

**COMPARATIVE STUDIES ON GROWTH PERFORMANCE, NUTRIENT DIGESTIBILITY, IMMUNITY INDEX AND PROTEASE ACTIVITIES BETWEEN WEANING-2 MONTH AND 2-3 MONTH NEW ZEALAND RABBITS**

**LI FU-CHANG<sup>1</sup>, LEI QIU-XIA<sup>2</sup>, ZHANG XIULING<sup>2</sup>**

1. College of Animal Science & Technology, Shandong Agricultural University.  
Tai'an, Shandong Province, 271018. P. R. CHINA. [chlf@sdau.edu.cn](mailto:chlf@sdau.edu.cn)

2. Shandong Academy of Agricultural Science.  
Jinan, Shandong Province, 250020. P. R. CHINA.

**ABSTRACT**

The experiment was carried out to study the effects of different age on production performance, nutrient digestibility, immunity index and small intestine protease activities of New Zealand rabbits. Twenty weaned rabbits were raised and the rabbits were allocated to weaning to 2 months and 2 to 3 months. The results showed as following: The average daily gain of weaning to 2 months rabbits was higher than that of 2 to 3 months ( $p < 0.05$ ), which are 33.4g and 29.6g; the feed/gain rate of weaning to 2 months rabbits was lower than that of 2 to 3 months ( $p < 0.05$ ), which are 2.93:1 and 4.41:1. The nutrient apparent digestibility of 2-3 months rabbits was higher than that of weaning-2 months, there into, the average apparent digestibility of crude protein of 2-3 months and weaning-2 months were 72.0% and 68.1%, respectively. The average nitrogen retention of 2-3 months and weaning-2 months were 1.5g/d and 1.3g/d. The immunity index of different age rabbits has not obvious change, the protease activities descended when age increased.

**Key words:** crude protein, production performance, immunity index, protease activity.

**INTRODUCTION**

Protein is important matter and component of forming structural and metabolic matter of life process, and is a material of renewing and repairing tissue. Now the dietary crude protein requirement of growing rabbits is 16% which comes from NRC (1977). The growing meat rabbits have differences on growth speed, feed conversion rate, digestive enzyme activities and immunity organs when the age changed, so it is essential to compare the production performances, nutrient utilization, immunity index and small intestine enzyme activities of growing rabbits by dividing different age stages. The objective of this experiment was carried out to study the effects of different age on production performance, nutrient digestibility, immunity index and small intestine

protease activities of New Zealand rabbits.

## MATERIALS AND METHODS

### Animals and diets

Twenty weaned New Zealand rabbits (30 day old and mean body weight  $0.63 \pm 0.14$ kg, males and females had half each) were divided into two age stage, which are Werner to 2 months and 2 to 3 months, and rabbits were individually housed in self-made (which can separate urine from feces) metabolism cages. Each cage contained a feeder to provide free access to feed and a nipple to provide free access to water. Table 1 gives the composition of diets, designed according to NRC (1977).

**Table 1. The composition of experimental diets**

Ingredients (%)		Composition (%)	
Peanut vine	32.0	Designed CP	16.00
Corn	24.0	Determined CP	15.55
Bran	24.5	DE (MJ/kg)	10.45
Soya bean meal	12.5	CF	12.00
Limestone	4.0	Ca	0.40
Salt	0.5	P	0.22
CaHPO <sub>4</sub>	1.5		
Premix	1.0		

### Experimental procedures

Experimental periods consisted of a 7-day adjustment period followed by a 53-day experimental period which was divided into weaning to 2 months and 2 to 3 months (including a 7-day collection of feces, urine and residual feed daily in two stages). Feed was offered in equal portions at 8:30 and 17:30 daily. Faeces, urine and residual feed were collected from rabbits in the metabolism cages. After feeding trial, 6 rabbits from each experimental age were slaughtered.

