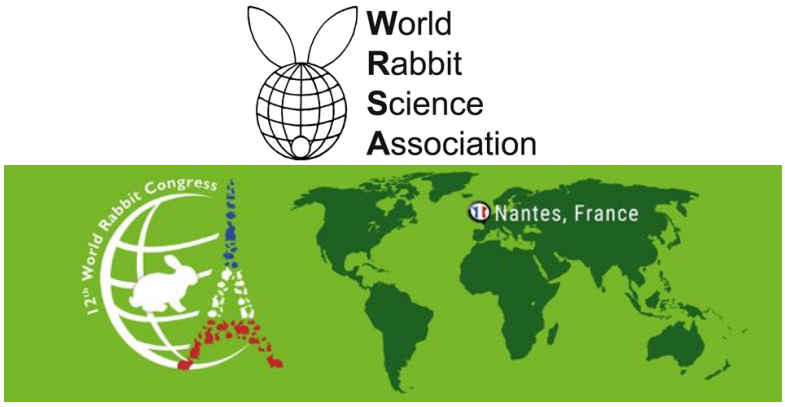

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THE EFFECT OF COMPLETE FEED SUBSTITUTION WITH KELOR (*Moringa oleifera*) DRIED LEAVES ON THE PHYSIOLOGICAL AND PRODUCTION PERFORMANCE OF MALE WEANED CROSSED NEW ZEALAND WHITE RABBITS

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THE EFFECT OF COMPLETE FEED SUBSTITUTION WITH *KELOR (Moringa oleifera)* DRIED LEAVES ON THE PHYSIOLOGICAL AND PRODUCTION PERFORMANCE OF MALE WEANED CROSSED NEW ZEALAND WHITE RABBITS

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ABSTRACT

The purpose of the research was to study the effect of a dietary substitution with *kelor* dried leaves on the physiological and production performance of weaned male crossed New Zealand White rabbit. The *kelor* (*Moringa oleifera*) leaves have a high crude protein content (26-30 %). Sixteen rabbits were used in a randomized trial design with 4 treatments and 4 replicates/treatment. Experimental rabbits were fed a complete diet (control: P_0) or a diet with 10% substitution (P_1), 20% substitution (P_2) and 30% substitution (P_3) with dried *kelor* leaves. The data obtained were analyzed by analysis of variance. The results showed that although the feeding of leaves had significant effects on the frequency of respiration ($P< 0.05$) but physiologically they are still in the normal range (t_b: 39.3ºC; fr: 74-86 times/min). The feed intake, and the body weight gain of the rabbit fed leaves were lower than in controls (8, 16 and 9%, respectively; $P<0.05$). It was concluded that substitution of complete feed with dried *Moringa oleifera* leaves is not recommendable to young rabbits although there were not physiological effects on the animals.

Key words: Dried leaves, High protein feed, Frequency of respiration, Feed conversion

INTRODUCTION

Rabbits, due to the ability to breed quickly, are one of the alternative meat-producing livestock that can be developed to meet the gap between the high number of requests and the lack of availability of livestock origin products. The type of rabbits that is currently being used by farmers is Crossed New Zealand White because this breed has the best body size, weight gain, feed conversion ratio, carcass weight and meat boner ratio compared to others. Feeding management for rabbits with complete feeding is an effective method. Complete feed in the form of pellets/grains is usually composed of 50-60% concentrate and 40-50% forage (Abdullah, Susanto and Aria, 2015). Moringa (*Moringa oleifera*) plant is a source of protein in the future and its content (26-36%) is higher than other animal feed ingredients. Furthermore, it has a balanced amino acid content even though it still contains anti-nutritional compounds (Marhaeniyanto *et al*., 2015). This plant is widely used in projects to combat malnutrition (Broin, 2010) and it is expected that in rabbits feeding dietary substitution with Moringa leaves have a good response. So, the purpose of this work was to study the effect of a dietary substitution with *kelor* dried leaves on the physiological and production performance of weaned male crossed New Zealand White rabbit.

MATERIALS AND METHODS

Animals and Experimental Designs

This study used 16 weaning male New Zealand White Peranakan rabbits, 35-40 days old, with an average body weight of 650-800 g. Trial was carried out for 42 days and animals were distributed in 4 treatments with 4 replicates/treatment. Experimental rabbits were fed a complete diet (control: P_0) or a

diet with 10% substitution (P_1), 20% substitution (P_2) and 30% substitution (P_3) with dried *kelor* leaves. Complete feed is composed of corn, soybean meal, pollard, bran, peanut shells, skim milk, meat and bone meal and premix. The chemical composition of complete feed was moisture (11.1%), dry matter (88.9%), ash (10.0%), crude protein (15.9%), crude fat (4.72%) and crude fibre (17.2%). *Moringa* leaves were still fresh and were dried in the sun for two days. Feed was given in the morning and in the evening. Drinking water was given *ad libitum*. The cages used in this study were 8 wire battery cages (50 cm x 50 cm x 50cm). Each cage contained two rabbits. Rectal temperature (ºC), respiratory rate (times/minute), average daily feed intake (g), average daily gain (g) and feed conversion ratio (g of feed intake/g of gain) were recorded during the experimental period (7 weeks).

