	6.61±0.07	6.59±0.05	6.61±0.04	6.55±0.10	NS	6.59±0.03	
$PH_{24hrs.}$ value	14	5.90±0.05	5.92±0.03	6.14±0.15	5.77±0.07	NS	5.93±0.05	NS
	18	5.95±0.05	5.91±0.01	5.90±0.07	5.90±0.08	NS	5.91±0.03	
$PH_{after\ storage}$ value	14	5.77±0.09	5.84±0.08	6.09±0.16	5.70±0.11	NS	5.85±0.06	NS
	18	6.01±0.02	6.00±0.05	5.98±0.08	5.89±0.12	NS	5.97±0.04	
Colour (Göfo)	14	81.50±1.33	82.50±0.65	77.00±1.83	80.50±0.65	NS	80.38^{b}±0.76	*
	18	83.75±0.48	82.25±1.25	81.25±2.46	82.25±0.48	NS	82.38^{a}±0.68	
Water holding capacity	14	25.29±4.51	24.12±2.03	23.40±2.86	22.26±2.43	NS	23.76±1.42	NS
	18	21.49±1.44	24.62±1.64	27.18±3.30	26.31±5.13	NS	24.90±1.55	
Cooking loss %	14	30.72±1.01	32.68±0.59	29.40±1.84	32.44±0.79	NS	31.31^{b}±0.62	**
	18	34.46±0.93	35.40±0.65	33.24±0.77	34.37±0.49	NS	34.45^{a}±0.38	

** = $p \le 0.01$; * = $p \le 0.05$; NS = $p > 0.05$

treatments. Cooking losses from each of the loin and hindquarter were higher in treatments 2 than those in the other treatments at 14 or 18 weeks of age.

The effect of age on the physical properties was significant only on the pH value of loin after storage, meat colour and cooking loss of hindquarter. Rabbits aged 18 weeks recorded higher ($p \leq 0.01$) pH value in loin meat after storage, darker meat ($p \leq 0.05$) and higher ($p \leq 0.01$) cooking loss percentage in hindquarter meat than younger rabbits (14 weeks old). Meat tends to be darker in older animals due to the deposition of brown pigment in muscle and also to the greater amounts of myoglobin (WILSON 1981).

Increasing water holding capacity with advancing age may be due to the lower moisture/protein ratio, higher pH value and the higher protein content of the meat with increasing age. FRONING and NORMAN (1966) found that the lower moisture/protein ratio is associated with the higher ability of muscle in question to retain water. HOFMANN (1986) indicated that the water holding capacity improved with increasing pH value of the meat. Increasing cooking loss percentage with advancing age may be attributable to the increasing in muscle shrinkage and in fat content of the meat (LAWRIE 1979).

Tab. 5: The correlation coefficients among physical properties of rabbits' meat

		2	3	4	5	6	7	8	9	10	11	12
1)	$PH_{15min.}$ (loin)	0.17	0.19	0.04	0.02	-0.07	-0.13	-0.08	0.12	-0.07	-0.10	-0.39
2)	$PH_{15min.}$ (hindquarter)		-0.14	0.03	-0.24	-0.10	-0.06	-0.20	-0.27	-0.47	-0.09	-0.27
3)	$PH_{24hrs.}$ (loin)			0.67	0.88	0.80	0.05	0.17	0.40	0.19	-0.44	-0.19
4)	$PH_{24hrs.}$ (hindquarter)				0.64	0.84	0.13	-0.04	0.47	0.20	-0.58	-0.52
5)	Final PH (loin)					0.80	0.10	0.25	0.58	0.29	-0.30	-0.02
6)	Final PH (hindquarter)						0.05	0.02	0.43	0.26	-0.50	-0.27
7)	Colour (loin)							0.60	0.02	-0.11	-0.06	0.01
8)	Colour (hindquarter)								-0.02	0.11	-0.01	0.38
9)	Water holding capacity (loin)									0.43	-0.16	-0.21
10)	Water holding capacity (hindquarter)										-0.18	-0.11
11)	Cooking loss (loin)											0.59
12)	Cooking loss (hindquarter)											

$p \leq 0.05$ $r=0.35$; $p \leq 0.01$ $r=0.45$

Data in table (5) indicated that, the correlation coefficients between pH values after 24 hours from slaughtering and after storage in each loin and hindquarter were highly significant ($r=0.64$ to $r=0.88$). A positive linear relationship existed also between colour ($r=0.60$), water holding capacity ($r=0.43$) and cooking loss percentage ($r=0.59$) in each loin and hindquarter muscle. The opposite trend was found between cooking loss percentage and pH value taken after 24 hours from bleeding out.

4 Summary

The effects of age and duration of severe restricted feeding on growth performance, carcass traits and meat quality of fattening rabbits were studied. Forty male California rabbits of 6 weeks old were divided into four treatments with five replicates each. The duration of severe restricted feeding (6 hours eating/day) lasted for zero, two, three and four weeks for treatments 1, 2, 3 and 4 respectively, followed by ad-libitum feeding up to the end of the experiment at age of 18 weeks. Body weight and daily gain were not statistically influenced by increasing the duration of restricted feeding, but daily feed intake was reduced ($p \leq 0.01$) by 3.79 to 19.81% and zero to 16.19% at 14 and 18 weeks of age respectively. No significant effect in feed conversion or mortality rate were observed with increasing the duration of restricted feeding. Carcass traits and meat quality were not affected by increasing the duration of restricted feeding. Age of rabbits at slaughter influenced nearly all carcass traits. Starved body weight, carcass weight, dressing percentage, loin percentage and abdominal fat percentage were increased ($p \leq 0.01$) while giblets percentage and head percentage were decreased ($p \leq 0.01$) with increasing slaughter age. Hind- and forequarter percentage were not statistically influenced with increasing slaughter age. A positive linear relationship was found among live body weight, carcass weight, dressing percentage and loin percentage. Dressing percentage was positively correlated with abdominal fat percentage, but negatively correlated with giblets percentage and head percentage. Meat quality was not negatively influenced by increasing the duration of restricted feeding and the meat had normal meat properties.

