INCLUSION OF FRESH Ipomoea aquitica IN THE DIETS OF GROWING INDONESIAN NATIVE RABBITS: A PRELIMINARY STUDY

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ABSTRACT

Twelve male Indonesian native rabbits of 12 weeks initial age were used to investigate the effect of fresh Ipomoea aquitica inclusion in the diets on the performance of rabbits. The rabbits were allotted to receive either one of the three experimental diets. The experimental diets were formulated to contain 30 % commercial pelleted concentrate (CPC) + 70 % fresh Ipomoea aquitica (Diet 1), 50 % CPC + 50 % fresh Ipomoea aquitica (Diet 2), and 100 % fresh Ipomoea aquitica (Diet 3). Results suggested that the use of Ipomoea aquitica as the only source of nutrients depressed dry matter (DM) intake. This low DM intake may be due to moisture content of the Ipomoea aquitica. There was a significant difference (P<0.01) between DM intakes of Diet 1 (22.4 g/d), Diet 2 (18.1 g/d), and Diet 3 (7.1 g/d). Consistently, rabbits fed Diet 1 exhibited higher (P<0.05) daily weight gain (5.4 g) than rabbits fed Diet 2 (3.6 g), and Diet 3 (1.2 g). In addition, the distinction between feed conversion ratio of rabbits fed Diet 1 (4.9), Diet 2 (6.4) and Diet 3 (11.6) was also significant (P<0.05). In contrast, there was no significant effect of diet treatments on the slaughter weight (1137 g, 1047 g, and 1024 g), carcass weight (532 g, 478 g, and 450 g) and edible meat production (185 g, 156 g, and 146 g) (for rabbits fed Diet 1, Diet 2 and Diet 3, respectively). In conclusion, all diets were utilized inefficiently by the rabbits. Consequently, there is no diet formulation used in the present study appropriate to be adopted routinely for conducting an intensive rabbits farm.

Keywords: carcass, concentrate, growing, Ipomoea aquitica, meat, native rabbit

INTRODUCTION

The domestic rabbit has been recommended to be an alternative to other animals to rapidly produce meat as one of the highest quality food available to human being, including to the people in the developing countries (Farrell and Raharjo, 1984; Cheeke, 1986; Prawirodigid, 1992). Farrell and Raharjo (1984) calculated that a rabbit doe weighing of 3-4 kg could produce 80 kg of dressed carcass per year.

Recently, Prawirodigid et al. (2004) provided a compelling evidence that average daily weight-gain of the New Zealand White rabbits fed diet containing waste vegetables and fruits was 33 g. In order to feed rabbits efficiently, however, Prawirodigid et al. (2004) offered the waste vegetables and fruits diet to the rabbits in a pellet form. The problem is that, to produce pellet themselves the farmers require a large capital outlay.

Generally, the farmers revolve around the system where they use the commercial diet instead of using their home made pellet. Although they understood well that using the commercial diet is cost effective and more expensive than using the home made pellet, almost all Indonesian farmers are attracted to adopt simple (instant) feeding management by using the commercial diet.

On the other hand, Harris et al. (1983) have demonstrated that replacement of a part of the commercial diet with green feed for rabbits could reduce feed cost with no deleterious effects. Moreover, Prawirodigid (1985) reported the view that Ipomoea aquitica was commonly used as a kind of green feeds.
for rabbits in the village rabbit farms in Central and West Java. Unfortunately, data on the use of *Ipomoea aquitica* as feed for rabbits are scarce. Yet, the maximum inclusion rate of *Ipomoea aquitica* appropriate in diet for rabbits has not been established. Therefore, the aim of this preliminary study was to determine the effect of fresh *Ipomoea aquitica* inclusion in substitution for the commercial pelleted concentrate (CPC) feed, in diet on the performance of growing native rabbits.

**MATERIALS AND METHODS**

**Experimental Diets**

The present experiment used the fresh *Ipomoea aquitica* and CPC feeds as the only sources of nutrients. The chemical composition of the two sources of nutrients are presented in Table 1.

The experimental diets (Table 1) were formulated to contain 50% CPC + 50% *Ipomoea aquitica* (Diet 1), 30% CPC + 70% *Ipomoea aquitica* (Diet 2) and 100% of *Ipomoea aquitica* as sole nutrient source (Diet 3). The proportion of CPC : *Ipomoea aquitica* in the diets was adjusted to fulfill the dry matter (DM) requirement of rabbit, which is 7% of body weight.

**Animals and Management**

The experiment was conducted at the animal house of Faculty of Animal Agriculture, Diponegoro University, Tembalang, Semarang. The present experiment used twelve male Indonesian native rabbits 3 months old of about 992 g initial body-weight; which were supplied by a farmer at Bandungan Village, Semarang District.

