THE USE OF MIRRA COAT OIL OR FISH OIL FOR THE REX RABBITS RAISED AT DIFFERENT ENVIRONMENTS

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Abstract - One major aim of the Rex rabbit farming is to produce prime quality fur, which is affected partly by dietary energy and unsaturated fatty acids as well as by environmental condition. An experiment applying 0,5 % *Mirra coat oil (MCO)*, a trade brand for improving lusters of pet animals, and 3,5 % *Fish Oil (FO)* in the diet was carried out on the Rex rabbits raised at cyclic (12 - 22 ^{o}C) and controlled (20 - 23 ^{o}C) environmental temperature (ET). Two blocks in a complete randomized block designed was applied, in which block 6 replicates of three 18-week old Rex rabbits were used for every dietary treatment. Dietary trial was run for six weeks until the animals reached the slaughter age. Measurements were made on growth performance including weight of internal organs, skin production, prime rate of fur, visual quality of fur and income over feed cost (IOFC). Results indicated that in general controlled environment produced significantly better results of the parameter measured. Supplementation of MCO and FO improved rabbit performance particularly on those raised at cyclic ET. In most parameters measured, especially of that fur quality [visual quality and prime rate] and IOFC, Fish oil produced significantly better results. Somewhat surprising that fur prime rate were over 93 % of the rabbits raised at controlled ET.

INTRODUCTION

Small scale rabbit raising, as occurs in many countries, is usually adopting simple management (LEBAS, 1983). Similar situation occurs to rabbit raising in Indonesia (SITORUS *et al.*, 1982). Program to increase rabbit production for rural family meat consumption was successful, but did not work for obtaining cash income purpose (SASTRODIHARDJO *et al.*, 1988). In an attempt to improve smallholding farmers' welfare, Rex rabbit farming, that produces high value skins as well as meatis offered.

Raising Rex rabbit is aim at producing prime quality fur. Various factors including environmental temperature (RAHARJO and SARTIKA, 1992) and dietary nutrients, such as biotin, zinc (OLDFIELD, 1991) and feed additive did affect fur quality. Lower temperature/colder condition usually gave better performance and denser and more shiny fur, except that when severe cold stress occurrs, the performance was reduced (RAHARJO *et al.*, 1995). Fatty acids, particularly those of unsaturated, essential and omega three types, that are contained in oil could also affect performance as well as luster/shineness of the animal fur (Oldfield, 1989). OLDFIELD (1985), however, reported that high content of unsaturated fatty acids oil were easier to get oxidized, producing free radicals that caused negative effects on growth and fur colour.

MirraCoat Oil (MCO) a product from Pet Ag, Inc. was reported to improve luster and density of dark colour mink fur (KAGOTA, unpublished). Beside containing a substantial amount of Linoleic and linolenic acid (as glycerides), MCO also fortified with Zinc and Biotin, both nutrients improved the fur quality. CHEEKE (pers. comm.) also stated that many of essential fatty acids help lustering the fur of animals

This experiment was carried out to study the use of Mirra- Coat (MCO) and Fish Oil (FO) in the rabbit diet on the quality of fur and performance of Rex rabbit raised at 2 environmentally different locations.

MATERIALS AND METHODS

Two locations differed in environmental temperature (T^{o}) and Relative humidity (Rh), i.e. Balitnak Ciawi (BC) and 'Sedep' Tea Plantation (TPS) were used. In BC, environmmental were controlled using air condition and fan; while at TPS was an open air area. Range of T^{o} and Rh of the locations are presented in Table 1.

Dietary treatments were the addition of MCO at 0.5 % or 3.5 % FO into the basal diet, replacing 0.5 % or 3.0 % vegetable oil respectively. Composition of the diets are shown in Table 2.

Table 1 : Temperature and humidity in the experimental locations

Lokation	Temperature,°C		Humidity, %
	minimum	maximum	
Balinak, Ciawi	20.3 ± 1.9	21.3 ± 1.5	74.0 ± 5.5
(BC)	(19 - 22)	(20 - 23)	(68 - 80)
Tea plantstion, Sedep	13.9 ± 0.7	19.9 ± 1.3	80.6 ± 10.4
(TPC)	(12 - 15)	(16 - 22)	(58 - 100)

Table 2 : Dietary ingredients used in the experiment (%)

