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THE EFFECT OF ADDING CHESTNUT TANNIN EXTRACTS AS GROWTH PROMOTOR ON RATION NEW ZEALAND WHITE RABBIT

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Abstract
This study aims to determine the impact of adding chestnut tannin extract into the diet on the body weight gain and ratio conversion of New Zealand White crossbreed rabbits. In a completely randomized design, New Zealand White rabbits were distributed to four treatment groups: R0 (Control Feed); R1 (0.25% addition of chestnut tannin extract); R2 (0.5% addition of chestnut tannin extract); R3 (0.75% addition of chestnut tannin extract), each with five replications. Addition of chestnut tannin extract significantly affected rabbits' body weight gain ($p<0.05$), but did not alter their protein consumption ratio, feed conversion ratio, protein efficiency ratio, percentage, and carcass components' percentages. Tannin derived from a chestnut extract at 0.25% can be considered as a viable additive in rabbit rations in the growing period, potentially replacing antibiotics and growth promoters in rabbit husbandry, and improving gut health without affecting rabbit's growth.
Keywords: Rabbit, Tannin Extract, Chestnut, and New Zealand White

PENGARUH PEMBERIAN EKSTRAK TANIN CHESTNUT SEBAGAI PERANGSANG PERTUMBUHAN DALAM RANSUM KELINCI PERANAKAN NEW ZEALAND WHITE

Abstrak
Penelitian ini bertujuan untuk mengetahui dampak dari pemberian ekstrak tannin kastanye pada ransum terhadap perkembangan bertambahnya bobot badan dan konversi ransum kelinci peranakan New Zealand White. Rancangan acak lengkap (RAL) yang digunakan dalam penelitian ini, kelinci New Zealand White dibagi ke dalam empat kelompok perlakuan, yaitu: R0 (Ransum kontrol); R1 (penambahan 0.25% ekstrak tannin kastanye); R2 (penambahan 0.5% ekstrak tannin kastanye); dan R3 (penambahan 0.75% ekstrak tannin kastanye), setiap perlakuan memiliki lima ulangan. Penambahan tanin dari ekstrak kastanye dalam ransum kelinci sampai tingkat 0,75% memberikan pengaruh terhadap pertambahan berat badan harian ($p<0,05$) dan tidak efektif terhadap konsumsi ransum harian, konsumsi protein harian, konversi ransum, imbangan efisiensi protein, persentase karkas, persentase daging karkas, persentase tulang karkas dan persentase lemak karkas. Pemberian tanin dari ekstrak kastanye dalam ransum kelinci sampai tingkat 0,25% dapat menjadi pengganti antibiotik alami pada ransum kelinci periode penggemukan, serta berpotensi untuk mengurangi kejadian diare dan menjaga kesehatan usus tanpa mempengaruhi pertumbuhan kelinci.
Kata kunci: Kelinci, Tanin, Kastanye, New Zealand White

INTRODUCTION

Rabbits are known for their high reproductive abilities and short birth intervals, low land requirement for breeding, and a large variety of species. Rabbit also offers a relatively high protein and low-fat meat, compared to other animal meat (Farrel and Raharjo, 1984; Lebas et al., 1986). Rabbits must be supported with optimal nutrients to support building and replacing body cells, and production quality and quantity (Anggorodi, 1994).

Rabbits are also prone to intestinal diseases, such as enteritis and diarrhea (McNitt *et al*., 2000). Diarrhea decreases rabbit productivity and meat quality, and often caused by altered feed, lack of dietary fiber, excess water content, and stress (Sarwono, 2001). Considering the importance of addressing rabbit's diarrhea problems, and the prohibition of antibiotics as growth promoters in Indonesia (Minister of Agriculture Regulation No. 14/2017 concerning the classification of veterinary drugs), rabbit breeders must find other alternatives to treat their rabbits. One of

the alternatives is by adding tannin, a secondary metabolite compound found in several types of plants, and consists of two classes based on their structure: condensed tannins (CT), and hydrolyzable tannins (HT) (Hagerman *et al*., 1992; Harbone, 1996). Antimicrobial compounds can be produced from HT, as hydrolyzed tannins have low stability, causing them to easily broken down into phenolic acids and simple sugar molecules (Waghorn, 2008).

