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Daily weight gain, feed conversion efficiency and digestibility coefficients as affected by protein levels and amino acids supplementation

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INTRODUCTION

Protein represents an important and expensive portion of the diet required for synthesis of body tissues and body fluids. The animal must have an adequate amount of protein in the diet, but an excess is not benefical and could be a disadvantage economically.

Lebas /1973/ used growing Californian rabbits to estimate the efficiency of diets of different protein levels ranged between 11 and 29 %. He found that growth was improved till a threshold of 17-18 % crude protein. Similarly, Razzorenova and Morozova/1980/ concluded that a complete feed mixture for growing rabbits should contain 16.5 to 18.5 % crude protein.

On the other hand, Lebas/1979/ recommended that the diet of growing rabbits /4-12 weeks old/ should contain 15 % crude protein with 0.6 % lysine, meanwhile Colin/1974a/suggested that crude protein and lysine requirements ranged about 17 % and 0.65 % of the diet. Similarly, Holdas and Gippert/1979a/ stated that the better results of meat gain were obtained when the crude protein level was 17.0 %.

Adamson and Fisher/1971/ concluded that lysine and methionine are essential amino acids for performance of rabbits and omission of them causes a sharp loss in body weight.

Cheeke/1971/ suggested that the growing rabbits require 0.93 % lysine and 0.45 % methionine of their diets. Similarly Spreadbury/1978/ concluded that addition of both lysine and methionine improved growth rates. He suggested that minimum requirements for normal growth were found to be 0.62 % methionine + cystine and 0.94 % lysine.

Colin/1974a,b ; 1976a,b/ concluded that supplementation with lysine and methionine improves growth rate of rabbits . He stated that the optimum sulphur-amino acids level varies between 0.6 and 0.7 % of the diet.

Colin / 1974b; 1976a/ found that lysine or methionine deficiency not affected digestibility of proteins. He showed also that digestibility of the diet does not seem to be affected by lysine or methionine addition.

Materials and Methods

Young rabbits from Californian /Ca/, New Zealand White /NZW/ and their crossbred Ca x NZW weaned at 37 days of age were used in the experiments during the growing period from 6 to 11 weeks old. Their body weights at the start of the experiments are shown in Table 1.

Animals were kept individually in wire cages, their body weights were recorded weekly. Daily weight gain /g/ was calculated over the period from 6 to 11 weeks of age.

Animals were fed ad libitum five pelleted rations. Feed intake of individuals was recorded weekly. Composition of the five experimental rations is shown in Table 2.

During the 10-th and 11-th week of age, twenty experimental animals from each genotype were divided to five groups. Each of them was fed one of the five experimental rations. During the two weeks animals were housed in metabolism cages that allowed separation of feces and urine. Every week feces were collected daily for four days /Colin and Lebas,976;Lebas and Colin 976/ and then were mixed and sampled. Feces samples were dried at 60-70 C° for 24 hours. After drying samples were ground and then chemically analysed.

Statistical analysis was carried out after Snedecor and Cochran /1967/ and Czakó /1982/.

Results and Discussion

1. Daily weight gain :-

1.1. Protein levels effects :-

Over the experimental period, daily weight gain averaged 29.5 and 30.1 g in the first experiment and 32.1 and 32.5 g in the second one for the low level /13.8 %/ and the high one / 16.9 % /, respectively / Table 3 /.

Similar figures of daily weight gain were reported by Constanta /1976/, Holdas and Gippert /1979b/, Dehalle /1981/ and Gippert et al. /1981/ who fed the rabbits diets of protein levels varied between 16.6 and 20.6 %.

Differences due to protein levels in daily weight gain were not significant in the two experiments / Table 3 /.

On the other hand, significant differences between protein levels were showed by Colin /1974a/, Holdas and Gippert /1979a/ and Ouhayoun and Delmas /1980/.

1.2. Methionine or/and lysine supplementation :-

Daily weight gain over the experimental period averaged 29.6, 30.7 and 31.0 g in the first experiment and 30.0, 32.8 and 33.5 g in the second one for methionine, lysine and methionine + lysine supplemented diets, respectively / Table 3 /.

Supplementation with methionine or/and lysine had no significant effect on daily weight gain /Table 3/ except in the second experiment where it significantly decreased /P = 0.05/ by methionine supplementation / Table 3 /.

Similar results were found by Colin /1974a/ who showed that lysine addition to 13 % crude protein diet had no significant effect on weight gain.

