Proceedings 5th World Rabbit Congress, 25-30 July 1992, Corvallis – USA, 1583-1589.

EFFECTS OF VARIOUS FIBER LEVELS ON THE PERFORMANCE, CARCASS PERCENTAGE AND SKIN QUALITY OF THE REX RABBITS

Tike Sartika[1] and Yono C. Raharjo[1]

[1]Research Institute fo Animal Production
PO Box 123 - Bogor, Indonesia

SUMMARY

Rabbits are well known to suit the backyard farming system. They are able to tolerate high fiber diet, although may not be fully utilising it. Indeed, in the villages, green feeds with high content of fiber contribute the largest portion of the total feed offered. An experiment was carried out to study the effects of various dietary fiber levels on the performance, percentage of carcass and on the quality of skin of the Rex rabbits, a breed of rabbits that is raised particularly for fur production. Sixtyfour weanling Rex rabbits were allocated randomly into 4 dietary fiber treatments, each consisted of 4 replicates of 4 rabbits/cage. At 3.5 months old, rabbits were caged individually. Dietary fiber levels (based on Acid Detergent Fiber) were 17 [T1], 20 [T2], 23 [T3] and 26 [T4] %. Diets were isocaloric and isonitrogenous. Parameters measured were feed consumption [FC], bodyweight gain [BWG], percentage of carcass [PCs], pelt area and skin quality, such as tensile strength, shearing strength, stretching strength and sewing strength.

Results indicated that FC, BWG and feed conversion in the first stage of growth (<3.5 months old) and FC at the second stage of growth were influenced by dietary fiber levels. The increase of fiber levels decreased BWG, feed efficiency, slaughter weight, pelt area, nutrient digestibility (except for nitrogen) and skin quality (except stretching strength). Dietary fiber level at 20 % ADF appeared to give higher BWG (22 g/rabbit/d) and slaughter weight (2607 g), better feed conversion (4.27), larger pelt area (990 cm^2) and better physical skin quality. Skin stretching strength, however, was highest in rabbits fed 26 % ADF (79.3 %).

INTRODUCTION

Rabbits have a numbers of attributes that would make them suitable as meat-producing small livestock in tropical countries. As herbivorous animals, rabbits are able to consume high fiber diets based mainly on roughages (Cheeke, 1986; Raharjo et al., 1990a). While its utilisation is poor, fiber is essential for the normal growth of rabbits (Cheeke, 1983; Fekete and Gippert, 1985; Cheeke et al., 1986). High level of dietary fiber depressed nutrient digestibility (deBlas et al., 1986; Mathius, 1988) and at level above 20 % (acid detergent fiber) growth depression was observed, yet very low mortality, if any, occurred (Spreadbury and Davidson 1978; Gultom et al., 1988; Raharjo et al., 1990b).

In particular, the information of the role of fiber on the Rex rabbit, a breed of rabbit raised particularly for good quality and expensive fur (Raharjo, 1988), is limited. Low fiber diet caused hair pulling (Portsmouth, 1977; Cheeke et al., 1987) and could increase fat content of skin causing some problrms in tanning process. On the other hand, high fiber diet could produce lighter slaughter weight, hence less pelt area, and may also produce lower quality skins and/or fur due to inadequate nutrient absorbed.

MATERIALS AND METHODS

Management of animals and dietary treatments

Sixty four weanling rabbits of 5-6 months old [860 ± 150 g] was distributed randomly into 4 dietary treatments. Animals were raised in a 'quonset-style wire cages' (Harris, 1983), 4 rabbits/ cage, up to 3.5 months old. Thereafter, rabbits were raised in the individual cages until reaching the slaughter age (5-6 months old). Dietary treatments differed in their acid detergent fiber level [ADF], i.e. 17, 20, 23 and 26 % in diet 1 [T1], diet 2 [T2], diet 3 [T3] and diet 4 [T4] correspondingly. Diets were isocaloric and isonitrogenous; their composition is shown in Table 1. Diets and water were provided ad libitum. Prior to slaughter, animalas were fasted overnight. Pelts were dried and tanned according to a chrom-tanning method (BBKKP, 1983).

Measurements

Measurements were made on feed consumption [FC], bodyweight gain [BWG], feed conversion [FCR], slaughter weight [SW], percentage of carcass [PCs], nutrient digestibility and quality of tanned skins in terms of tensile strength, shearing strength, stretching strength and sewing strength.

