รายงานผลการวิจัย

เรื่อง

ผลการใช้มันสำปะหลังร่วมกับแหล่งโปรตีน ในการขุนกระต่าย

(Effects of cassava root meal and protein supplement on growing rabbits)

โดย

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EFFECTS OF CASSAVA ROOT MEAL AND PROTEIN SUPPLEMENT ON GROWING RABBITS

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Abstracts

Fourty-eight male and female crossbred rabbits (NZW x Thai Native) with average initial weight at 1,000 grams were used in the experiment. Rabbits were divided equally in sex and number to 8 groups. Each group received the diets base on two different sources of protein (fish meal-FM and rubber seed meal-RSM) and four levels of cassava root meal (CRM), residual from pelleting process, 0, 50, 75 and 100 % to substitute broken rice. Growth performances, and the concentrations of thiocyanate and thyroxin in the serum were measured.

Growth characteristics and the concentration of thyroxin in serum were not affected by the levels of CRM. Increasing the quantity of CRM significantly coincided with an increase in the level of thiocyanate in the serum ($P<.01$). FM showed lower feed intake, and better feed conversion ratio than RSM. Level of thiocyanate in rabbits serum was obtained from RSM higher than FM ($P<.01$) and caused the reduction in serum thyroxin levels ($P<.05$). Used of FM-CRM rations showed a tendency to give better production performances than RSM-CRM. CRM at the levels of 50 % to substitue broken rice (20 % in the ration) gave the best results in both protein sources.

Introduction

Thailand is the world's biggest producer of cassava root meal (Manihot spp.). The expected increase in world cassava exports in 1989 would mainly reflect larger sales by Thailand. These are anticipated to be the order of 10 million tonnes compared with 8.7 million tonnes in 1988 (Asian Livestock, 1990). The product is used less than 10 % within the country because of its low protein content and the cost per unit of protein is more expensive than the other conventional cereals such as corn and broken rice. Hydrocyanic acid (HCN) content in cassava is another limitation to use cassava root meal. Growth rate and feed efficiency have been shown to decrease while urinary excretion of thiocyanate is increased when the animal consumed high level of HCN. Thiocyanate, the cyanide detoxification product is a goitrogenic substance and affect the iodine uptake of thyroid gland (Ermans et al, 1973). Moreover, the high proportion of cassava root meal in the diets will cause unpalatability and less consumed by the animals due to its powdery and bulky characteristics (Khajarern et al,1979). However, the cassava root meal will become the important source of energy for livestock in the country when the conventional cereals are used for human consumption.

Few data are available on works of cassava root meal in rabbits, although many studies have been done in the effects of different rations of cassava peel meal and boiled cassava in diet on toxicity (Omole and Onwudike, 1983) and growth performances (Omole and Sonaiya, 1981 ; Prawirodigo et al, 1985). However, the cassava root meal in rabbit rations should not be used higher than 15 percents (Cheeke,1987).

The present experiment was designed to search for the optimal levels of cassava root meal to substitute the broken rice with two difference sources of protein (fish meal and rubber seed meal) and also the effects of cassava root meal on growth performance, level of thiocyanate and thyroxin in serum of growing rabbits.

Materials and Methods

Fourty-eight male and female six-week old crossbred of Newzealand White and Thai Native rabbits with average initial weight at 1,000 grams were randomly allotted to the individual wire cages with feeder and automatic water supplier. Rabbits were divided equally in sex and number to 8 groups. Each group received one of the following diets base on two different sources of protein and four levels of cassava root meal 0, 50, 75 and 100 percent to substitute broken rice (Table 1). Cassava root meal used in this experiment as the residual from pelleting process and the chemical analysis showed in Table 2. Fish meal and rubber seed meal were calculated to provide the same level of protein in the diets. All rations were adjusted to have the same level of protein and energy. Rabbits were received para grass adlibitum.

Weight gain and feed intake (concentrate) were recorded weekly and blood samples were collected biweekly from ear blood vessel. Thiocyanate and thyroxin concentrations in the serum were measured by Standardisation methods (Basu et al,1986) and Solid-phase ^{125} I radioimmunoassay, respectively. All data were analysed using Analysis of variance and Duncan's new multiple range Test (Steel and Torrie, 1980).

Results and Discussion

Effects of cassava root meal level on growth performances and concentrations of thiocyanate and thyroxin in the serum :

Growth characteristics, thiocyanate and thyroxin level in serum are showed in Table 3. There were no significant different in using cassava root meal (CRM) to substitute broken rice at all levels on growth characteristics which was similar to the report of Radwan and co-worker (1989). They found that substituted CRM to barley at the level of 0, 17, 34 and 50 % in growing rabbit showed no significant differences in growth rate and dry matter food conversion ratio. CRM at the level of 17 % trended to gave better result which was nearly the same in this experiment (20 %).

