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By

I Made Nuriyasa, Wayan Sayang Yupardhi, and Eny Puspani

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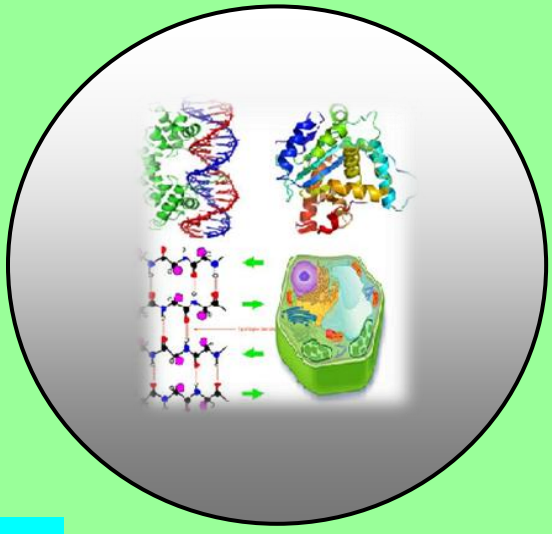

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Dr. I Made Nuriyasa
http:// www.sasjournals.com
http:// www.jbcr.in
jbiolchemres@gmail.com

RESEARCH PAPER

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Study on Growth Rate of Local Male Rabbits (*Lepus nigricollis*) Fed Different Energy Levels Diet and Sheltered in Different Density

I Made Nuriyasa, Wayan Sayang Yupardhi, and Eny Puspani
Department of Animal Nutrition, Faculty of Animal Science, Udayana University

ABSTRACT

Randomize Block Design - 2 x 3 factorial design with 6 blocks as the replications was used in this experiment. The first treatment was diet contains the same protein for 16 % (R) with metabolic energy contents for 2500 k cal/kg (R1) and 2800 k cal/kg (R2).The second treatment was space of shelter floor (L) which consists of 3500 cm^2/head (P1), 1750 cm^2/head (P2) and 1167 cm^2/head (P3). Final body weight and weight gain of the animals fed R1 was higher (P<0.05) than that of the R2.The final body weight of the animal which was reared on the density levels P2 and P3 was higher (P<0.05) than that of the P1. From the results of the experiment could be concluded that the Rabbit (Lepus nigricollis) fed diet R1 produced growth rate higher than that of the R2.The density level of the shelter P1 produced lower growth rate than that of the P2 and P3.
Key words: local Rabbit, Metabolic Energy, Levels of Density Shelter and Growth Rate.

INTRODUCTION

Rabbit has some superiority compare to big ruminant in the third country with densely populated such as Indonesia. Rabbit farm is no needs large area, big capital for producing qualified meat which is indicated of protein contents for 20,8% and low of fat for 10,2% (USDA, 2009). At the behind of the superiority that belong to the animal, it is also has some inhibition factors i.e. sensitivity to environment exchanges factor particularly hyperthermia and diet quality. The ideal temperature of the animal is 15^{o}C to 20^{o}C. Indonesia is a tropical wet country with a temperature for 21.87^{o}C to 3.13^{o}C and moisture for 79 to 86% (BMKG, 2014). These temperatures actually are not suitable for developing it. The use of the shelter floor size and energy: protein ratio balances which are not in optimum of it needs would impact no good to temperature humidity index and biological responses of the animal.

According to Mc Nitt et al. (1996) that the animal on it growth stage needs diet with metabolic energy content for2350 k cal/kg and crude protein for 15% with energy: protein ratio balances for 156.66. Xiagmei (2008) stated that the Rabbit fed energy: protein ratio imbalances diet which is not in optimum of it needs would affect its productivity. Experimental result of Obasilar and Obasilar (2007) showed that final body weight and diet consumption of the 3 animals which are reared in one shelter compartment (4200 cm^2/head) was better than the 1 animal (1400 cm^2/head) and the 5 animals (8400 cm^2/head). Zucca et al. (2012) found that the animal which are reared for the amount of 3 and 4 in one shelter compartment caused the animal behavior was better than the 2 and the 1 animal in one shelter compartment. Experimental result of Buijis et al. (2012) founded that the amount of the Rabbit for 20 animals in area for 1 m2 in a shelter produced higher tibiafibula diameter, but their welfares were lower than the17.5; 15; 12.5; 10; 7.5 and 5 animals. Base on the problems mentioned above it is important to be known about floor size of the shelter and metabolic energy of diet for the local male Rabbit at tropical lowland plain to increase its productivity efficiencies.

