

# Effect of weaning age and diet on growth performance, caecal characteristics and potential pathogenetic microflora in rabbits

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**ABSTRACT** - The aim of this study was to investigate the effect of age and diet at weaning on growth performances, caecal characteristics and development of potential pathogenetic microflora. The trial was carried out on 64 litters from 18 to 45 days of age comparing two weaning age (25 vs. 34 d) and two weaning diets (HF and LF) characterized, especially, by different energy, fat and starch concentration (HF: DE=11.5 MJ/kg, EE=6.2%, Starch=8.7%; LF: DE=10.1 MJ/kg DM, EE=3.1%, Starch=11.3%).

At 45 d, early weaning determined a significant reduction of growth (1219 vs 1282;  $P<0.01$ ), although the solid feed intake resulted significantly higher, from 25 to 34 days of age, in early weaned rabbits (50.0 vs 29.8 g/d;  $P<0.001$ ). The age at weaning did not modify caecal traits, with the exception of pH value, that was lower in rabbits early moved to the mothers (5.53 vs 5.83;  $P<0.05$ ).

Independently by age of weaning, the administration of diet HF promoted growth performance in rabbits at 45 d (1280 vs 1222;  $P<0.01$ ).

Diet composition did not influence mortality rate at 34 days of age, while early weaning determined values significantly higher than those found in rabbits weaned later.

The data of microbial analysis, carried out on 10 animals per diet (at 25 and 34 days of age), showed potential pathogenetic microflora development depended by the age of animal and was not affected by the composition of diets.

**Key words:** Diet composition, Weaning, Caecal characteristics, Pathogenetic microflora, Rabbit.

**INTRODUCTION** - In rabbit production, one of the most crucial phase is the weaning period, when the kit replace milk with solid feed, microflora colonization begins to develop and caecal fermentations rapidly increase. In this period, rabbits are sensitive to multifactorial digestive disorders, which can determine high mortality rate. In order to reduce the economical impact of digestive diseases on rabbit farm, the antibiotics are often added to the feed from weaning to 8 week of age. Antibiotic resistance and public opinion on human health and animal welfare have stimulated the study of new strategies to promote favourable caecal microbial activity and growth performance of animals controlling potential pathogenetic microflora development without the use of drugs. In particular, the composition of the diet could modify the microflora population and, consequently, affect the fermentation in the caecum and the development of pathogenic strains (Licois and Gidenne, 1999). A specific diet formulated for young rabbits could promote an earlier solid feed intake and favour the establishment of a balanced caecal ecosystem (Gidenne and Fothun-Lamothe, 2002). In commercial rabbit farm, however, dams and kits eat solid feed in the same feeder and diet is often inadequate to cover the antagonistic nutritional requirements of lactating females and young rabbits. Early weaning, therefore, could better cover nutritional kit requirements and promote their digestive development (Gidenne and Fortun-Lamhote, 2002). The aim of this study was to investigate the relationship between diet and age of weaning on growth performance, caecal characteristics and potential pathogenetic microflora.

**MATERIAL AND METHODS** - A total of 64 litters (8 kits per litter) were divided into two groups fed *ad libitum*, from 18 to 34 days of age, one of two experimental weaning diets (HF = High Fat and LF = Low Fat) formulated according to the recommendation of Gidenne and Fortun-Lamothe (2002) and characterized by different composition and different level of digestible energy, fat and starch (HF: DE=11.5 MJ/kg DM, DP=12.3%, EE=6.2%, Starch=8.7%, NDF=33.3%, ADF=18.8%, ADL=4.9%; LF: DE=10.1 MJ/kg DM, DP=10.6%, EE=3.1%, Starch=11.3%, NDF=36.3%, ADF=20.9%, ADL=5.2%). The diets, containing only coccidiostat but no antibiotics, were fed using specific feeders able to separate litter and dam intake. The animals of each group were weaned at two different ages (25 or 34 days) moving the does to other cages. After 34 days of age, 54 animal per group, representative in terms of average weight, were selected, transferred to the fattening cages and fed the diet LF administrated *ad libitum*.

At 25, 34 and 45 days of age, 10 rabbits per group, representative in terms of average weight and in good health, were slaughtered to measure caecum weight and caecal content composition in terms of pH and volatile fatty acid (VFA). Fatty acid analyses were performed by gas chromatography on a capillary column. At 25 and 34 days of age pathogenic microflora population (*Escherichia coli*, *Clostridium perfringens* and *Staphylococcus aureus*) were studied to evaluate the effect of diet submitting 10 caecal samples per experimental group to quantitative and qualitative bacteriological analyses (Grilli *et al.*, 1992 modified). Data recorded were analysed by General Linear Model procedure (SAS, 2001).

**RESULTS AND CONCLUSIONS** - The data reported in table 1 showed the age at weaning influenced the solid feed intake between 25 and 34 days of age. Early weaned rabbits, in fact, consumed more dry feed than those weaned at 34 days to compensate the interruption of milk intake, but this higher intake of solid feed was insufficient to ensure a similar growth. The LF diet did not significantly affect solid feed intake and body weight until 34 days of age, while at 45 days the diet HF determined live weights higher than those registered in animals fed the conventional diet.