Tannins inhibits bacteria and fungi activity that influences the conversion of lactic acid to acetic acid, ethanol, or butyrate (Salawu *et al*., 1999). *Clostridium Sp.* bacteria causes spoilage and decreases the feed conversion to butyric acid. Most of the tannin extract from chestnuts contains HT (Tabacco *et* al., 2006). Various plant extracts containing tannins have demonstrated efficacy in preventing the colonization of bacteria, parasites, protozoa, and viruses in livestock digestive tract. Aside from their use as traditional medicines for diarrhea and dysentery, tannins have also been studied as feed additives (Maertens and Štruklec 2006).

Tannin contracts the cell wall or membrane, disturbing its permeability, and results in the inhibition of cell's vital activities, eventually leading to its death (Ajizah, 2004). Tannins are also considered as an antibacterial because they precipitate proteins and phenolic compounds, react with bacteria's cell membranes, inactivate their enzymes, and destruct their genetic material functions (Masduki, 1996). Therefore, tannin have the potential to increase the body weight gain of rabbits by preventing diseases caused by parasites and microbes. The tannin dosage plays a crucial role in determines its effects. Administering tannin extracted from grapes to non-ruminant in high amounts (3%) can decrease the growth performance of broiler chickens, but an optimal amount (up to 1 %) results in the inhibition of pathogenic bacteria growth (Hughes et al., 2005).

Adding 0.20% chestnut wood tannin extract can increase growth and reduce mortality in broiler (Schiavone et al., 2008), while 0.5% chestnut wood tannin extract can increase rabbits' weight gain and reduce its mortality, due to tannin's anti-microbial activity (Maertens and Štruklec 2006). Hydrolyzable tannin (HT) content such as castalagin found in chestnut wood extract, has anti-microbial effects against various microbes, such as *Escherichia coli, Bacillus subtilis, Salmonella enteritis, Clostridium perfringens,* and *Staphylococcus aureus* (Schiavone et al., 2008). Therefore, it was hypothesized that the addition of 0.25% chestnut tannin extract in the rabbit ration may improve the performance of New Zealand White rabbits.

MATERIALS AND RESEARCH TOOLS

This research was conducted in the rabbit farm of the Faculty of Animal Husbandry, Padjadjaran University, with an altitude ranging between 725 - 800 m above sea level (asl). The weather conditions include rainfall with an average annual rainfall of 492,64 mm^3, temperatures ranging from 22 to 31 °C, humidity between 60-80%, and wind speeds of 1 - 15 km per hour (BMKG, 2017). This study was conducted in July - August 2021.

Twenty New Zealand White rabbits were used for this research, with an average weight of approximately 700 grams. They were weaned at 2 months of age, and then housed in individual cages with a battery system during the experiment. The ration was given as pellets, and a mixture of several feed ingredients added with tannins from chestnut extract (*Castanea sativa*) at three different concentrations. This feed was formulated as a ready-to-use feed mixture, containing no ingredients other than tannin.

Research Methods

In a Completely Randomized Design (CRD), 20 rabbits were divided into 4 treatment groups, designed as follows: R0 (ration without the addition of tannin extract), R1 (control diet plus 0.25% tannin extract), R2 (control diet plus 0.50% tannin extract), and R3 (control diet plus 0.75% tannin extract), each replicated 5 times. The result data were analyzed with analysis of variance (ANOVA), and Duncan's test was performed to determine the effects between treatments.

Observed Variables

This research observed several variables, including: daily ration consumption, daily protein consumption, daily body weight gain, ration conversion, protein efficiency balance, carcass percentage, carcass meat percentage, carcass bone percentage, and carcass fat percentage.