MARIAL AND METHODS

The experiment used Randomize Block Design 2x3 factorial with 6 blocks as the replications. The blocks were made base on the lowest commencement body weight up to the highest. The first factor was diet contains the same protein for 16 % (R) consists of diet metabolic energy for 2500 k cal/kg (R1) and diet with protein content for 2800 k cal/kg (R2). As the second factor were size of shelter floors (P) consisted of 3500 cm^2/head (P1), 1759 cm^2/head (P2) and 1166cm^2/head (P3). The diets were made of yellow corn, pressed coconut, fish meal, tapioca powder, soy bean powder, rice bran, elephant grass, NaCl, and pignox. The diet was formed pellet and fed *adlibitum* (feed available all the time).

Experimental Variables

Micro Climate Variables

Temperature and air moisture data in the shelter were measured by thermo hygrometer digital type CE 11/08. They were measured on 5 points i.e. at each angle of the shelter and the center point of it. The result of the measurements at the 5 points was averaged to obtain representative temperature data in each shelter compartment. The measurement was conducted on each unit of the experiment (shelter compartment) 3 times per day i.e. 07.30 (central Indonesia time), 13.30 (central Indonesia time) and 17.30 (central Indonesia time). Daily average temperature was calculated by using Handoko formula (1995) as follows:

$$\frac{|(2 \times \text{morning temperature}) + \text{Afternoon temperature} + \text{evening temperature}|}{4}$$

The air moisture was founded by sum up of the morning, the afternoon and the evening observations data and then divided by 3. Temperature Humidity Index (THI) for the animal was calculated by using empirical formulates as follows (Marai, 2002):

$$THI = T - |(0.31 - 0.31 \times RH)(T - 14.4)|$$

Explanation:

THI : Temperature Human Index

T : Average Temperature in the shelter compartment (^oC)

RH : Relative Humidity/100

Physiological Variables

Skin Temperature: The skin temperature was measured by using Digital Basal Body Temperature, model185, accuracy: 0.05^{o}C, measurement ranges: 32^{o}C to 42^{o}C, measurement sensitivity: 0,1^{o}C. The measurements were conducted at 4 points i.e. head, neck, back and bottom (Kasa, et al., 1993).

Rectal Temperature: Pre treatment was conducted for 1 week on the animals before the rectal temperatures data were taken. The rectal temperature was measured by using digital thermometer with round and a bit sharp shape sensor enters to anus for 6 cm deep (Purnomoadi, 2003).

Respiration Rate: Respiration rate was obtained by calculating the movement up and down of ribs-bowels for 1 minute (Purnomoadi, 2003). A stopwatch was used as a pointer time and hand tally counter to calculate the sum of ribs-bowels movements. One up movement (ribs-bowels extend) and down (ribs-bowels hollow) were calculated as one times of the respiration rate.

Heart Beat. Pre treatment used to be conducted for 1 week on the animals before the thru experiment was implemented. The first step was to observe or palpate artery beat pulse on a certain area where it can be fill strongly. Then, heart beat measurements was conducted by stethoscope pastes on it for 1 minute (Purnomoadi, 2003).

Performance Variables

Feed and water consumptions: Feed and water consumptions were calculated every day by i.e. the amount of the feed or water offered minus the rest.

Body Weight: Body weight measurements were conducted every week to obtain weight gain per week. The body weight commencement was measured at the beginning of the experiment to obtain it commencement weight, while to obtain the final weight the animal was weighed at the end of the experiment. And weight gain of the animals during the experiment was obtained by diminishing the final body weight with the commencement weight. All animals were fastening for 12 hours before they weighed.

Feed Conversion: Feed Conversion Ratio (FCR) was calculated by calculating the conversion between the amount of feed consumption and weight gain during the experiment.

Rabbit

There were 72 local male Rabbit with average body weight for 258.50 g $\pm$ 1.08 g used in the experiment.

Animal Shelter

The experiment used 40 compartments battery shelter with the size for 70 cm length, 50 cm wide and 45 cm high each (Sceira, 1999).

Diet and Drinking Water

The experiment used diet composed of yellow corn, fish meal, rice bran, pressed coconut, soy bean powder, elephant grass, tapioca powder, coffee bean skin, coffee bean skin fermented, coconut oil, and bone powder. The Animal fed diet contains the same protein for 16 % with metabolic energy contents 2500 k cal/kg and 2800 k cal/kg. The diet and water offered adlibitum (feed available all the time).