Statistical Analysis

The results of this study were analysed as a completely randomized design with 4 treatments and 4 replicates/treatment using an analysis of variance. The mathematical model was as follows:

$Y_{ij} = \mu + a_i + \varepsilon_{ij}$

Information: Y_{ij} = Observation value in the i-th treatment and j-th test; μ = Common midpoint; a_i = Effect of i-i treatment; ε_{ij} = Error (error) of the experiment in the i-th and j-th tests (Siska and Salman, 2012).

Means comparisons were analysed using the smallest Real Difference Test (LSD) and with the following formula:

$LSD = t(0.05.12) \sqrt{(2MSE / r)}$

Note: MSE = Mean Standard Error; r = Number of replicates

RESULTS AND DISCUSSION

Treatments had no effect on rectal temperature (P>0.05; Table 1). Previous works observed that rabbits fed with different diets without differences in rectal temperature could indicate that metabolic heat due to the differences in treatments could be managed by animals (Nuriyasa *et al.*, 2014). It is known that the heat in the animal's body, which is measured as the rectal temperature, comes from the heat of feed metabolism and the environment. The temperature of the cage during this trial varied from 22 to 25ºC and the average rectal temperature of rabbits ranged from 39.2 to 39.3 ºC that is still within the range of normal body temperature for rabbits. This result could indicate that animals can be fed with *Moringa* leaf without any problem.

Table 1: Effect complete feed substitution with *kelor* dried leaves on physiological and growth performances (n=4)

Treatment	ADFI	ADG	FCR	FBW	RT	RR
P_0 (0% Moringa)	62.3±2.54^{b}	25.0±4.65^{a}	2.6±0.49	1717±86.5	39.2±0.17	83.3±1.46^{b}
P_1 (10% Moringa)	64.2±1.63^{a}	21.8±3.^{33bc}	3.0±0.43	1722 ±93.0	39.2±0.17	82.9±2.90^{b}
P_2 (20% Moringa)	61.5±4.79^{b}	21.0±4.59^{c}	3.0±0.52	1547 ±69.2	39.2±0.08	74.9±4.89^{a}
P_3 (30% Moringa)	65.2±1.30^{a}	23.0±3.85^{b}	2.9±0.49	1537±239	39.3±0.17	86.0±7.08^{b}

ADFI: average daily feed intake (g); ADG: average daily gain (g); FCR: feed conversion rate (g intake/g gain); FBW (g): final body weight; RT: rectal temperature (ºC); RR: respiratory rate (times/m). Different superscripts in the same column are significantly different (P <0.01) (ADFI and ADG) and (P <0.05) (RR).

On the other hand, the average respiratory rate was significantly affected (P<0.05) by the treatments, although it was still within the normal range. Kurniawati *et al.* (2018) found that the normal respiratory frequency for New Zealand White rabbits was 80 times/minute. If the temperature of the rearing environment is higher than its comfort zone, the animals could maintain their body temperature by increasing the respiratory rate above the normal range up to 130 times/minute (Nuriyasa *et al.*, 2014). The lowest respiratory rate (74.9±4.89 times/minute) was obtained in animals fed with P_2, probably because these animals presented a higher incidence of coccidiosis and scabies than the other groups. Control, P_1 and P_3 treatments had a respiratory rate between 82.9 and 86.0 times/minute. In general, in this study the dietary inclusion of dried *Moringa oleifera* leaves did not cause physiological changes in the rabbits.

Feed intake of the control (without *Moringa* leaves substitution) and P_2 diets were lower ($P < 0.01$) than P_1 and P_3 treatments (Table 1). In this study the substitution of dried *Moringa* leaves by up to 10% increased feed intake except for treatment P2, which could be explained by the higher incidence of coccidiosis and scabies in this group. However, the increase on feed intake was not followed by an increase on body weight gain that was lower than the control in all treatments. This can be caused by the presence of anti-nutritional factors content in Moringa leaves.