Statistical analysis

Results were analysed by a one-way analyses of variance. Differences between means were tested using a Least Significant Difference method (Steel and Torrie, 1980).

Table 1. Chemical composition of dietary treatments [dry matter basis].

Nutrient	T1	T2	T3	T4
ADF [%]	17	20	23	26
[Dry matter, %	87.1	87.4	87.8	89.2]
Crude Protein, %	20.0	19.4	20.0	20.6
ADF, %	17.6	20.3	22.0	25.1
Gross Energy Kcal/kg	4513	4707	4852	4876

RESULTS AND DISCUSSION

Growth response

Rabbit performance at first [in a group] and second [individual] stage of raising in response to the dietary treatments are presented in Table 2. During the first stage of trial (5 weeks - 14 weeks old), FC, BWG and FCR of rabbits fed diets containing 17 to 23 % ADF were not different statistically (P>0.05). However,

Table 2. Performance of rabbits in the first and second stage of growth in response to various dietary fiber levels.

response measured [ADF, %]	T1 17	T2 20	T3 23	T4 26
First stage :				
Feed consumption [g/rabbit/d]	98^{ab}	94^{a}	96^{ab}	100^{b}
Bodyweight gain [g/rabbit/d]	20^{b}	22^{b}	19^{b}	13^{a}
Feed conversion ratio	4.90^{a}	4.27^{a}	5.06^{a}	7.98^{b}
Second stage :				
Feed consumption [g/rabbit/d]	119^{a}	142^{bc}	132^{b}	148^{c}
Bodyweight gain [g/rabbit/d]	12	14	13	13
Feed conversion ratio	9.97	9.85	10.29	10.59
Slaughter weight [g]	2477^{ab}	2607^{b}	2575^{b}	2368^{a}
Percentage carcass	50.5	51.2	51.1	49.5
Pelt area [cm^2]	979^{b}	990^{b}	918^{b}	828^{a}

^{a,b,c} within the same line differed significantly (P<0.05).

significant depression on BWG and feed efficiency occurred, although feed consumption was increased significantly, when dietary ADF level was increased to 26 %. Unlike in the first stage, in the second stage of growth, marked increase (P<0.05) of FC [with the increasing levels of dietary fiber] produced a non significance results in BWG and FCR. These results were obviously related to the nutrient digestibility values obtained in this experiment (Table 3). Increasing level of dietary fiber decreased the digestibility of dry matter and gross energy markedly. Consequently, a slight increase [although significant] of FC in T4, in the first stage of growth, did not provide the same amount of digested nutrients as did the T1. On the other hand, in the second stage of growth, the increase of FC in T4 was high and might provide similar amount of digested nutrients with the T1, hence the BWG did not differ significantly. Increased feed intake associated with the increase of fiber diets has been attributed with the maintenance of energy homeostasis (Lebas and Laplace, 1977; de Blas et al., 1986). Beneficial effects of the inclusion of moderate levels of fiber (10 - 20 % ADF) and negative effects occurred with

low or high level of dietary fiber (> 20% ADF) on the performance of rabbits have been reviewed (e.g. Cheeke, 1983; Fekete and Gippert, 1985; Cheeke et al., 1986). Important to note that best performance obtained from this experiment came from rabbits fed diet containing 20 % ADF (T2). These results supported those reported by Gultom et al (1988) and Raharjo et al (1990b). A level of 20 % ADF was similar to 11.6 % CF (Pagano et al., 1986), a level recommended by NRC (1977).

Bodyweight gain and feed efficiency were obviously lower at the second stage of growth and this was because of the animals were reaching the mature stage, in which the growth rate is already slower. Slaughter weight and pelt area , but not carcass percentage, were also affected by the dietary fiber levels. Response patterns were similar to that of BWG.