All data were recorded, tabulated, and analyzed using analyze of variance. Whenever significantly difference among treatment were found, analysis will be continued using Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSIONS

Effects of Different Diets

Treatment diet with different energy contents were not affects significantly (P>0.05) to air temperature, air moisture, temperature humidity index and sun radiation intensity in the Rabbit shelters (Table 1). Wire walls of battery shelter is a very effective ventilation, therefore the different of heat metabolism expansion by the animals were not accumulated, but very fast changes to it environment air. This condition causes different growth rate and different of the animal amount in one shelter was not affected significantly to micro climate in the shelter. This opinion was supported by Nuriyasa (2012) that the micro climate in the shelter was affected by ventilation or exchange rate of the air in and outside of the shelter.

There were no significantly different (P>0.05) to heart beat, rectal temperature, skin temperature and respiration rate of the animal fed treated diet with different metabolic energy content. These were caused by treated diet and the different animal density levels which were not affected significantly to the shelter micro climate. This statement was supported by Nuriyasa (2012), physiological responses of the animal was affected by the different levels of heat stress, as the result of the shelter micro climate.

Table 1. Climate, Physiological Responds and the Rabbit Performance Fed Different Treated Diet.

Variables	Treatments		SEM
	R1	R2	
Micro Climate			
Air moisture (%)	69.22[a]	70.37[a]	0.61
Air Temperature (^{o}C)	28.85[a]	2.,73[a]	0.27
Temperature Humidity Index (THI)	27.41[a]	27.44[a]	0.29
Sun radiation intensity (Fc)	11.34[a]	10.73[a]	0.57
Physiological Responses			
Heart beat (time/minute)	100.12[a]	101.34[a]	4.21
Rectal temperature (^{o}C)	39.26[a]	39.48[a]	0.09
Skin temperature (^{o}C)	37.94[a]	37.88 [a]	0.22
Respiration rate (time/minute)	59.28[a]	58.36[a]	1.13
Performance			
Diet consumption (g/day)	69.63[a]	63.25[b]	6.75
Drinking water (ml/day)	119.95[a]	110.92[b]	3.98
Final body weight (g)	1897.25[a]	1754.91[b]	70.38
Weight gain (g/day)	21.35[a]	19.50[b]	1.16
Feed conversion ratio	3.26[a]	3.24[a]	0.09

R1 = Diet with metabolic energy for 2500 k cal/kg

R2 = Diet with metabolic energy for 2800 k cal/kg

Values in the same rows bearing similar scripts letter were not statistically significant (P>0.05)

SEM = Standard Error of the Treatment Means

The animals fed diet with metabolic energy for 2500 k cal/kg (R1) consumed for 69.63 g/day higher (P<0.05) than that for 2800 k.cal/day (R2) i.e. 63.25 g/day.

Results of the experiment was supported by Owen and Owen (1981) who found that New Zealand White Rabbit fed diet with energy for 8 MJ DE/kg, 10 MJ DE/kg and 12 MJ DE/kg consumed diet for 8.05 kg, 3,12 kg and 3,40 kg each. The animals fed diet R1 consumed more water (P<0.05) than that the R2. Nuriyasa (2014) said that the Rabbit does not like ate dashy feed, so the higher the feed consumption, the higher the water consumption.

Table 1 showed that final body weight (on the age of 17 weeks) and weight gain of the animal fed diet R1 was higher (P<0.05) than that the R2. This condition was due to that the animals fed R1 consumed more diet than that the R2. On the diet contains the same protein for 16 %, the higher consumption of the diet causes protein consumption was higher too. De Blas and Wisman (1998) stated that the protein was the main component of the Rabbit growth. This statement was supported by the experimental results of Nuriyasa et al. (2013) who found that the animal fed diet contains metabolic energy for 2600 k cal/kg resulted higher weight gain than the 2800 k cal/kg, 2400 k cal/kg and 2200 k cal/kg. The different of treated diet was not caused statistically significant (P>0.05) to the variables of diet consumption. Weight gain was higher on the animals fed diet R1 due to diet consumption was higher, so diet conversion was not different, and this match with opinion of Nuriyasa et al. (2014).

Table 2. Climate, Physiological Responses and Performance of the Rabbit on Different Levels of Populated Shelters.