Increasing the quantity of CRM significantly coincided with an increase in the level of thiocyanate in the serum ($P<.01$). It has been known that thiocyanate will affect the iodine uptake of thyroid gland (Ermans et al., 1973) and reduce the thyroxin level in serum. However, the present experiment showed that the levels of serum thyroxin were not altered which may indicate that rabbits have a capability to detoxify HCN in the rations as same as other domestic animals (Khajarern et al., 1978). Another posibility is that the HCN content in CRM may be low, because the CRM used in the experiment was sun dried and passed through the pelleting process. Therefore, much of the HCN was probably eliminated during the process (Maner, 1973 and Khajarern et al, 1979).

Effects of protein sources on growth performances and concentration of thiocyanate and thyroxin in the serum :

The effects of protein sources on growth performance and levels of thiocyanate and thyroxin in serum were shown in Table 4.

There were no significant differences in daily weight gain while feed intake and feed conversion ratio of rabbits fed with fish meal (FM) were better than rubber seed meal (RSM). This may relate to a better amino acid pattern in FM (Kijparkorn and Kijpayup, 1985). In the present experiment rabbits received FM as protein source which showed a tendency in gaining better daily weight than the RSM. These results were similar to those which were done in growing pigs received 20-30 % RSM in the ration (Siriwatananukul et al.,1982).

The level of thiocyanate in serum of rabbits obtained RSM was higher than those obtained FM ($P<.01$). This difference was reflected in the content of HCN which RSM contains by average 20 mg/kg DM (Tinimit, 1985) while FM contains no HCN. This higher goitrogenic substances in RSM will cause the reduction of thyroxin levels in serum ($P<.05$) and would affect the growth characteristics.

Effects of cassava root meal and protein sources on growth performances and concentrations of thiocyanate and thyroxin in the serum :

The combination of RSM and CRM in diet gave higher level of thiocyanate in serum than that of FM and CRM ($P<.05$). However, thyroxin in serum and growth characteristics showed no significant differences (Table 5). Rabbits fed with CRM-FM ration showed a tendency to give better production performances than RSM-CRM, this may be due to the balance of amino acid in FM.

It can be concluded that cassava root meal, residual from pelleting process, can be used up to 100 % to substitute broken rice (40 % in the ration) for growing rabbit without causing any

adverse effect on growth characteristics, especially at the level of 20 % in the ration. Addition of cassava root meal in fish meal rations give better production performances compared with rubber seed meal. Supplementation of lysine to rubber seed meal ration should be gain more efficiency the same as in pigs (Kosolkunaporn et al., 1989).

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Table 1 Composition and Chemical analysis of the diets

Ingredient	Protein sources							
	Fish meal				Rubber seed meal			
Cassava root meal	0	20	30	40	0	20	30	40
Corn	33.0	29.3	27.5	25.5	11.5	8.0	6.0	4.2
Broken rice	40.0	20.0	10.0	-	40.0	20.0	10.0	-
Rice bran	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Fish meal	6.0	6.0	6.0	6.0	-	-	-	-
Soybean oil meal	13.7	17.4	19.0	20.5	17.5	21.0	23.0	24.7
Rubber seed meal	-	-	-	-	22.5	22.5	22.5	22.5
Oyster shell	0.7	0.4	0.2	0.1	1.0	0.6	0.5	0.4
Dicalcium phosphate	0.7	1.0	1.4	1.5	1.6	2.0	2.1	2.2
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Premix	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Chemical Analysis								
Dry matter	90.44	90.22	90.45	90.58	90.21	90.29	90.41	90.58
Crude Protein	15.74	15.97	15.68	16.25	15.88	15.78	16.00	15.82
Fiber	7.09	8.54	6.94	7.09	7.96	7.80	8.44	8.26
Gross energy, Kcal/kg	3847	3751	3750	3701	3880	3893	3855	3833

Table 2 Chemical analysis of cassava root meal

Constituents	Cassava root meal
Dry matter, %	88.5
Crude protein, %	2.45
Amino acid, mg/kg	
Alanine	1.44
Arginine	1.29
Aspartic acid	1.65
Cystine	0.37
Glutamic acid	3.26
Glycine	0.81
Histidine	0.35
Isoleucine	0.65
Leucine	1.11
Lysine	0.89
Methionine	0.45
Phenylalanine	0.69
Proline	0.79
Serine	0.64
Threonine	1.29
Tyrosine	0.17
Valine	0.89

Table 3 Effect of cassava root meal on growth characteristics, level of thiocyanate and thyroxin in serum of growing rabbits (MEAN ± SD)