The animals were housed individually in the wire-mesh cages, and randomly allocated to one of either Diet 1, Diet 2 or Diet 3 (see Table 1). Water was supplied ad libitum throughout the experimental period using aluminium bowl drinkers kept at the front part of each cage.

The rabbits were acclimated to their diets over a 7 d period and fed their experimental diets for further 42 d. Diets were offered in 2 meals/d. The rabbits receiving Diet 1 and Diet 2 were allowed to access to the *Ipomoea aquitica* after consumed their concentrate feed completely. Feed intake was determined and weight gain of rabbits measured once a week. A daily quantitative record was maintained for CPC and green feeds refusal.

The CPC feed samples were collected in the labelled plastic bags, stored at -4°C until analysed. The *Ipomoea aquitica* samples were also collected, air-dried, weighed (for determination of moisture lost), and stored for nutrients content determination.

At the end of the experimental period all animals were fasted over night, weighed, and finally slaughtered by cervical dislocation. The fore and hind legs were cut and the heads removed by cutting up at the base of the skull. They were then skinned, the abdomens opened and eviscerated, and the carcasses weighed (the liver, lungs, heart and kidney were included). The liver, lungs and trachea, heart

| Table 1. Nutrients Composition of the Commercial Concentrate Feed and the Experimental Diets (g/kg, air-dry basis) |
|---------------------------------|---------|---------|---------|
| **Constituent**                  | **CPC** | **Diet 1** | **Diet 2** | **Diet 3** |
| Dry matter                       | 905.1   | 520.6    | 366.7    | 136.0      |
| Crude protein (N x 6.25)         | 164.9   | 101.1    | 75.5     | 37.2       |
| Fat                              | 62.1    | 32.2     | 20.0     | 2.2        |
| Crude fibre                      | 25.0    | 18.3     | 15.5     | 11.5       |
| Ash                              | 95.7    | 57.5     | 42.2     | 19.2       |
| Nitrogen-free extract            | 557.4   | 305.4    | 204.6    | 53.4       |

1)Calculated analyses; 2) Determined analyses; CPC, Commercial pelleted concentrate, 3) Containing 50% CPC + 50% fresh *Ipomoea aquitica*; 4) Containing 30% CPC + 70% fresh *Ipomoea aquitica*; 5) Containing 100% of *Ipomoea aquitica*; I A: *Ipomoea Aquitica*
and kidney were removed as was the subcutaneous fat. The edible meat production data was obtained by separation of the meat from the bone and then weighed.

**Chemical Analyses**

The DM content of the diets was determined by drying in a forced-air oven at 95 - 105°C for 24 h (Prawirodigidodo *et al.*, 1998). In the present study total N profile of the diets was determined using Micro Kjeldahl method according to the procedures of Association of Official Analytical Chemist (AOAC, 1990).

The diets samples were digested in sulphuric acid and a selenium catalyst, and the digested solution were steam-distilled. The aliquot of samples were analysed using a series of a semi-automatic N analyser (Radiometer Copenhagen, Denmark) consisting of a PHM82 Standard pH metre, TTT80 Titrator and ABU80 Autoburette (Prawirodigidodo, 1999). The fibre, fat and free N extract contents of the experimental diets were determined following the procedures as recommended by AOAC (1990).

**Statistical Analyses**

The present experiment employed a completely randomized design with 4 replications for each treatment. The data of DM intake, daily weight gain, slaughter weight, carcass weight and edible meat production were analysed using analysis of variance (ANOVA) as described by Steel and Torrie (1981). Furthermore, the mean differences were examined using the Duncan’s Multiple Range Test (Steel and Torrie, 1981).

**RESULTS AND DISCUSSION**

**Feed Intake**

Results of the current study show that DM intake of the experimental diets among the rabbits varied. Furthermore, the DM intake of rabbits fed Diet 2 (30% CPC + 70% *Ipomoea aquitica*) was significantly (P<0.01) lower than DM intake of rabbits consuming diet 1 (50% CPC + 50%). The DM intake of rabbits fed diet containing *Ipomoea aquitica* solely was much lower (P<0.01) compared to DM intake of the other two groups of rabbit consuming either Diet 1 or Diet 2. Although the experimental diets were offered to the rabbits according to the DM requirement, the DM intake of Diet 3 was consistently lower than that on Diet 2 or Diet 1 (Table 2). This was due to the high moisture content of *Ipomoea aquitica* (See Table 1). It seems that the rabbit could not consume sufficient amount of Diet 3 for full filling their DM requirements due to the limitation of their gut capacity. Thus, the rabbits fed *Ipomoea aquitica* solely consumed the lowest amount of DM.