### Chemical analysis and statistics

All experimental rabbits were weighed at weaning, 2 months and 3 months and the average daily gain was calculated. The average daily feed consumption was recorded and feed/gain rate was calculated. Feed and feces samples were analyzed for dry matter (DM), crude fiber (CF), nitrogen (N), fat and energy according to the procedure of YANG SHENG (1993). Urine samples also were analyzed for nitrogen (N) according to the

procedure of YANG SHENG (1993).

Spleen and thymus weight was weighed after the rabbits were slaughtered and spleen index and thymus index were calculated according to the following formulae: spleen index=spleen weight/body weight, thymus index=thymus weight/body weight. The small intestine chyme were collected when rabbits were slaughtered, chymotrypsin and trypsin activities were analyzed according to the method of JI CHENG (1997).

Treatment means comparison was done using Duncan's Multiple Range Test.

## RESULTS AND DISCUSSION

### Effect of age on performance

Effects of different age on production performance were showed on Table 2. The average daily gain of weaning to 2 month rabbits was higher than that of 2 to 3 months ( $P<0.05$ ). The average daily gain of weaning to 2 month and 2-3 month rabbits were 33.4g and 29.6g. The average feed/gain of weaning to 2 month rabbits was lower than that of 2 to 3 months ( $P<0.05$ ), the value of weaning to 2 months and 2-3 months were 2.93 and 4.41. CHENG YUAN (1997) also reported that the growth speed of New Zealand rabbits was the highest in weaning to 2 months, then was 2-3 months. Our results were similar to those reported by De Blas and Wiseman (1998).

**Table 2. Comparison of production performance of weaning to 2 months and 2-3 months**

Traits	Weaning to 2 months	2 to 3 months
Average daily gain (g)	33.4±2.1 <sup>a</sup>	29.6±1.2 <sup>b</sup>
Feed/gain rate	2.93 <sup>b</sup>	4.41 <sup>a</sup>

### Effect of age on nutrient digestibility

The nutrient digestibility and nitrogen retention of 2-3 month rabbits were higher than that of weaning to 2 months, it means that the digestive function rise with age. Among of them, the CP digestibility of weaning to 2 month and 2-3 month rabbits were 68.1% and 72.0%, the nitrogen retention of weaning to 2 month and 2-3 month rabbits were 1.3g/d and 1.5g/d. CHENG YUAN (1997) pointed out that the feed conversion rate of 2-3 month New Zealand rabbits was the highest. The nourishment of rabbit post-weaning is very different from that of suckling rabbits, the assimilation organ is becoming mature and the assimilation capability is improving because of age increase, thereby, the nutrient

digestibility and nitrogen retention of 2-3 month rabbits were higher than that of weaning to 2 months.

**Table 3. Nutrient digestibility and nitrogen retention in different age (%)**

	Weaning to 2 months	2-3 months
Energy	63.3±0.8	66.7±1.9
CP	68.1±3.8	72.0±3.7
CF	28.4±1.8	32.3±1.3
DM	57.5±4.5	59.9±2.2
Organic Matter	63.5±4.4	66.6±1.9
Fat	73.6±7.1 <sup>a</sup>	70.1±6.8 <sup>b</sup>
Nitrogen retention (g/d)	1.3±0.3	1.5±0.2

### Effect of age on immunity indexes

Spleen is peripheral immunity organ and is the biggest immunity organ in animal body, which larges when the body weight increase. Spleen weight of 2-3 month rabbits was bigger than that of weaning to 2 months ( $P<0.05$ ), the spleen index of two stages had not significant difference ( $P>0.05$ ).

Thymus is main immunity organ. It also is the main place of differencing, maturing T lymphocyte and excreting thymus hormone. The size of thymus varies from animal age. The thymus index is the biggest at birth day and the thymus weight is the biggest at puberty. From table 4 we know that thymus weight of 2-3 month rabbits was bigger than that of weaning to 2 months ( $P<0.05$ ), the thymus index had not showed significant difference ( $P>0.05$ ).