On the contrary, significant effect on daily weight gain by methionine or/and lysine addition was observed by Colin /1974b; 1976b/, Mazziotti et al. /1976/, Spreadbury /1978/ and Lebas and Greppi /1980/.

2. Feed conversion efficiency :-

2.1. Protein levels effects :-

Overall the experimental period feed conversion efficiency averaged 3.16 and 3.13 in the first experiment and 3.22 and 3.44 in the second one for the low and the high protein level, respectively /Table 4 /.

Differences between the two protein levels in respect of feed conversion efficiency were not significant /Table 4 /.

Similar figures of feed conversion efficiency were reported by Raimondi et al. /1973/, Lebas /1973/, Holdas and Gippert /1979b/, Dehalle /1980/, Ouhayoun and Delmas /1980/, Jensen /1982/ and Gippert et al. /1982/ when fed the rabbits diets of protein levels varied between 16.6 and 20.6 %.

2.2. Methionine or/and lysine supplementation effects :-

Feed conversion efficiency over the experimental period averaged 3.09 , 3.14 and 3.11 in the first experiment and 3.39, 3.35 and 3.30 in the second one for methionine, lysine and methionine + lysine supplemented diets, respectively / Table 4 /.

Supplementation with methionine or/and lysine had no significant effect on the feed conversion efficiency / Table 4 /. Similar results were found by Mazziotti et al. / 1976 /.

On the other hand, several workers stated that methionine or/and lysine supplementation improved the feed conversion efficiency of diets, Colin /1974a, 1976a,b /, Razzorenova and Morozova /1980/ and Lebas and Greppi /1980/.

3. Digestibility of experimental diets :-

3.1. Protein levels effects :-

Digestibility coefficients of different constituents as affected by protein levels are shown in Table 5.

It was noted that digestibility of dry matter, organic matter, crude fiber and N-free extractive not differed significantly between protein levels / Table 5 /.

Crude protein digestibility of the high protein diet surpassed significantly /P = 0.01/ that of the low one, whilst crude fat digestibility of the low protein diet was better than that of the high one /Table 5/.

3.2. Methionine or/and lysine supplementation effects :-

Digestibility coefficients of different constituents as affected by methionine, lysine and methionine + lysine supplementation are shown in Table 5.

Supplementing diets with methionine or/and lysine not improved digestibility of dry matter, organic matter, crude fat and N-free extractive /Table 5/. On the other hand , crude fiber digestibility was improved by those amino acids supplementation /Table 5/.

Concerning crude protein digestibility, it was noted that methionine or lysine addition had no significant effect while methionine + lysine supplementation significantly /P = 0.01/ increased it /Table 5/.

These results agreed with that reported by Colin /1974b, 1976a / and Colin and Arkhurst /1973/.

Literature Cited

1 - Adamson,I. and H.Fisher. 1971, Nutr. Rep.Int.4, 59-64.
2 - Cheeke, P.R. 1971. Nutr. Rep. Int. 3, 123-128.
3 - Colin, M. 1974a. Ann. Zootech., 23, 119-132.
4 - Colin, M. 1974b. I.T.A.V.I., 19 - 21.
5 - Colin, M. 1976a.First World Rabbit Cong. Dijon, France.
6 - Colin, M. 1976b First World Rabbit Cong. Dijon, France.
7 - Colin, M and G.Arkhurst. 1973. Poult. and rabbit research days, Paris, 12-13-14 December.
8 - Colin, M. and F.Lebas. 1976. Sci.Tech.Anim.Lab.1,129-33.
9 - Constanta, M. 1976.First World Rab.Cong. Dijon, France.
10- Czakó, J. 1982. Academic Press, Budapest, 40-161 pp.
11- Dehalle, C. 1981. Ann. Zootech. 30, 197 - 208.
12- Gippert,T.; L.S. Szabóné and C. Lászlóné. 1982. Baromfit. és feld., 113-118.
13- Gippert,T.; T.Valter and S.Holdas. 1981. Baromfit. és feld. 159 - 162.
14- Holdas, S. and T.Gippert.1979a. Állatt.28, 79 - 83.
15- Holdas, S. and T.Gippert. 1979b. Állatt. 28, 569-573.
16- Jensen, J.F. 1982. 2-nd Int. Colloquy, 15-17 Sep. GDR.
17- Lebas,F. 1973. Ann. Zootech. 22, 83-92.
18- Lebas,F. 1979a. Cunicultre, 6, 159 -160.