Ingredient	Basal	MCO diet	FO diet
Soybean meal	13.5	13.5	13.5
Fish meal	2.0	2.0	2.0
Ground elephant grass	6.0	6.0	6.0
Lactating cattle diet	70.0	70.0	69.5
Molasses	3.0	3.0	3.0
Vegetable oil	3.0	3.0	---
Mirra coat oil [MCO]	---	0.5	---
Fish oil [FO]	---	---	3.5
Bone meal	1.0	1.0	1.0
Lime	0.5	0.5	0.5
Premix A	0.25	0.25	0.25
Lysine	0.1	0.1	0.1
Methionine	0.1	0.1	0.1
Salt	0.3	0.3	0.3
Chemical composition, calculated :			
Crude protein	17.8	17.8	17.8
Digestible energy, kcal/kg	2630	2630	2630
ADF	>9.2	9.2	9.2

A 2 x 2 factorial in complete randomized block design was applied this study. Each location consisted of 2 blocks, in which block six replicates of three 18-week old Rex rabbits were used for every dietary treatment. Diets were fed for 6 weeks until the animals reached slaughter age. Measurements were made on growth performance, skin production, prime rate of fur, visual quality of fur and economic analyses was also performed in term of income over feed cost ratio (IOFC). Results were subjected to analyses of variance and differences between means were tested using LSD [STEEL and TORRIE, 1980].
Measurement of fur quality was carried out through comparing 'standard' tanned fur from USA, by 10 people similar to that of preference test [sensory (visual) evaluation]. Such comparisons were scored, with the maximum of 5 (best) to 1 (worst).

RESULTS AND DISCUSSION

Results of the study on the performance of animals are shown in Table 3. Statistical analyses data indicated no significant interaction occured between location (i.e. environment) with the dietary treatments for all parameters measured. Significant differences between treatments were detected only on slaughter weight and prime rate. In general, however, the use of MCO and FO slightly but not significantly improve the performance of rabbits. Improvement was more profound and consistent, in both locations, in rabbits fed FO containing diet. Reasons for this is not very clear since more detail analyses on types of fatty acids were not performed. REINHART (1995) however reported that metabolism of n-6 fatty acids (such as linoleic acid, which is contained 12.5 % in MCO) produces proinflammatory and proaggregatory eicosanoids, which could be immunosuppresive. On the other hand, metabolism of n-3 fatty acids (e.g. alpha linolenic, contained only 1.3 % in MCO) produces eicosanoids that are less inflammatory and less aggregatory. In addition, there is possibility that the level of MCO used were not sufficient to improve growth. KAGOTA (unpublished) recommended a level of 5 % in the diet containing 10 % moisture. Nonetheless, higher level of MCO greatly increases feed cost.

Between locations, BC was found to produced better results. It was clear that at BC the environment was more controllable. Fluctuation of temperature and humidity was relatively less than that of at TPS, hence the animals were more comfortable. In contrast, at the time of study, TPS underwent frequent heavy rains, which to some extent could cause stress to the animals. Surprisingly, however, in such cold and humid environment there was no indicative of prolonged pneumonia. Most rabbits at TPS suffered severe sorehock and most of mortalities were caused by enteritis, indicated by very dirty wet feces around the vent fur.
It is worth noting that the prime rate produced from rabbits raised at BC, regardless of the diet fed, was extremely high (93 - 98 %). Taylor and JOHNSTON (1984) and RAHARJO *et al.* (1995) in raising of rabbits in

open air environment reported prime rate values were only about 75 %. This experimental results indicated that less fluctuating T° and Rh could produce better fur quality.
These results were in fact supported by the data in Table 4.

Table 3 : Growth performance of Rex rabbit fed diet containing MCO or FO raised at BC and TPS.

Measurement	Location	Basal	MCO diet	FO diet	Mean
a. Feed consumption	BC	115	112	106	111 ± 6.4
(g/rabbit/d)	TPS	100	104	101	102 ± 7.7
Mean		108±5.4	108±4.8	104±11.0	
b. Bodyweight gain	BC	5.9	7.3	6.7	6.6 ± 2.4
(g/rabbit/d)	TPS	3.4	4.3	5.5	4.4 ± 2.0
Mean		4.7±1.1	5.8±1.3	6.1±1.5	
c. Slaughter weight	BC	2449	2425	2538	2471 ± 137^{a}
(g/rabbit/d)	TPS	1805	2306	2346	2152 ± 216^{b}
Mean		2127 ± 122^{a}	2366 ± 189^{ab}	2442 ± 219^{b}	
d. Mortality (%)	BC	5.5	11.1	5.5	7.4
	TPS	16.7	11.1	11.1	13.0
Mean		11.1	11.1	8.3	
e. Carcass percentage	BC	52.3	53.5	52.4	52.7 ± 2.3
(%)	TPS	46.2	50.0	47.9	48.0 ± 3.7
Mean		49.2±1.9	51.7±4.9	50.1±2.3	
f. Pelt percentage (%)	BC	10.4	9.8	10.9	10.4 ± 1.0
	TPS	9.4	10.6	9.0	9.7 ± 1.7
Mean		9.9±1.1	10.2±1.2	10.0±1.1	
g. Pelt area (cm^2)	BC	879	788	1023	897 ± 146
	TPS	998	899	1014	970 ± 152
Mean		939±112	844±229	1019±108	
h. Prime rate (%)	BC	93.5	93.6	98.0	95.0 ± 2.4^{a}
Mean	TPS	52.0	62.2	69.8	61.3 ± 1.8^{b}
		72.8±9.7	77.9±9.6	83.9±7.0	