Table 1. Composition of Control Rations

Feed Ingredients	(%)
Yellow Corn Flour	17.50
Coconut Meal	12.00
Soybean meal	17.00
Fine Rice Bran	11.00
Field Grass Flour	40.00
Molasses	2.00
Dicalcium Phosphate	0.50
Amount	100

Treatment ration: R0 = (Control ration, without added tannin)
R1 = (Control ration added with 0.25% tannin)
R2 = (Control ration added with 0.50% tannin)
R3 = (Control ration added with 0.75% tannin)

Table 2. Nutrient Content of Trial Rations and Rabbit Nutrient Requirements

Feed Ingredient Value	Trial Ration (%)	Rabbit NRC (%)
Crude protein	17,37	15.00
Crude Fat	3.37	3.00
Coarse Fiber	16.58	14.00
Calcium	0.52	0.40
Ash	6,39	8.75
Phosphor	0.26	0.22
Digestible Energy	2789.65	2500.00

Source: National Research Council (1997)

RESULTS AND DISCUSSION

Effect of giving Chestnut Tannin on the measured parameters

The observation results regarding the effect of different chestnut tannin extract levels on rabbit performance are shown in Table 3.

Daily Ration and Protein Consumption.

The analysis of variance indicated that the administration of chestnut tannin extract to the New Zealand White crossbreeds diet had no significant effect on the ration consumption and palatability. Parakkasi (1999) suggested that the variation in rations consumed is often influenced by their smell, taste, and texture. The inclusion of chestnut extract tannins at a level up to 0.75% did not add astringent or bitter taste to feed.

Protein consumption is calculated as the amount of ration consumption (grams) multiplied by the crude protein content (%) contained in the ration. The average protein consumption for the rabbits, with chestnut extract tannins levels up to 0.75%, were 11.76 (R0), 12.25 (R1), 9.64 (R2) and 9.54 grams/head/day (R3), respectively (Table 3). The average protein consumption ranged between 9.54 to 12.25 grams/head/day, indicating that the protein consumption requirements of the rabbits were fulfilled. The addition of chestnut extract tannins to the ration did not significantly affect the protein ration consumed ($p>0.05$). Consequently, fluctuations in protein consumption mirrored those in ration consumption, as protein consumption positively correlates with ration consumption (Cakra *et al.*, 2005).

Body Weight Gain and Ration Conversion

The addition of 0.25% chestnut extract tannins in rabbit rations significantly increased body weight gain in rabbits ($p < 0.05$) (Table 3). The astringent properties of tannin slow down intestinal peristaltic movements, enabling optimal digestion of feed protein with a tannin addition, resulting in the observed body weight gain results. Tannin compounds, characterized by astringency, bitterness, and polyphenol groups, can form protein-tannin complexes, leading to proteins precipitation (Murtini, 2011). The inclusion of 0.25% tannin in the rabbit diet in this research appears to be beneficial as a substitute for natural antibiotics, as it promotes satisfactory growth.