19- Lebas,F. and Colin,M.1976. Sci.Tech.Anim.Lab.1,71-77.
20- Lebas,F. and G.Greppi. 1980. Reprod.Nutr. Develop. 20 , 1661 - 1665.
21- Mazziotti,P.D.C.; R.Raimondi; M.T.Auxilia and G.Masoero. 1976. Ann.Ist.Sper.Zootec. 9,1, 35 -46.
22- Ouhayoun,J. and D.Delmas.1980. 2nd World Rab.Cong.Spain.
23- Raimondi,R.; M.T.Auxilia; D.M.Carmela and G.Masoero. 1973. Ann.Ist.Sper.Zootec., 6,133-150.
24- Razzorenova,E.A. and K.N. Morozova. 1980. Krolikovo. i Zverovo., 11 - 20.
25- Snedecor, G.W. and W.G.Cochran.1967. Ames, Iowa, USA.
26- Spreadbury, D. 1978. Br. J. Nutr. 39, 601 - 613.

Summary and Conclusions

This work was carried out to study the effect of two protein levels /13.8 and 16.9 % / and the effect of methionine or/and lysine supplementation on daily weight gain , feed conversion efficiency and the digestibility of the different experimental rations.

Protein levels had no significant effect on daily weight gain during the experimental period. Methionine or/and lysine supplementation not improved daily weight gain.

Feed conversion efficiency not affected by protein level or by methionine or/and lysine supplementation.

Protein levels had no significant effect on the digestibility of dry matter, organic matter, crude fiber and N-free extractive, meanwhile digestibility of crude protein and crude fat was differed significantly between protein levels.

Methionine or lysine supplementation not improved digestibility of different constituents except that of the crude fiber where significantly improved.

Methionine + lysine supplementation slightly improved digestibility of different constituents except that of the crude fiber where it was greatly improved.

All results from the present study show that 13.8 % of good quality plant original protein may be used economically for growing rabbits feeding without amino acids addition.

Table : 1

Body weight of rabbits at the start of the experiments at 6 weeks of age for different experimental groups

Rations	A		B		C		D		E		Total	
Genotypes	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E
	First experiment / n = 3 x 5 x 18 /											
Ca	926	53	894	39	843	38	929	43	857	43	890	19
NZW	1078	43	1105	38	1088	26	1063	34	1082	51	1083	17
Ca x NZW	1054	51	1034	31	1046	40	1103	45	1110	37	1070	18
Total	1019	29	1011	24	993	25	1032	25	1016	29	1014	12
	Second experiment / n = 3 x 5 x 12 /											
Ca	880	52	905	42	867	51	912	51	890	49	891	21
NZW	978	59	875	30	982	43	996	77	962	62	959	26
Ca x NZW	951	37	998	58	888	38	956	36	978	48	958	20
Total	936	29	933	27	912	26	955	34	943	31	936	13

Table : 2

Composition of exoerimental pelleted rations %

Components	A	B	C	D	E
Wheat	23.0	23.0	23.0	23.0	21.0
Barley	20.0	20.0	20.0	20.0	20.0
Wheat bran	6.0	6.0	6.0	6.0	6.0
Lucerne meal	30.0	30.0	30.0	30.0	30.0
Sunflower seed meal	6.0	6.0	6.0	6.0	6.0
Soyabean meal	-	-	-	-	-
Sugar beet	8.0	7.0	7.0	6.0	3.0
Straw	5.0	5.0	5.0	5.0	7.0
Ap - 18	0.7	0.7	0.7	0.7	0.7
Limestone	0.3	0.3	0.3	0.3	0.3
Salt	0.5	0.5	0.5	0.5	0.5
Premix XXIV	0.5	0.5	0.5	0.5	0.5
Biomethionine	-	1.0	-	1.0	-
Biolysine	-	-	1.0	1.0	-
Gross energy MJ/kg dry matter	17.2				17.2
Crude protein %	13.8				16.9
Methionine	0.23	0.43	0.23	0.43	0.26
Methionine + cystin	0.47	0.67	0.47	0.67	0.54
Lysine	0.54	0.54	0.74	0.74	0.69

Table 3
Daily weight gain /g/ as affected by protein levels and amino acids supplementation from 6 to 11 weeks of age