As it is known, *Moringa* leaves have high protein content but also contains anti-nutritional substances such as carotenoids (85.2-92.4 mg g^{-1}), phenols (36.0-45.8 mg g^{-1}) and flavonoids (15-27 mg g^{-1}) (Simbolan *et al*., 2007, and Sreelatha and Padma, 2009). Some techniques have already been used to reduce the anti-nutritional factors. For instance, the results of Sukria, Nugraha and Suci (2018) indicated that the inclusion of boiled moringa leaves in broiler chickens produced a final body weight similar than those of the control. However, in the same study, boiled *Moringa* leave flour had a negative effect on the final weight of the broilers. Negative effects of *Moringa* leaves flour have been also found in quail because the inclusion *Moringa* leaves flour up to 6% in the ration reduced feed intake (palatability) and quail growth (Sedyaadi, Manshur and Notarianto, 2018). In the present research, the reduction of the anti-nutritional substances in *Moringa* leaves was only done by drying the leaves in the sun, but the inclusion of sun dried dry *Moringa* leaves has not provided better growth performance compared to the control without substitution although the feed conversion was the same for all treatments.

In a similar study with Crossed New Zealand White rabbits does, the substitution of pollard by 10, 20 and 30% of *Moringa* leaf flour gave positive results ($P<0.05$) on dry matter feed intake, weight gain and number of kits born (Marhaeniyanto *et al*., 2015). In that study, 3-month-old female rabbits were used during 1-2 parturitions with initial weights of 1553 ± 216 g. In our study, 35-40 days old rabbits in the growth phase were used with initial weights of 640-852 g, because animals in the growth phase provide the best response of improving feed nutrition. On the other hand, using the same levels of substitution (0, 10, 20 and 30%) the body weight gain in the present work (25.0, 21.8, 21.0 and 23.0) was higher than in the study of Marhaeniyanto *et al*. (2015) (9.69, 13.5, 18.9 and 19.8 g/day). These differences among studies might be explained because the substitution of *Moringa* leaves could develop different effects depending on the physiological conditions, treatment of feed ingredients (made flour, boiling or steaming) and the age of animals.

CONCLUSION

From the results of this study it was concluded that the substitution of dried *Moringa* leaves on complete feed up to 30% had no effect on the physiological status of the animals but impaired productive performance of growing rabbits. Therefore, the inclusion of dried Moringa leaves is not recommended for weaned New Zealand White rabbits during the growth phase.

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INTRODUCTION

- One of the alternative meat-producing livestock
- Crossed New Zealand White breed has the best body size, weight gain, feed conversion ratio, carcass weight and meat bone ratio compared to others
- Complete feeding is an effective method ,usually composed of 50-60% concentrate and 40-50% forage
- Moringa (*Moringa oleifera*) plant is a source of protein in the future and its content (26-36%) is higher than other animal feed ingredients. It has a balanced amino acid content even though it still contains anti-nutritional compounds
- Purpose: To study the effect of a dietary substitution with *kelor* dried leaves on the physiological and production performance of weaned male crossed New Zealand White rabbit.

MATERIAL AND METHODS (1)

- 16 weaning male New Zealand White rabbits, 35-40 days old, with an average body weight of 650-800 g
- Trial was carried out for 42 days ; 4 treatments with 4 replicates/treatment
- Treatments: a complete diet (control: P_0) or a diet with 10% substitution (P_1), 20% substitution (P_2) and 30% substitution (P_3) with dried *kelor* leaves
- Complete feed is composed of corn, soybean meal, pollard, bran, peanut shells, skim milk, meat and bone meal and premix. The chemical composition of complete feed was moisture (11.1%), dry matter (88.9%), ash (10.0%), crude protein (15.9%), crude fat (4.72%) and crude fibre (17.2%).

MATERIAL AND METHODS (2)

- *Moringa* leaves were still fresh and were dried in the sun for two days. Feed was given in the morning and in the evening.
- Drinking water was given *ad libitum*.
- The cages used in this study were 8 wire battery cages (50cm x 50cm x 50cm). Each cage contained two rabbits.
- Rectal temperature (ºC), respiratory rate (times/minute), average daily feed intake (g), average daily gain (g) and feed conversion ratio (g of feed intake/g of gain) were recorded during the experimental period (7 weeks).

RESULTS AND DISCUSSION

Treatment	ADFI	ADG	FCR	FBW	RT	RR
P_0 (0% Moringa)	62.3 ± 2.54^{b}	25.0 ± 4.65^{a}	2.6±0.49	1717±86.5	39.2±0.17	83.3 ± 1.46^{b}
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CONCLUSION

- The substitution of dried *Moringa* leaves on complete feed up to 30% had no effect on the physiological status of the animals but impaired productive performance of growing rabbits.
- The inclusion of dried Moringa leaves is not recommended for weaned New Zealand White rabbits during the growth phase.

Thank you