Heavier rabbits had darker meat ($p \leq 0.05$) and higher cooking loss percentage ($p \leq 0.01$) in hindquarter and also higher pH value after storage of loin region in comparison to lighter ones. A positive linear relationship existed between pH value taken after 24 hours from bleeding out and pH value after storage. Cooking loss percentage decreased with increasing pH value taken after 24 hours from slaughtering. Nearly all the physical properties of loin meat were positively correlated ($r=0.43$ to 0.80) with the corresponding characteristics of hindquarter meat.

Zusammenfassung

Der Einfluß der Mastdauer und der Verkürzung der Freßzeit auf die Mastleistung, den Schlachtkörperwert und die Fleischqualität beim Mastkaninchen wurde untersucht. Die Tiere waren beim Beginn der Untersuchung 6 Wochen alt. Die Dauer der Verkürzung der Freßzeit auf 6 Stunden/Tag war 0, 2, 3 und 4 Wochen in den 4 Behandlungen. Anschließend bekamen die Tiere das Futter ad-libitum bis zum Alter von 18 Wochen. Die Ergebnisse zeigten keine Differenzierung in der Mastleistungskritierien zwischen den Behandlungen. Lediglich bei der Futteraufnahme war ein signifikanter Einfluß der

restriktiven Fütterung festzustellen. Auf die Kriterien des Schlachtkörperwertes und der Fleischqualität war kein Einfluß der restriktiven Fütterung vorhanden.

Zwischen beiden Schlachtterminen im Alter von 14 und 18 Wochen waren Unterschiede in den Kriterien des Schlachtkörperwertes vorhanden. Die älteren Tiere zeigten höhere Anteile an Schlachtausbeute, Fleisch und Abdominalfett und geringere an Innereien und Kopf als die jüngeren Tiere.

Die schweren Schlachtkörper hatten dunkleres Fleisch und höheren Kochverlust als die leichteren.

References

1. ABOU-RAYA, A.K.; RAAFAT, M.A.; ABOUL-SEOUD, A.A.; ABDEL-SALAM, F.E.; M.H. RADWAN 1970: Effect of restricted feed intake on growth and slaughter test for rabbits. Egyptian J. Anim.Prod. 10,2, 255-266

2. BAUMIER, L.M.; B. RETAILLEAU 1988: Growth, feed consumption and dressing in rabbit from a strain selected for meat production. Ani. Breeding Abs., 56, 12

3. FRONING, G.W.; G. NORMAN 1966: Binding and water retention properties of light and dark chicken meat. Poul.Sci. 45, 797-800.

4. GRAU, R.; R. HAMM 1957: Über das Wasserbindungsvermögen des Säugetiermuskels II. Mitteilung: Über die Bestimmung der Wasserbindung des Muskels. Zeitschrift für Lebensmittel - Untersuchung und Forschung, 105, 446-460

5. HOFMANN, K. 1982: Bestimmung der Wasserbindung des Fleisches Schnelle, nicht-planimetrische Auswertung der Filterpapier-Pressmethode. Die Fleischwirtschaft, 62(3), 346-348.

6. HOFMANN, K. 1986: Der pH-Wert - ein Qualitätskriterium für Fleisch. Chemisch-physikalische Merkmale der Fleischqualität - Kulmbacher Reihe, Band 6, 134-155

7. JÜRGING, A.M. 1975: Untersuchungen zur Produktion von Kaninchenfleisch unter besonderer Berücksichtigung verschiedener Futterrationen und Zuchtverfahren. Dissertation, Universität Bonn

8. LAWRIE, R.A. 1979: Meat science, Third edition, Pergamon Press, Oxford, New York, Toronto, Sydney, Paris, Frankfurt.

9. LUKEFAHR, S.; W.D. HAHENBOKEN; P.R. CHEEKE; N.M. PATTON 1983: Appraisal of nine genetic groups of rabbits for carcass and lean yield traits. J. Anim. Sci. 57, 4, 899-907

10. MILLER, W.O.; R.L. SAFFLE; S.B. Zirkle 1968: Factors which influence the water-holding capacity of various types of meat. Food Technology, 22, 1139-1142

11. RAO, D.R.; C.P. CHEN; G.R. SUNKI,; W.M. JOHNSON 1978: Effect of weaning and slaughter age on rabbit meat production II Carcass quality and composition. J.Anim. Sci., 46, 578

12. RISTIC, M. 1986: Schlachtkörperwert und Fleischbeschaffenheit von Jungmastkaninchen. Mitteilungsblattt, der BAFF 91, 6725-6731

13. S.A.S. 1988: SAS User's Guide: Basics SAS Inst. Inc. Cary, N.C.

14. SZENDRÖ, Zs.; S. LACZA-SZABÓ 1986: Effect of the reduction of eating time on production and behaviour of growing rabbits. 3rd International Colloquy "Quality and Yield of Rabbit Products", Rostock, DDR.

15. WASHBURN, K.W.; K. BONDARRI 1978: Comparison of the effects of severity and duration of restricted feeding on growth, feed consumption and feed conversion of broiler chicks grown in individual cages and floor pens. Arch. Geflügelk. 42, 94-98.

16. WILSON, N.R. 1981: Meat and Meat Products: Factors affecting Quality Control. Applied Science Publishers, London and New Jersey