Nutrient digestibility

Increasing levels of dietary fiber significantly decreased the nutrient digestibility (Table 3). Patterns of these results have been reported elsewhere (e.g. Champe and Maurice, 1983; Mathius, 1988). High fiber diet increases rate of passage, hence reduces transit time of ingesta in the intestine and consequently reduces the digestibility. In addition, high fiber diet errodes mucosal wall of the intestine (Sheard and Schneeman, 1980), indicated by the increase amount of endogenous excretion (Raharjo and Farrell, 1984). The effect of high fiber on the crude protein (CP) digestibility, however was not significant. In different trial, Raharjo et al (1990b) showed a small relationship between fiber levels with the CP digestibility. Fekete and Gippert (1985) also reported similar results, in which the levels of fiber combined with various levels of CP in the diet did not affect the CP digestibility in rabbits. These results showed the role of cecum and practice of coprophagy (cecotropy) that is capable to utilise dietary protein efficiently (Robinson et al., 1985; Mathius, 1988). Nevertheless, when high tannin-containing ingredient (e.g. black locust leaves) was included at high level in the diet, cecum fermentation and cecotropy did not seem to alleviate the negative effect of tannins on the CP digestibility (Raharjo et al., 1990c).

Table 3. Nutrient digestibility of diets with various levels of ADF [%].

Nutrient	T1	T2	T3	T4	SEM
Dry matter	64.5^{d}	59.8^{c}	53.2^{b}	48.3^{a}	1.46
Crude protein	75.9	76.7	77.0	78.6	1.26
ADF	16.0^{b}	10.5^{b}	7.8^{ab}	0.4^{a}	2.88
Gross energy	65.3^{c}	60.8^{b}	59.1^{b}	52.0^{a}	1.49

^{a,b,c,d} within the same line differed significantly ($P<0.05$).

Skin quality

Chrom-tanned skins were evaluated for their tensile, shearing, stretching and sewing strength. Results were shown in Table 4. Regardless the dietary fiber levels, all results met the requirements of goat skin quality for garment according to the Indonesian Standard of Industry (SII no. 0061-74)(Dept. Industry, 1974). However, not all of them met the quality of chrom-tanned goat fur , particularly in their tensile strength, which should be over 200 kg/cm^2 (SII no. 0763-83).

Table 4. Physical quality of skins of Rex rabbits fed different levels of dietary ADF.

Response measured	T1	T2	T3	T4	SII 0061-74	SII 0763-83
Tensile strength [kg/cm^2]	157^{ab}	195^{b}	197^{b}	124^{a}	100	200
Stretching strength [%]	69^{ab}	71^{ab}	65^{a}	79^{b}	50	-
Shearing strength [kg/cm]	19^{a}	26^{b}	19^{a}	20^{a}	17.5	17.5
Sewing strength [kg/cm]	99^{ab}	143^{c}	119^{bc}	83^{a}	20	20

High (26 %) level of ADF gave lower values of tensile strength and sewing strength than other 2 dietary treatments (T2 and T3). This could be related with the quality of diet. Diet 4 (26 % ADF) had remarkably low DM (48 %) and GE (52 %) digestibility, and consequently less nutrients could be used for the formation of skin components, such as collagen, elastin , etc. Judoamidjojo (1981) reported that low quality diet produced thin skin, less substances that composed skin components, less colagen content and therefore the physical quality of skin is low. Between treatments, T2 (20 % dietary ADF) gave the best results of all responses measured. Chrom-tanning, to some respects, is consider- ed best for fur tanning compared with other fur-tanning technique (Raharjo et al., 1990d). It gives a stable cross-linking complex

of collagen and other skin substances with tanning compounds (Sharphouse, 1975).

REFERENCES

BBKKP. 1983. Tanning process of the rabbit fur. A Guideline. The Institute for Research and Development of Leather and Allied Industries. IRDLAI. Yogyakarta. Indonesia. 5 pp.

Champe, K.A. and D.V. Maurice. 1983. Response of early weaned rabbits to source and level of dietary fiber. Journal of Animal Science 56 : 1105-1114.

Cheeke, P.R. 1983. The significance of fiber in rabbit nutrition. Journal of Applied Rabbit Research 6 : 103-106.

Cheeke, P.R. 1986. Potentials of rabbit production in tropical and sub-tropical agricultural systems. Journal of Animal Science 63 : 1581-1586.

Cheeke, P.R., M.A. Grobner and N.M. Patton. 1986. Fiber digestion and utilisation. Journal of Applied Rabbit Research 9 : 25-30.

Cheeke, P.R., N.M. Patton, S.D. Lukefahr and N.M. Patton. 1987. Rabbit Production. Sixth edition. Interstate Printers and Publishers. Danville, Illinois.

deBlas, J.C., G. Santoma, R. Carabano and M.J. Fraga. 1986. Fiber and starch levels in fattening rabbit diets. Journal of Animal Science 63 : 1897-1904.