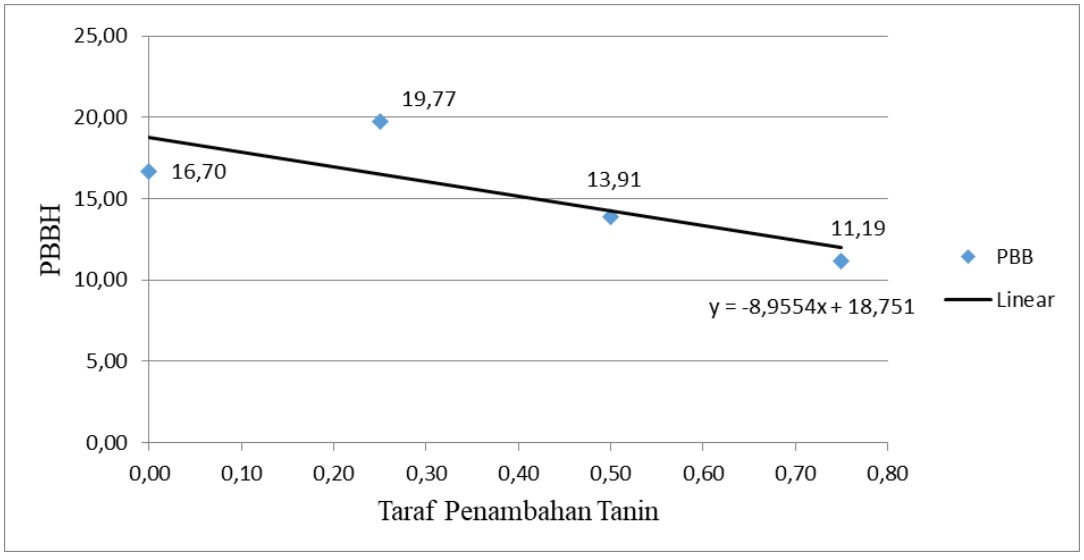
The increase in body weight in rabbits treated with tannin shows a linear pattern (Illustration 1). Higher concentration of chestnut extract tannins decreased rabbit's body weight gain due to the anti-nutritional nature of tannin. Tannin can also forms insoluble protein-tannin complexes that leads to cloudy conditions, precipitation, and inhibition of protease enzyme activity (Djuwadi et al., 1987).

Table 3. Effect of *Chestnut Tannin* on rabbit performance

Parameter	R0	R1	R2	R3	P value
Ration Consumption (g/h/d)	71,30	69,07	59,73	63,64	0,853
Protein Consumption (g/h/d)	11,76	12,25	9,64	9,54	0,336
Body Weight Gain (g/h/d)	**16,01[a]**	**16,88[a]**	**14,37[b]**	**11,57[c]**	**0,002**
Ration Conversion	4,53	4,75	4,18	5,74	0,565
Protein Efficiency Ratio	1,43	1,64	1,48	1,19	0,466
Carcass Percentage (%)	45,30	49,00	45,80	47,80	0,879
Meat Percentage Carcass (%)	62,30	56,60	62,90	59,90	0,592
Bone Percentage Carcass (%)	30,10	34,50	33,30	34,60	0,707
Fat Percentage Carcass (%)	0,93	1,91	1,34	1,81	0,139

Description: R0 = Without additional treatment
R1 = Addition of 0.25% chestnut tannin
R2 = Addition of 0.50% chestnut tannin
R3 = Addition of 0.75% chestnut tannin

Illustration 1. Linear Equation for Daily Body Weight Gain Due to Addition of Tannins in Rabbit Rations.



Tannin extract did not significantly affect feed conversion in rabbits (Table 3). The average feed conversion in this study was higher than what recommended by McNitt (1996) and de Blass and Wiseman (1998), who stated that good ration conversion for rabbits is in the range of 3.0 to 4.0. This higher conversion may also be attributed to the introduction of anti-nutrient tannin during this research, which decreased the feed nutrients quality.

Protein Efficiency Balance

Protein efficiency balance (IEP) refers to how much dietary protein consumption is converted into body weight gain. The proteins efficiency ratio of the treated rabbits with an extent of 0.75% chestnut extract tannins on their diet did not show significant different ($p>0.05$). The addition of chestnut extract tannins in the rabbit diet has other benefits, namely that it can improve the health of the digestive tract, especially in the intestines, because *c*hestnut extract tannins contain ellagitannins. Ellagitannin can inhibit the formation of active oxygen as a cause of oxidation (Okuda et al., 1992). The intestinal health of livestock can be improved by adding chestnut wood extract to the treatment diet (Gai et al., 2010).