Observation	ANOVA[1/]	Cassava root meal				Average
		10	20	30	40	
No. of rabbits		12	12	12	12	12
Growth characteristics						
initial weight, g	NS	1063 ± 167	1014 ± 117	1042 ± 95	1076 ± 148	1049 ± 132
final weight, g	NS	2093 ± 181	2068 ± 163	2095 ± 135	2113 ± 185	2092 ± 163
daily weight gain, g	NS	18.39 ± 3.11	18.81 ± 1.78	18.81 ± 2.16	18.53 ± 1.93	18.64 ± 2.23
daily feed intake, g	NS	65.28 ± 7.73	61.10 ± 7.32	66.07 ± 6.50	67.87 ± 12.5	65.09 ± 8.93
feed conversion ratio	NS	3.68 ± 0.95	3.28 ± 0.50	3.56 ± 0.57	3.68 ± 0.69	3.55 ± 0.70
Thiocyanate in serum, Mg %						
week 0	NS	2.29 ± 0.88	2.35 ± 1.03	2.06 ± 0.39	2.07 ± 0.36	2.19 ± 0.72
week 2nd	**	1.32 ± 0.58^{a}	1.86 ± 0.70^{ab}	2.02 ± 0.76^{bc}	2.51 ± 0.85^{c}	1.93 ± 0.83
week 4th	**	1.29 ± 0.56^{a}	1.44 ± 0.28^{a}	1.53 ± 0.50^{ab}	1.87 ± 0.57^{b}	1.53 ± 0.52
week 6th	**	1.29 ± 0.53^{a}	1.56 ± 0.53^{a}	1.56 ± 0.44^{a}	3.09 ± 1.99^{b}	1.88 ± 1.27
week 8th	**	1.46 ± 0.36^{a}	1.68 ± 0.19^{a}	1.75 ± 0.38^{a}	2.38 ± 0.74^{b}	1.82 ± 0.57
Thyroxin in serum, Mg %						
week 4th	NS	2.11 ± 0.75	2.29 ± 0.82	1.92 ± 0.68	2.28 ± 0.66	2.15 ± 0.71
week 8th	NS	1.96 ± 0.73	2.51 ± 0.79	2.50 ± 0.68	2.40 ± 0.79	2.34 ± 0.75

[1/] Analysis of Variance : NS = Nonsignificant, **=P<.01

Table 4 Effects of protein sources on growth characteristics, level of Thiocyanate and thyroxin in serum of growing rabbits (MEAN ± SD)

Observation	ANOVA[1/]	Protein sources		Average
		Fish meal	Rubber seed meal	
No. of rabbits		24	24	24
Growth characteristics				
initial weight, g	NS	1069 ± 160	1028 ± 97	1049 ± 132
final weight, g	NS	2139 ± 148	2045 ± 166	2092 ± 163
daily weight gain, g	NS	19.11 ± 2.14	18.16 ± 2.27	18.64 ± 2.23
daily feed intake, g	**	60.32 ± 7.46[a]	69.84 ± 7.73[b]	65.08 ± 8.93
feed conversion ratio	**	3.19 ± 0.48[a]	3.91 ± 0.70[b]	3.55 ± 0.70
Thiocyanate in serum, Mg %				
week 0	NS	2.20 ± 0.72	2.18 ± 0.73	2.19 ± 0.71
week 2nd	**	1.52 ± 0.53[a]	2.33 ± 0.88[b]	1.93 ± 0.83
week 4th	**	1.24 ± 0.35[a]	1.82 ± 0.51[b]	1.53 ± 0.52
week 6th	**	1.26 ± 0.44[a]	2.49 ± 1.53[b]	1.88 ± 1.27
week 8th	**	1.56 ± 0.39[a]	2.08 ± 0.60[b]	1.81 ± 0.57
Thyroxin in serum, Mg %				
week 4th	NS	2.26 ± 0.89	2.04 ± 0.48	2.15 ± 0.71
week 8th	*	2.63 ± 0.76[a]	2.06 ± 0.63[b]	2.34 ± 0.75

[1/] Analysis of Variance : NS = Nonsignificant, *=P<.05, **=P<.01

Table 5 Level of cassava root meal and protein sources on growth characheristics, level of thiocyanate an thyroxin in serum of growing rabbits (MEAN ± SD)