The bigger the immunity index is, the stronger the immunity capability is. The immunity capability of meat rabbits becomes stronger when age increase. After weaning, the immunity organ of rabbits is immature and the capability of resisting pathogen is lower. When age and nutrient intake increase, organ is becoming mature and function is becoming perfect, and it is consistent with the growth rule of animal.

**Table 4. Immunity index in different age**

Traits	Weaning to 2 months	2-3 months
Spleen weight (g)	1.1±0.6 <sup>a</sup>	1.8±0.5 <sup>b</sup>
Spleen index	3.6±1.0 <sup>a</sup>	4.8±0.7 <sup>b</sup>
Thymus weight (g)	1.0±0.9	0.8±0.2
Thymus index	2.8±0.8	2.0±0.3

### Effect of age on main small intestine proteases

The activities of small intestine chymotrypsin and trypsin in 2-3 month rabbits were higher than that of weaning-2 months ( $P<0.05$  and  $P>0.05$ ). Chymotrypsin and trypsin are two kinds of important enzyme in digesting and breaking down protein, their activities vary because of rabbit age and protein kinds of digestive tract. Because of the different of nutrient intake between suckling rabbits and post-weaning rabbits, the digestive enzyme system is variable. So, all enzyme activities in the digestive tract descend in a week after weaning, then the levels are the same as suckling rabbits (JI CHENG, 1997). After that, the development of digestive tract and enzyme system mature gradually, then the enzyme activity will drop, it is the same as our experimental results. And it is also the same as the variety rules of piglet protease reported by LINDEMANN (1986) and LI CHANGZHONG (2002).

**Table 5. Enzyme activities in small intestine at different ages (U/g)**

Traits	Weaning to 2 months	2-3 months
Chymotrypsin	15.7±3.2 <sup>a</sup>	14.0±0.5 <sup>b</sup>
Trypsin	125.7±3.6	121.4±8.2

### CONCLUSIONS

The average daily gain of weaning to 2 month rabbits was higher than that of 2 to 3 months ( $P<0.05$ ), the average daily gain of weaning to 2 month and 2-3 month rabbits were 33.4g and 29.6g, respectively. The average feed/gain rate of weaning to 2 month rabbits was lower than that of 2 to 3 months ( $P<0.05$ ), which were 2.93:1 and 4.41:1. The nutrient digestibility and nitrogen retention of 2-3 month rabbits were higher than that of weaning to 2 months, the CP average digestibility of weaning to 2 month and 2-3 month rabbits were 68.1% and 72%, the average nitrogen retention of weaning to 2 month and 2-3 month rabbits were 1.3g/d and 1.5g/d. Spleen weight and thymus weight of 2-3 month rabbits was bigger than that of weaning to 2 months ( $P<0.05$ ), the spleen index and thymus index of two stages had not significant difference ( $P>0.05$ ). The activities of small intestine chymotrypsin and trypsin of 2-3 month rabbits were higher than that of weaning-2 months ( $p<0.05$  or  $p>0.05$ ).

### REFERENCES

- NRC. 1977. Nutrient requirements of domestic animals, No. 9 .Nutrient requirements of rabbits. *Second Revised Ed. National academy of sciences-National Research Council, Washington, DC.*

- YANG SHENG. 1993. Feed analysis and feed quality assay. *Beijing Agricultural University Press*.
- JI CHENG. 1997. Studies on some digestive enzyme activities before and after weaner in the piglet. *Acta Zoonutrimenta Sinica*, 9(3):7~12.
- CHENG YUAN. 1997. Measurement of growth speed and slaughter rate of New Zealand rabbits. *Chinese Journal of Rabbit Farming*, 1:7-8.
- DE BLAS AND WISEMAN 1998. The nutrition of the rabbit. *CABI Publishing*. pp177-195
- LINDEMANN M.D. 1986. Effect of age weaning and diet on digestive enzyme levels in the piglet. *J. Anim. Sci.*, **62**:1298-1307.
- LI CHANGZHONG. 2002. Effect of age weaning on digestive enzyme levels in the piglet. *Anim. Sci. & Anim. Med.*, **21**(3):7-8.