Percentage and Carcass Components

A rabbit carcass constitutes of several separate parts of its body, starting from the head, toes, skin, tail, and innards, except the kidneys. The carcass percentage and components of the rabbits in this study are shown in Table 3. carcass percentage is defined as the comparison of weights carcass by weight cut. Kartadisastra (1997) stated that good rabbit carcass percentage ranges between 40-52% of live weight, indicating that tannin extract addition results in a good carcasses percentage (average carcass percentage of45.3 – 49.1%). There was no significant effect of adding tannins to the rabbit ration on the carcass percentage and components. This insignificant result might be caused by the chestnut extract tannins dose being too high for monogastric animals, interfering on its digestion system. Although it was expected that this addition reduces damage to the intestinal mucosa from pathogenic bacteria and diarrheal diseases (Tobacco *et al.*, 2006), the opposite could happen. Digestive tract inflammation can be caused by excessive consumption of tannin resulting in absorption nutrition becoming not optimal, and the nutritional needs of livestock that are not fulfilled can influence growth carcass. That's also appropriate with the statement by Mueller *et al*. (2006) that giving high doses of tannin to rabbits might causes hypersecretion of mucin from the stomach and duodenum.

Inhibition of carcass formation in rabbits could be the influence of chestnut extract tannins, which contain anti-nutritional substances. Ambula *et al.* (2001) stated that tannin in diet can suppresses growth and decreases protein digestibility into amino acids, important components used for carcass formation. Liu *et al.* (2009) also observed that adding tannins to rabbit ration did not affect the carcass percentage and hot carcass dressing. In this research, the role of tannin from a chestnut extract in the ration is as a feed additive in the form of herbal antibiotics as a substitute for chemical antibiotics in the ration and functions to prevent diarrhea due to stress during the weaning period.

The anti-nutrient tannins contained in the ration might affect the meat carcass percentage. Tannins bind with proteins in the digestive tract, resulting in the coating of intestinal walls and compacting the mucus layer. This process hampers the digestion and absorption of feed necessary for meat formation (Gai et al., 2009). The bitter taste caused by tannins will result in suboptimal ration consumption.

The analysis results indicated no significant effect of tannin extract on bones percentage. this assumption arose because the development of rabbit bones was close to optimum and had reached the peak of its growth, so the treatment could not have a significant effect. Bones are essential for livestock growth because bones, muscle, and fat development determine body conformation. High concentrations of tannin can harm the digestive tract due to reduced nutrient digestibility, accompanied by inhibited enzyme activity in the digestive tract, and can indirectly affect the process of bone formation. Makkar's statement (2003) supports that tannins form complex bonds with amino acids, polysaccharides, ions, vitamins, bacterial cell membranes, and enzymes involved in the digestion of proteins and carbohydrates. The bone structure consists of organic and inorganic materials, of which the organic material of bone

consists of ossein (proteins) that can produce gelatin if heated in water.

Fat is an important source of energy for the body. Farrell *et al.* (1984) explained that fat formation is caused by excess energy from consumed rations. Fat develops in rabbits after they are over three months old, when their body weight reaches around 1.5-2.0 kg. Adding chestnut extract tannin in rabbit rations had no significant effect on the fat percentage of carcass. Usually, after maturity, there will be changes in the growth of carcass components because the condition of the bones has begun to stabilize, and fat will increase body fast. This research used young rabbits (2 months old), hence the small amounts of carcass fat. that carcass fat produced from rabbits slaughtered at a young age (<4 months) yields less meat compared to older rabbits (Hernandez *et al.*, 2004).

CONCLUSIONS AND SUGGESTIONS

Conclusion

a. The addition of 0.75% tannins from a chestnut extract in rabbit rations influences weight gain, but is not effective on daily feed consumption, daily protein consumption, feed conversion, protein efficiency balance, carcass percentage, carcass meat percentage, carcass bone percentage, and carcass fat percentage.
b. Providing 0.25% of tannins from chestnut extract in rabbit rations can substitute natural antibiotics in rabbit rations during the fattening period.

Suggestion

Rabbit breeders can provide tannin as feed additive to prevent diarrhea and maintain intestinal health without affecting rabbits' growth.

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