Table 1. Effect of weaning age at weaning and diet on growth performance, mortality and caecal traits.

			Weaning age			Weaning diet		RSD	
			25	34	Prob.	HF	LF	Prob.	
Ingestion	18th-24th	(g/d)	3.15	3.13		3.09	3.19	1.38	
	25th-34th	(g/d)	50.0	29.8	***	38.3	41.5	6.44	
	35th-45th	(g/d)	110	109		110	109	20.4	
Live weight at	18th day	(g)	290	289		287	292	21.2	
	25th day	(g)	418	423		423	418	35.1	
	34th day	(g)	709	819	***	779	748	71.0	
	45th day	(g)	1219	1282	**	1280	1222	**	145
Weight gain	18th-24th	(g/d)	18.3	19.1		19.4	18.0	3.61	
	25th-34th	(g/d)	32.2	44.0	***	39.8	36.4	*	5.22
	35th-45th	(g/d)	44.6	42.2		43.1	43.6	12.2	
Mortality	18th-34th	(%)	7.02	2.46	*	4.77	4.71	7.34	
Caecal characteristics at 45 days of age									
Empty caecum weight		(%BW)	1.83	1.80		1.81	1.81	0.21	
Caecal content weight		(%BW)	6.13	5.48		5.99	5.61	0.86	
pH			5.53	5.83	*	5.63	5.73	0.26	
Total VFA		(mMol/l)	83.9	79.6		80.1	83.4	15.7	
Acetic acid		(mol/100mol VFA)	86.2	85.3		84.2	87.4	**	1.57
Propionic acid		(mol/100mol VFA)	3.33	3.30		3.45	3.18		0.75
Butyric acid		(mol/100mol VFA)	10.4	11.4		12.3	9.46	***	1.19
C3/C4			0.32	0.30		0.28	0.34		0.07

\*\*\*:  $P < 0.001$ ; \*\*:  $P < 0.01$ ; \*:  $P < 0.05$ .

Caecum and caecal content weight parameters at 45 days, expressed in percentage of body weight, were not significantly affected by treatments and were similar to those reported by Gutiérrez *et al.* (2003). Caecal pH was not influenced by the diet, while was lower in animals weaned at 25 d than in rabbits weaned later. The two experimental factors did not significantly influence total VFA, while VFA molar proportions were statistically affected by the diet. In particular, rabbits given the diet LF, lower in fibre/starch ratio, showed a lower butyrate proportion (without the change of the C<sub>3</sub>/C<sub>4</sub> ratio) and a higher acetate proportion.

The mortality at 34 days of age was not affected by the diet, while the early weaning determined values significantly higher than those found in rabbits weaned later.

The results of bacteriological analyses, determined in healthy rabbits, showed the age of animal influenced significantly the number of potential pathogenic microflora population. The values of *Escherichia coli*, determined in our study, were lower in animals at 25 days of age than those found in rabbits at 34 d (2.80 *vs* 4.10 log CFU/g caecal content; P<0.01) and resulted strongly lower than those reported by Padilha *et al.* (1995). On the contrary, at 25 d the number of *Clostridium perfringens* was significantly higher than that recorded in animals slaughtered later (3.90 *vs* 2.16 log CFU/g caecal content; P<0.001). The concentration of *Staphylococcus aureus* resulted not detectable at 25 and 34 days of age. On the whole, diet composition did not influence the development of pathogenic strains in rabbits at 25 and 34 days of age.

In conclusion, the early weaning determined in rabbit a significant reduction of growth, without modifications of caecal traits at 45 days of age, and an increased of mortality at 34 d.

The administration of a low-starch and high-fat diet improved growth performance in rabbits (independently by age of weaning) and not statistically modified potential microflora population.

Further researches are necessary to formulate diets more suitable for the critical period of weaning and to define the relationship between diet, establishment of caecal microflora and development of pathogenic strains.

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**REFERENCES** - Gidenne, T., Fothun-Lamothe L., 2002. Feeding strategy for young rabbits around weaning : a review of digestive capacity and nutritional needs. *Anim. Sc.* 75:169-184. Grilli, G., Orsenigo, R., Brivio, R., Invernizzi, A., Luini, M., Gallazzi, D., 1992. Microbiological investigation on frozen rabbit semen. *J. Appl. Rabbit Res.* 15:511-519. Gutiérrez, I., Espinosa, A., Garcia, J., Carabaño, R., De Blas, J.C., 2003. Effect of protein source on digestion and growth performance of early-weaned rabbits. *Anim. Res.* 52:461-471. Licois, D., Gidenne, T., 1999. L'emploi d'un régime déficient en fibres par le lapereau augmente sa sensibilité vis d'une infection expérimentale par une souche d'*Escherichia coli* entéropathogène. 8<sup>ème</sup> J. Rech. Cun. Fr., Paris. pp. 101-104. Padilha, M.T.S, Licois, D., Gidenne, T., Carrè B., Fonty G., 1995. Relationship between microflora and caecal fermentation in rabbits before and after weaning. *Reprod. Nutr. Dev.* 35:375-386. SAS, 2001. Rel. 8.01, SAS Inst. Inc., Cary, N.C., USA.