Results of the present study also show that the higher inclusion level of *Ipomoea aquitica* in the diet resulted the lower DM intake of such diet. Overall, these apparent DM intake differences predominantly due to the moisture content of the experimental diets.

**Growth Rate**

It was found that the rabbits consuming Diet 1 grew faster (P<0.05) than rabbits receiving Diet 2. While rabbits fed diet containing *Ipomoea aquitica* only grew slower (P<0.05) than rabbits fed Diet 2, and much slower (P<0.01) than rabbits fed Diet 1. However, since the number of animal available to conduct a comparison between the performance of rabbits fed concentrate and rabbits fed *Ipomoea aquitica* diets was limited, the growth rate of rabbits fed concentrate diet solely could not be examined directly. Therefore, in this study it was not possible to determine whether the concentrate diet alone was better than the sole *Ipomoea aquitica* diet.

Previously, Prawirodigidodo *et al.* (1985b) documented that average growth rate of New Zealand White rabbits fed concentrate diet was 40 g/d. In fact, the New Zealand White rabbits has been widely accepted as a rabbit breed having genetic potency to grow faster than the Indonesian native rabbits. Thus, if these two breeds of rabbit are reared under the same diet and feeding management, then growth rate of the New Zealand White rabbit would be prominent.

In the other investigation, Prawirodigidodo *et al.* (1985a) documented that the growing Indonesian native rabbits exhibited average daily weight gain 9.6 g when fed diet containing 50 g of boiled cassava root + cabbage leaf residue (*ad libitum*). It was also considered that when cabbage leaf residue was of
fered as a sole diet to the growing rabbits, they exhibited a very low daily weight gain (Prawirodigidodo et al., 1985a).

It was not expected, that the native rabbits fed the CPC + Ipomoea aquitica diet in the present experiment visually performed similar weight gain to rabbits fed fresh cabbage residue solely in the previous experiment (Prawirodigidodo et al., 1985a) (5.4 g/d versus 5.5 g/d, respectively).

Because Diet 1 contained complete concentrate, so that, logically the rabbits fed Diet 1 should grow even faster than rabbits fed the boiled cassava root + cabbage leaf residue diet. Indeed, the rabbits consumed the boiled cassava root + cabbage leaf residue diet grew faster than the rabbits received the CPC + Ipomoea aquitica diet. The previous experiment, however, was performed at the Salib Putih animal house in Salatiga (Prawirodigidodo et al., 1985a). It was possible that the deference of the environmental effects between animal house in Tembalang and in Salatiga was more apparent than the effect of diets used in both studies. Certainly, at Salib Putih animal house the ambient temperature (20°C) was much lower than at Tembalang animal house (38°C). It was possible that the distinction between the two ambient temperatures of the animal houses had led the rabbits grow inconsistently. Obviously, rabbits are susceptible to heat stress (Cheeke, 1986; Jin et al., 1990; Lukefahr and Cheeke, 1993). Cheeke (1986) emphasized that at temperatures above about 30°C, rabbits production could be severely limited. Probably, the difference between nutrients profile and character of green feed (cabbage leaf residue) that was used in the previous study (Prawirodigidodo et al., 1985a) and green feed employed in the present study (Ipomoea aquitica) also contributed in a controversial growth rate appearance on both studies.

Results of the present experiment provide further evidence for the results of the previous investigations (Prawirodigidodo et al., 1985a; Prawirodigidodo and Muryanto, 1995). Prawirodigidodo et al. (1985a) and Prawirodigidodo and Muryanto (1995) consistently demonstrated that rabbits fed diet containing fresh forage as a single nutrients source grew too slowly.

The effect pattern of the diets on the growth rate of rabbits in the present study, however, is in close agreement with the diets effect pattern determined previously (Prawirodigidodo et al., 1985a;). In addition, Prawirodigidodo and Muryanto (1995) also documented that substitution of pelleted concentrate feed by local forages up to 75% in the diet for the Rex rabbits produced similar body weight gain to the rabbits received 100% pelleted concentrate diet. It seems that the Rex rabbits utilized the nutrients from the feed for producing their fur. Thus the effect of diet may be more apparent on the production and quality of fur. Whereas, the native rabbits utilized such as nutrients for lean meat and fat deposition in the body.