Observation	ANOVA[1/]	Protein sources							
		Fish meal				Rubber seed meal			
		0	20	30	40	0	20	30	40
No. of rabbits	-	6	6	6	6	6	6	6	6
Growth characteristics									
initial weight, g	NS	1087	985	1060	1145	1040	1043	1023	1007
final weight, g	NS	2142	2082	2168	2165	2045	2053	2022	2062
daily weight gain, g	NS	18.84	19.58	19.79	18.21	17.94	18.04	17.83	18.84
daily feed intake, g	NS	61.93	56.73	63.07	59.55	68.63	65.48	69.08	76.19
feed conversion ratio	NS	3.35	2.89	3.22	3.29	4.01	3.66	3.90	4.07
Thiocyanate in serum, Mg %									
week 0	NS	2.08	2.73	1.86	2.13	2.51	1.97	2.26	2.00
week 2nd	NS	0.88	1.56	1.71	1.94	1.76	2.15	2.32	3.08
week 4th	**	0.81^{a}	1.49^{bc}	1.26^{b}	1.42^{bc}	1.77^{c}	1.38^{bc}	1.81^{c}	2.31
week 6th	*	0.86^{a}	1.19^{a}	1.24^{a}	1.77^{a}	1.72^{a}	1.93^{a}	1.89^{a}	4.41^{b}
week 8th	*	1.13^{a}	1.65^{bc}	1.48^{ab}	1.98^{c}	1.79^{bc}	1.72^{bc}	2.02^{c}	2.78^{d}
Thyroxin in serum, Mg %									
week 4th	NS	2.58	2.47	1.57	2.40	1.65	2.10	2.28	2.15
week 8th	NS	2.30	2.48	2.88	2.85	1.62	2.55	2.13	1.85

[1/] Analysis of Variance : NS = Nonsignificant, *=P<.05

ผลการใช้มันสำปะหลังร่วมกับแหล่งโปรตีนในการขุนกระต่าย

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บทคัดย่อ

กระต่ายลูกผสมระหว่างพันธุ์นิวซีแลนด์ไวท์และพื้นเมือง จำนวน ๔๘ ตัว แบ่งออกเป็น ๘ กลุ่มๆละ ๖ ตัว เป็นเพศผู้และเพศเมียอย่างละครึ่ง แต่ละกลุ่มได้รับอาหารที่มีแหล่งโปรตีนต่างกัน ๒ แหล่งคือ ปลาป่น และกากเมล็ดยางพารา ปลายข้าวในอาหารแต่ละแหล่งโปรตีนถูกทดแทนด้วยมันสำปะหลังที่เหลือจากขบวนการผลิตมันสำปะหลังอัดเม็ด ในระดับ ๐, ๕๐, ๗๕ และ ๑๐๐ % หรือเทียบเท่ากับการใช้มันสำปะหลังในระดับ ๐, ๒๐, ๓๐ และ ๔๐ % ในอาหาร ทำการเก็บข้อมูล คุณลักษณะการให้ผลผลิต และตรวจวัดความเข้มข้นของระดับไทโอไซยาเนต และไทร็อกซินในน้ำเหลือง แผนการทดลองเป็นแบบ Completely Random Design และเปรียบเทียบความแตกต่างโดยใช้ Duncan's new multiple range test.

จากการศึกษาพบว่า ระดับมันสำปะหลังที่ใช้ไม่มีผลต่อลักษณะการให้ผลผลิต และความเข้มข้นของระดับไทร็อกซินในน้ำเหลือง แต่การเพิ่มระดับมันสำปะหลังมีผลทำให้ความเข้มข้นของระดับไทโอไซยาเนตในน้ำเหลืองเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ ตั้งแต่สัปดาห์ที่ ๒ หลังจากได้รับมันสำปะหลัง ($P<.01$) การใช้ปลาป่นเป็นแหล่งโปรตีนในอาหารกระต่ายให้ประสิทธิภาพการเปลี่ยนอาหารที่ดีกว่า ($P<.01$) และมีระดับความเข้มข้นของสารไทโอ-ซยาเนต ($P<.01$) และไทร็อกซิน ($p<.05$) ต่ำกว่าการใช้กากเมล็ดยางพารา ไม่พบความแตกต่างในการใช้มันสำปะหลังร่วมกับแหล่งโปรตีนทั้ง ๒ แหล่งต่อคุณลักษณะการเจริญเติบโตและระดับไทร็อกซินในน้ำเหลือง แต่พบความแตกต่างของระดับไทโอไซยาเนต ในสัปดาห์ที่ ๔ จนถึงสัปดาห์สุดท้ายหลังจากได้รับอาหาร โดยที่กลุ่มที่ได้รับมันสำปะหลังร่วมกับกากเมล็ดยางพารามีระดับสูงสุด การใช้มันสำปะหลังทดแทนปลายข้าวในระดับ ๕๐ % หรือใช้ในระดับ ๒๐ % ในอาหารให้ผลดีที่สุดในทั้ง ๒ แหล่งของโปรตีน