Rations	A		B		C		D		E		Total	
Genotypes	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E
	First experiment											
Ca	29.5	1.3	28.1	1.3	31.0	1.1	31.4	1.0	28.3	1.0	29.6	0.5[a]
NZW	29.7	0.8	29.5	0.9	29.1	1.1	29.8	0.9	30.4	1.0	29.7	0.4[a]
Ca x NZW	29.5	0.9	31.3	1.0	31.8	0.7	31.9	0.8	31.7	1.0	31.2	0.4[b]
Total	29.5	0.6	29.6	0.6	30.7	0.6	31.0	0.5	30.1	0.6	30.2	0.3
	Second experiment											
Ca	32.5	2.1	28.0	1.4	34.0	1.4	32.8	1.4	31.9	1.0	31.7	0.7
NZW	33.4	0.7	32.9	1.0	32.8	1.3	34.1	1.3	33.6	1.4	33.4	0.5
Ca x NZW	30.4	1.6	29.5	1.3	31.7	1.2	33.5	1.2	31.9	1.1	31.4	0.6
		b		a		bcd		bcd		bc		
Total	32.1	0.9	30.0	0.8	32.8	0.7	33.5	0.7	32.5	0.7	32.2	0.4

Means having the same letters are not significantly different.

Table 4

Feed conversion efficiency as affected by protein levels and amino acids supplementation from 6 to 11 weeks old

Rations	A		B		C		D		E		Total	
Genotypes	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E
	First experiment											
Ca	3.12	0.1	3.04	0.10	2.95	0.05	3.03	0.06	3.14	0.1	3.06	0.03[a]
NZW	3.18	0.1	3.18	0.08	3.33	0.09	3.17	0.06	3.10	0.1	3.19	0.04[b]
CaxNZW	3.18	0.1	3.05	0.06	3.18	0.06	3.14	0.07	3.15	0.1	3.14	0.03[ab]
Total	3.16	0.1	3.09	0.05	3.14	0.04	3.11	0.04	3.13	0.0	3.13	0.02
	Second experiment											
Ca	3.25	0.1	3.47	0.12	3.35	0.13	3.42	0.09	3.51	0.1	3.40	0.05
NZW	3.07	0.1	3.19	0.09	3.33	0.08	3.37	0.12	3.33	0.2	3.26	0.05
CaxNZW	3.34	0.1	3.47	0.07	3.36	0.10	3.13	0.12	3.49	0.1	3.35	0.04
Total	3.22	0.1	3.39	0.06	3.35	0.06	3.30	0.06	3.44	0.1	3.34	0.03

Means having the same letters are not significantly different.

Table : 5

Protein levels and amino acids supplementation effects on carcass weight /g/ and dressing percentage of rabbits slaughtered at 87 days of age / x ± S.E/

Rations / Genotypes		A		B		C		D		E		Total	
Ca	*	1342	57	1255	29	1347	51	1295	19	1348	42	1317	19
	**	62.6		60.4		59.8		62.5		62.0		61.4	b
NZW	*	1330	51	1340	21	1295	28	1312	39	1383	64	1332	19
	**	60.4		61.0		59.9		59.3		58.5		59.8	a
Ca x NZW	*	1332	35	1420	48	1290	33	1277	33	1283	42	1320	19
	**	61.3		62.2		60.0		60.8		60.1		60.9	b
Total	*	1334	26	1338	25	1311	22	1294	17	1338	29	1323	11
	**	61.4		61.2		59.9		60.9		60.2		60.7	

* Mean carcass weight ± S.E

** Mean dressing percentage

Table : 5

Digestibility coefficients as affected by protein levels and amino acids supplementation in growing rabbits