Variable	Treatments			SEM
	P1	P2	P3	
Micro Climate				
Air moisture (%)	69,24[a]	69,86[a]	70,28[a]	0,74
Air Temperature (^oC)	28,48[a]	28,83[a]	28,71[a]	0,71
Temperature Humidity Index (THI)	27,04[a]	27,53[a]	27,41[a]	0,83
Sun radiation intensity (Fc)	10,77[a]	10,76[a]	11,41[a]	0,36
Physiological Responses				
Heart beat (time/minute)	97,24[b]	99,47[a]	105,58[a]	3,59
Rectal temperature (^oC)	39,21[a]	39,38[a]	39,52[a]	2,31
Skin temperature (^oC)	37,89 [a]	37,87[a]	37,99[a]	1,08
Respiration rate (time/minute)	56,35[b]	59,46[a]	60,65[a]	1,25
Performance				
Diet consumption (g/day)	59,91[b]	69,06[a]	70,34[a]	8,04
Drinking water (ml/day)	106,97[b]	119,11[a]	120,27[a]	8,01
Final body weight (g)	1732,04[b]	1893,83[a]	1851,48[a]	97,22
Weight gain (g/day)	19,39[a]	20,99[a]	20,89[a]	1,12
Feed conversion ratio	3,09[a]	3,29[a]	3,37[a]	0,13

P1 = Level of populated shelter for 3500 cm^2/head
P2 = Level of populated shelter for 1750 cm^2/head
P3 = Level of populated shelter for 1166 cm^2/head
Values in the same rows bearing similar scripts letter were not statistically significant (P>0.05),
SEM = Standard Error of the Treatment Means

Effects of Different Shelter Density

Different shelter density levels were not affected to air moisture, air temperature, temperature humidity index and sun radiation intensity. Animal released heat to it environment in order to homeostatic according to thermo regulator (Mount, 1976). More densely populated animals caused the more heat realized to their environment (Esmay, 1978). Wire walls of Battery Shelter were very effective as ventilations, so the different of metabolic heat realized by the animals were not accumulated, but changed fast with their environmental air (Nuriyasa, 2011). This condition caused different growth, but the amount of animal in one shelter was not affected significant to micro climate in the shelters.

The density shelter levels were not significantly affect ($P>0.05$) to skin and rectal temperature of the animals. These were caused by non different of air shelters temperature on different density levels. Esmay (1978) and Nuriyasa (2012) reported that good shelter ventilation probably air exchange occurs in and outside, so the heat was not accumulated in the shelters. Experimental results of Twaites et al. (1990) reported that Rabbit which was reared on temperature of 34^{o}C caused its rectal temperature was 40.2^{o}C and on temperature of 36^{o}C its rectal temperature was 40,7^{o}C. Heart beat and respiration rate of the animals at the density levels of 3500 cm^2 and 1750 cm^2 were higher ($P<0.05$) than that of the 1166cm^2/head. The higher amount of the animals in the same size of shelter caused the heat amount expenses by the animals was higher (Esmay, 1978). The higher growth rate of the animals on the density levels of 3500 cm^2/head and 1750cm^2/head were also caused body insulation as sub cutan fat and hair were higher than that of the 1166 cm^2/head (Nuriyasa, 2012), so the animals would increased their heart beat.

The animals which was reared on the density levels of 3500 cm^2/head and 1750 cm^2/head consumed higher diet ($P<0.05$) than that of 1166 cm2/head. This was caused by the animals had original habit to live together in group. This affected diet consumption of the animals due to an animal consumed diet would stimulate the others (Obasilar and Obasilar, 2007). Final body weight of the animals on the density levels of 3500 cm^2/head and 1750cm^2/head were higher ($P<0.05$) than that of 1166 cm^2/head, but there was no significantly different ($P>0.05$) on weight gain. The higher diet consumption caused the nutrient amount consumed was higher too; therefore the final body weight was higher. Among the nutrients i.e. carbohydrate, protein, fat, and mineral were component structured of the body; those were similar to opinions of McNitt et al. (1996) and de Blass and Wiseman (1998). There was no significantly different ($P<0.05$) on variable of diet conversion among the shelter density levels. This was due to higher body weight as consequences of higher diet consumed, and not because of the different efficiency in used of diet (Nuriyasa, 2012).

CONCLUSION

The shelter micro climate and physiological responses of the Rabbit were not affected by treated diet in different energy contents and the different of density levels of the animals. The local male Rabbit (*Lepus nigricollis*) which was reared at the density levels of 3500 cm^2/head, 1750 cm^2/head, and 1166 cm^2/head resulted weight gain per day were 19.39 g/day, 20.99 g/day, and 20.89 g/day respectively. The animals fed diet contains the same protein for 16 %, contained metabolic energy for 2500 k cal/kg resulted weight gain for 21.35 g/day, and 2800 k cal/kg was 19.50 g/day.

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REFERENCES

Buijs, S. E., Van Poucke, S., Van Dongen., L. Lens and F.A.M Tuytttens (2012). Cage size and enrichment effects on the bone quality and fluctuating asymmetry of fattening rabbits. *Journal Anim. Sci*, Vol 19, No 10: 3568-3573.