^{a,b} within the same row or column differs significantly [P<0.05]

Table 4 : Quality of fur of Rex rabbit fed diet containing MCO or FO raised at BC and TPS, measured visually

Measurement	Location	Basal	MCO diet	FO diet	Mean
a. Overalll appearance	BC	3.42	3.32	3.54	3.43 ± 0.55^{a}
	TPS	2.24	2.21	3.21	$2.55\pm0,12^{b}$
Mean		2.83 ± 0.35^{a}	2.77 ± 0.26^{a}	3.38 ± 0.40^{b}	
b. Luster/shine	BC	3.14	3.14	3.39	3.22 ± 0.55^{a}
	TPS	2.23	2.15	3.00	2.46 ± 0.11^{b}
Mean		2.69 ± 0.22^{a}	2.66 ± 0.29^{a}	3.20 ± 0.43^{b}	
c. Density	BC	3.16	3.05	4.04	3.42±0.34
	TPS	2.92	2.52	2.96	2.80±0.43
Mean		3.04 ± 0.17^{a}	2.79 ± 0.18^{a}	3.50 ± 0.17^{b}	
d. Hair tightness	BC	3.56	3.41	3.64	3.54±0.40
	TPS	3.11	2.94	3.29	3.11±0.53
Mean		3.34±0.17	3.18±0.17	3.47±0.34	
e. Texture/softness	BC	3.40	3.50	3.64	3.51 ± 0.47^{a}
	TPS	2.08	2.85	3.50	2.81 ± 0.13^{b}
Mean		2.74 ± 0.14^{a}	3.18 ± 0.25^{ab}	3.51 ± 0.51^{b}	
f. Average total score	BC	3.34	3.28	3.60	3.41 ± 0.25^{a}
	TPS	2.52	2.53	3.19	2.75 ± 0.31^{b}
Mean		2.93 ± 0.15^{a}	2.91 ± 0.17^{a}	3.40 ± 0.19^{b}	

^{a,b} within the same row or column differs significantly [P<0.05]

Consistently and significantly higher values in all parameters measured were obtained from the rabbits fed FO containing diet and/or from the rabbits raised at BC. These data confirming the superiority of using Fish Oil and raising animals at a more controlable environment. The use of MCO, however, improved the fur quality compared with those of basal. Again there might be inadequate level of MCO included in the diet to produce significant effect on the fur quality, as KAGOTA reported a 75 - 228 % improvement of luster on the dark coat mink, both at pre- and post-shedding period.
Results of the economic analyses, as measured by income over feed cost ratio (IOFC), are presented in Table 5.

Table 5 : Income over feed cost ratio of Rex rabbit fed diet containing MCO or FO raised at BC and TPS

Measurement	Location	Basal	MCO diet	FO diet	Mean
a. Feed cost,	BC	5630	6612	5380	5874±651
(Rp./rabbit)	TPS	4895	6139	5127	5367±661
Mean		5262±520[a]	6376±334[b]	5254±178[a]	
b. Income over	BC	2.04	1.75	2.54	2.11±0.40[a]
feed cost ratio	TPS	1.41	1.31	2.13	1.62±0.44[b]
Mean		1.73±0.44[a]	1.53±0.31[a]	2.34±0.29[b]	

[a,b] within the same row or column differs significantly ($P<0.05$)

These results showed that the use of MCO increased the feed cost almost 18 %, whereas the growth performance and fur quality were similar. Consequently, IOFC of raising rabbits fed diet supplemented with MCO was less than that of without MCO. In contrast, similar feed cost of FO diet to the basal, yet producing higher quality products (heavier weight + better fur quality) made the IOFC from rabbits fed FO diet was much higher. At the time of the experiment conducted, the price of MCO was almost 18 times of that vegetable oil or fish oil.

CONCLUSION AND SUGGESTION

This study clearly indicated that Fish Oil supporting good growth and better fur quality of the Rex rabbits. Controlled environment also produced better products. Mirra-Coat Oil (0.5 % in the diet) and/or cyclic temperature/humidity proven to cause poorer results. It is suggested to pursue the components of fish oil responsible for such better growth and fur quality as well as to test a higher level of MCO in the diet regardless of the economic analysis.

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