Rations	A		B		C		D		E		Total	
Genotypes	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E	$\bar{x}$	S.E
	Dry matter											
Ca	71.2	0.06	69.8	0.04	70.4	0.01	74.8	0.03	72.0	0.04	71.6	0.01[a]
NZW	77.5	0.01	77.1	0.01	74.4	0.07	78.7	0.01	72.7	0.05	76.1	0.01[b]
C x NZW	70.9	0.05	73.8	0.01	72.0	0.01	71.3	0.01	72.7	0.06	72.1	0.01[a]
Total	73.3	0.02	73.6	0.02	72.3	0.01	75.0	0.02	72.4	0.01	73.3	0.01
	Organic matter											
Ca	72.6	0.05	70.9	0.04	71.5	0.01	75.8	0.03	73.1	0.04	72.8	0.01[b]
NZW	78.1	0.01	79.0	0.01	76.2	0.07	80.1	0.01	74.6	0.06	77.9	0.01[a]
C x NZW	72.1	0.06	74.5	0.01	73.1	0.01	72.5	0.01	74.1	0.06	73.3	0.01[b]
Total	74.8	0.02	74.9	0.02	73.6	0.01	76.2	0.02	74.0	0.02	74.7	0.01
	Crude protein											
Ca	64.3	0.15	62.6	0.05	66.6	0.03	72.1	0.01	74.6	0.09	68.1	0.02[a]
NZW	71.8	0.05	73.4	0.01	70.1	0.11	73.7	0.01	73.8	0.04	72.6	0.01[b]
C x NZW	64.2	0.11	70.3	0.03	62.7	0.04	65.4	0.04	71.1	0.10	66.8	0.02[a]
		ab		abc		a		cd		d		
Total	66.8	0.04	68.8	0.03	66.5	0.03	70.4	0.02	73.2	0.02	69.2	0.01
	Crude fat											
Ca	81.0	0.02	83.9	0.02	81.7	0.01	82.3	0.10	75.5	0.06	81.0	0.01[b]
NZW	84.1	0.20	79.5	0.01	79.9	0.06	76.7	0.09	71.8	0.13	78.6	0.03[a]
C x NZW	81.5	0.02	84.0	0.03	81.4	0.01	81.2	0.04	82.4	0.02	82.1	0.01[b]
		bcd		bcd		bc		b		a		
Total	82.2	0.03	82.5	0.01	81.0	0.01	80.1	0.03	76.7	0.05	80.6	0.01
	Crude fiber											
Ca	24.8	0.57	22.7	1.60	22.1	0.13	36.7	0.24	19.7	0.44	25.0	0.12[a]
NZW	44.8	0.01	49.4	0.05	39.1	0.37	48.1	0.03	26.5	0.55	41.4	0.07[b]
C x NZW	6.0	2.40	30.3	0.08	30.8	0.11	30.8	0.04	34.5	0.33	25.3	0.20[a]
		a		cd		bc		d		ab		
Total	23.1	0.63	33.7	0.28	30.4	0.11	38.4	0.08	26.7	0.16	30.3	0.05
	N-free extractive											
Ca	82.0	0.02	81.0	0.01	81.4	0.02	84.1	0.03	82.9	0.02	82.3	0.01[a]
NZW	86.1	0.01	86.3	0.01	84.6	0.04	88.5	0.01	84.3	0.04	86.0	0.01[b]
C x NZW	83.8	0.04	83.6	0.04	83.2	0.02	82.0	0.01	82.0	0.03	82.9	0.01[a]
Total	84.0	0.01	83.7	0.01	83.1	0.01	85.0	0.02	83.1	0.01	83.8	0.01

Means having the same letters are not significantly different.

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Die Wirkung der Eiweissmenge der mit Aminosäueren ergänzte Futtermischung auf die Kaninchen's tägliche Zuwachsrate, Futterverwertung und Verdaulichkeitskoefficienten der Futtermischung

Diese Abhandlung untersucht die Verdaulichkeit und Wirkung von verschiedene eiweissgehaltenden Futtermischungen /13,8 %, 16, 9 %/, die ergänzt wurden mit Methionin und /oder/ Lysin auf die Futterverwertung und auf die Gewichtzunahme bei Kaninchen.

Die geprüfte Eiweissgehalte verursachten keinen signifikanten Unterschied in der Gewichtzunahme während der Experimenten. Die Ergänzung der Futtermischung mit Methionin und /oder/ Lysin hatte die Gewichtzunahme nicht verbessert.

Die Eiweissmenge un die Aminosäure Ergänzung verursachten keinen Einfluss auf die Futterverwertung.

Die Verdaulichkeit der Trockensubstanz, Organischesubstanz, Rohfaser, N.-frei Extraktstoffe hatten keinen signifikanten Einfluss auf die Verdauung der Futtermischung.

Signifikant wirkten aber die Eiweissmenge, Roheiweiss und Rohfett auf die Verdaulichkeit.

Die Methionin und /oder/ Lysin Ergänzung verbesserte nicht die Verdauung der Nahrung. Ausnahme war die Verdauung von Rohfaser, die signifikant besser war.

Alle Ergebnisse zeichnen, dass 13,8 % von Pflanzen stammenden gute Qualitäte Eiweiss in der Futtermischung kann ökonomisch mit Jungtiere gefüttert werden, und man braucht keine Aminosäuere Ergänzung.