BMKG (2014). Informasi Cuaca, Iklim dan Gempa Bumi Provinsi Bali. Bulletin. Tahun III No. 09 September 2011. Balai Besar Meteorologi Klimatologi dan Geofisika Wilayah III, Denpasar.

De Blass, C. and J. Wiseman (1998). The Nutrition of the Rabbit. CABI Publishinr. University of Nottingham. Nottingham.

Esmay, M.L. (1978). Principles of Animal Environment. Avi Publishing Company, Inc., Westport, Connecticut. p. 17-33.

Handoko, (1995). Klimatologi Dasar, Landasan Pemahaman Fisika Atmosfer dan Unsur-Unsur Iklim. Penerbit Pustaka Jaya, Jakarta.

Kasa, I.W. and C.J. Thwaites (1993). The Effect of Imfra-Red Radiation on Rectal, Skin and Hair-Tip Temperatures of Rabbits. World Rabbit Science (1993), 1 (4), 133-138.

Marai, I.F.M., A.A.M. Habeeb, A.E. Gad (2002). *Rabbits Productive, Reproductive and Physiological Performance Traits as Affected by Heat Stress.* Department of Animal Production, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.

Mc.Nitt, J.I., N.M. Nephi, S.D. Lukefahr and P.R. Cheeke (1996). Rabbit Production. Interstate Publishers, Inc.

Mount, L. E. (1979). Adaptation to Thermal Environment, Man and His Productive Animal. Edward Arnold Publishing, London.

Nuriyasa, I.M. (2012). Iklim Mikro dan Respon Hematologi Kelinci Lokal (Lepus nigricollis) pada Jenis Kandang Berbeda. *Majalah Ilmiah Peternakan* Vol. 15, No 1: 11 – 15.

Nuriyasa, I.M., I.M. Mastika, A.W Puger, E. Puspani, I.W. Wirawan (2013). Performans Kelinci Lokal (*Lepus nigricollis*) yang Diberi Ransum dengan Kandungan Energi Berbeda. *Majalah Ilmiah Peternakan*. Vol 16, No 1 : 12 -17

Nuriyasa, I.M., I.M. Mastika, E. Puspani (2014). Produksi Panas Kelinci Lokal yang Diberi Ransum Kandungan Energi dan Protein yang Berbeda. Prosiding Snastek 2014. Peranan Sain dan Teknologi yang Berwawasan Lingkungan dalam Meningkatkan Kesejahtraan Umat Manusia. Denpasar, 18 -19 September 2014. Lembaga Penelitian dan Pengabdian kepada Masyarakat, Universitas Udayana, Hal: 140 – 146.

Onbasilar, E. E and I. Onbasilar (2007). Effect of cage density and sex food utilization and some stress parameter of young rabbit. *J. Lab. Anim. Sci*. 2007. Vol 34 No 3.

Owen, E. and J.E. Owen (1981). The Effect of Metabolizable Energy Concentration on Performance and Digestibility in Growing Rabbits. *Trop. Anim. Prod*. 6 (2) : 93 – 100.

Purnomoadi, A. (2003). Petunjuk Praktikum Ilmu Ternak Potong dan Kerja. Fakultas Peternakan, Universitas Diponogoro. http:// eprints.undip.ac.id./21200/1/1061-ki-fp-05 pdf.

Schiere, J.B. (1999). Backyard Farming in the Tropics. CTA Published.

Steel, R.G.D. and J.H. Torrie (1980). Prinsip dan Prosedur Statistika. Suatu Pendekatan Biometrik, Edisi kedua. Diterjemahkan Oleh Sumantri. Gramedia. Jakarta.

USDA (2009). *Rabbit Protein*. http://www.mybunnyfarm.com/rabbitprotein/. Disitir Tanggal 24 Juli 2010.

Yan, Y. and Li, M. (2008). Feeding Management and Technology of Breeding Rabbit in Hot Climate. Qingdao Kanada Food Company Limited Kanada Group, Qingdao, 266400, China.Yanyk@vip.sina.com.

Zucca, D., S.P. Marelli, Veronica Redalli, Eugenio Heinzi, Heidi Cardile, Cristian Ricci, Marina Verga and Fabio Lazi (2012). Effect of Environmental enrichment and group size on behavior and live weight in growing rabbits. *World Rabbit Science Journal,* Vol. 20 No 2 (2012).

Corresponding author: Dr. I Made Nuriyasa, Department of Animal Nutrition, Faculty of Animal Science, Udayana University
Email: madenuriyasa@yahoo.com