Furthermore, the rabbits fed diet containing 30% CPC + 70% fresh Ipomoea aquitica visually grew slightly slower than rabbits consuming Diet 1

Table 2. Effect of the experimental diets on dry matter intake, weight gain, feed conversion ratio, and carcass performance of the rabbits

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter intake (g/d)</td>
<td>Diet 1</td>
<td>22.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Diet 2</td>
<td>18.1&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>Diet 3</td>
<td>7.1&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Weight gain (g/d)</td>
<td>Diet 1</td>
<td>5.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Diet 2</td>
<td>3.6&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>Diet 3</td>
<td>1.2&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>Feed conversion ratio</td>
<td>Diet 1</td>
<td>4.9&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Diet 2</td>
<td>6.4&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Diet 3</td>
<td>11.6&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Slaughter weight (g)</td>
<td>Diet 1</td>
<td>1137</td>
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<tr>
<td></td>
<td>Diet 2</td>
<td>1047</td>
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<tr>
<td></td>
<td>Diet 3</td>
<td>1024</td>
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<tr>
<td>Carcass weight (g)</td>
<td>Diet 1</td>
<td>532</td>
</tr>
<tr>
<td></td>
<td>Diet 2</td>
<td>478</td>
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<tr>
<td></td>
<td>Diet 3</td>
<td>450</td>
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<tr>
<td>Edible meat (g)</td>
<td>Diet 1</td>
<td>185</td>
</tr>
<tr>
<td></td>
<td>Diet 2</td>
<td>156</td>
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<tr>
<td></td>
<td>Diet 3</td>
<td>146</td>
</tr>
</tbody>
</table>

At the same row a, b and c differ significantly; N.S., non significant.

Table 2. Effect of the experimental diets on dry matter intake, weight gain, feed conversion ratio, and carcass performance of the rabbits
Inclusion of Ipomoea Aquitica in the Diets of Growing Indonesian Native Rabbits (Prawirodigidho et al.)

(50% CPC + 50% fresh Ipomoea aquitica). However, there was no statistical different indicated between the effect of both experimental diets on such rabbits growth rate. These results are not in agreement with the results of the recent experiment (Prawirodigidho et al., 2004). Prawirodigidho et al. (2004) documented that rabbits fed pelleted diet containing various green feeds grew remarkably (33 g/d).

Feed Conversion Ratio

The present experiment shows that feed conversion ratio (FCR) of Diet 1 (4.9) was superior (P<0.05) compared to the FCR of other two diets (6.4 and 11.6 for Diet 2 and Diet 3, respectively). It was clear that FCR of the sole fresh Ipomoea aquitica diet was the worst compared to FCR of the Diet 1 and Diet 2. The results suggested that to reach a good growth performance the rabbits should not only consume a single green feed as the only source of nutrients, but need to consume a diet containing various feedstuffs as sources of nutrients (Prawirodigidho et al., 2004).

Nevertheless, the present experiment also supports evident for the previous study of Prawirodigidho (1999) that high crude protein profile of a diet does not warrant its protein utilization. For instance, in the present experiment crude protein content of Diet 1 was 164.9 g/kg, while crude protein content of Diet 1 in the recent experiment (Prawirodigidho et al., 2004) was 148 g/kg. However, the crude protein of Diet 1 in the present experiment was utilized less efficiently than in the diet of the recent experiment. It was proven by the quite high daily weight gain (23 g/d) of rabbits fed Diet 1 in the recent experiment (Prawirodigidho et al., 2004). Again, it is important to highlight that both factors of rabbit breed and the nutrients availability of diet influence growth performance of rabbit.

Carcass and Edible Meat Production

It is often that some indices of performance (weight gain and feed conversion ratio) do not truly reflect tissue retention of nutrients as well as carcass gain (Prawirodigidho, 1999). It is because to hard to reach the true empty gut when the animals are only denied to access their feed over night. Therefore, here the rabbit carcass and edible meat production were evaluated to confirm the effect of the experimental diets.

In the current experiment, it was found that the experimental diets did not significantly influence either slaughter weight, carcass weight or edible meat production (Table 2). These data confirmed the study results of Harris et al. (1983) that inclusion of green feed in the diet for rabbit did not significantly reduced rabbit performance. However, it was appeared that the average difference between carcass weight of the rabbits fed Diet 1 and Diet 2, was 54 g (532 g versus 478 g). While, carcass weight of rabbits fed Diet 3 were 82 g less than in rabbits fed Diet 1. Consistently, the rabbits fed Diet 2 and Diet 3 also produced smaller amount of edible meat (29 and 39 g less, respectively) than rabbits fed Diet 1 (185 g). Prawirodigidho et al. (1985b) documented that the growing (fryer) New Zealand White rabbits exhibited 2 kg of live weight at eight weeks old, which proximately produced 1 kg of carcass. However, such fryer rabbits were reared under an excellent feeding management. It is, therefore, to feed rabbits for producing rabbit meat rapidly, the diets should be formulated properly based on the rabbit nutrients requirement and nutrients profile of the feedstuffs.

In conclusion, all diets used in the present experiment were utilized inefficiently by the rabbits. Consequently, there is no diet formulation used in the present experiment appropriate to be practiced routinely for conducting an intensive rabbit farm.

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