Depperin. 1974. Requirements for the quality of leathercoat made from goat or sheepskin. SII 0061-74. Indonesian Industry Standard. Dept. Industry.

Depperin. 1983. Chrom tanning of goatfur. A guideline. SII. 0763-83. Indonesian Industry Standard. Dept. Industry.

Fekete, S. and T. Gippert. 1985. Effect of crude fiber on protein utilisation by rabbits. Journal of Applied Rabbit Research 8 : 31-38.

Gultom, D., Khalil and D. Aritonang. 1988. The effect of high level of acid detergent fiber on the performances of weaning rabbits. Proceeding Seminar Nasional Peternakan dan Forum Peternak Unggas dan Aneka Ternak II. Balai Penelitian Ternak. pp. 368-375.

Harris, D.J. 1983. Construction of quonset-style rabbit cages. Journal of Applied Rabbit Research 6 : 142-147.

Judoamidjojo, R.M. 1981. Basic Leather Technology and Chemistry. Dept. Industrial Technology, Fac. Agric. Technology, IPB, Bogor, Indonesia.

Lebas, F. and J.P. Laplace. 1977. Digestive transit in the rabbit : Influence of source of fiber. Annales de Zootechnia 18 : 197 - 208.

Mathius, I.W. 1988. Effect of dietary fiber on urea utilisation by weanling rabbits. Proceedings Seminar Nasional Peternakan dan Forum Peternak Unggas dan Aneka Ternak II. Balai Penelitian Ternak. pp. 387-397.

NRC. 1977. Nutrient Requirement of Rabbits. Second revised edition. National Academy of Sciences, National Research Council, Washington D.C.

Portsmouth, J. 1977. The nutrition of rabbits. In W. Haresign, H. Swan and D. Lewis (Ed.) : Nutrition and the Climatic Environment. Butterworth, London. pp. 93-111.

Raharjo, Y.C. 1988. Rex, an alternative breed for rabbit raising. Seminar Ekspor Ternak Potong. Direktorat Jendral Peternakan, Jakarta.

Raharjo, Y.C. and D.J. Farrell. 1984. A new biological method for determining amino acids digestibility in poultry feedstuffs using a simple cannula, and the influence of dietary fiber on endogenous amino acid output. Animal Feed Science and Technology 12 : 29-45.

Raharjo, Y.C., P.R. Cheeke and N.M. Patton. 1990a. Evaluation of tropical forages and by-peroduct feeds for rabbit production. 3. Growth performance of rabbits fed different forages and agricultural by-products. Ilmu dan Peternakan 4 : 197-202.

Raharjo, Y.C., P.R. Cheeke and N.M. Patton. 1990b. Evaluation of rice hulls as a fiber source for weanling rabbits. Journal of Applied Rabbit Research 13 : 10-13.

Raharjo, Y.C., P.R. Cheeke and N.M. Patton. 1990c. Effect of cecotropy on the nutrient digestibility of alfalfa and black locust leaves. Journal of Applied Rabbit Research 13 : 56-61.

Raharjo, Y.C., A. Budiman, K. Suradi, T. Sartika dan B. Oetoyo. 1990d. Effects of different tanning agents in a fur tanning on the quality of Rex rabbit fur. Proc. Sem. Assoc. Leather Chem. Technol. of Indonesia. IRDLAI, Yogyakarta, Indonesia. pp.146 - 151.

Robinson, K.L., P.R. Cheeke and N.M. Patton 1985. Effect of prevention of coprophagy on the digestibility of high forage and high concentrate diets by rabbits. Journal of Applied Rabbit Research 8 : 57-59.

Sharphouse, J.H. 1975. Leather Technician Handbook. Leather Producers Association. Ninth edition. Thomas Street, London.

Sheard, N.F. and B.O. Schneeman. 1980. Wheat bran's effect on digestive enzyme activity and bile acid level in rats. Journal of Food Science 45 : 645-648.

Spreadbury, D. and J. Davidson. 1978. A study on the need for fiber by the growing New Zealand White rabbits. Journal of Food Science and Agriculture 29 : 640-648.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. A Biometrical Approach. Second edition. Mc Graw Hill Book Co., New York.