ASSESSMENT OF SUPPLEMENTARY FEEDING OF LEAF MEALS OF *TRICHANTHERA GIGANTEA* ON GROWTH PERFORMANCE IN BARBADOS BLACKBELLY SHEEP

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CERTIFICATION

This is to certify that we have read this research paper entitled **'Assessment of Supplementary Feeding of Leaf Meals of *Trichanthera gigantea* on growth performance in Barbados Blackbelly sheep'** by Wan Ahmad Syafiq Bin Wan Salman, and in our opinion, it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course DVT 5436 – Research Project.

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Thank You

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ABBREVIATION

Ca	-	Calcium
CF	-	Crude fibre
CP	-	Crude protein
DM	-	Dry matter
EE	-	Ether extract
NDF	-	Neutral detergent fibre
P	-	Phosphorus

ABSTRACT

An abstract of a research paper presented to the Faculty of Veterinary Medicine, Universiti Malaysia Kelantan, as part of the course DVT 5436 - Research Project, as a partial requirement.

There is presently little evidence about the advantages of rising the proportion of *Trichanthera gigantea* leaves in the grass-based diets of lambs raised in Malaysia's tropical climate. *T. gigantea* have the potential to substitute other fodder tree leaves in terms of growth performance. Six Barbados Blackbelly ewe lambs aged 3-4 months were divided into 2 different groups (n = 3 ewe lambs in each group). For Group 1, animals were provided only chopped grass forage, *Pennisetum purpureum* only. For group 2, the feed of the animals consisted of chopped *Pennisetum purpureum* (1000 g for each animal) and chopped dried *T. gigantea* leaf (200 g for each animal) daily in the following ratios (*T. gigantea* leaves: chopped napier grasses, 17:83). Over the course of eleven days, daily measurements of total body mass were taken. Before starting the feeding process, the initial weight of the sheep was recorded. For observation purposes, the weight of the sheep (kg), and the amount of feed given (kg) were taken or recorded every day to see the progression. After 21 days, the final weight of the sheep was recorded to evaluate the weight. Overall, there was no significant difference in the intakes of *T. gigantea* leaves ($P>0.05$). While level of *T. gigantea* leaves fed to lambs did not generally affect total intakes of grass. Animal performance on this feed cannot be assumed to be similar until longer-term feeding studies have been performed, as level of leaf in the diet just increased.

Keywords: *Trichanthera gigantea, Barbados Blackbelly sheep.*

ABSTRAK

Abstrak daripada kertas penyelidikan dikemukakan kepada Fakulti Perubatan Veterinar, Universiti Malaysia Kelantan untuk memenuhi sebahagian daripada keperluan kursus DVT 5436 – Projek Penyelidikan.

Buat masa kini, terdapat sedikit bukti tentang kelebihan meningkatkan meningkatkan perkadaran daun *T. gigantea* dalam diet ternakan yang diberikan kepada bebiri yang diternak di iklim tropika Malaysia. Enam ekor kambing betina Barbados Blackbelly berumur 3-4 bulan dibahagikan kepada 2 kumpulan berbeza (n=3 ekor kambing betina dalam setiap kumpulan). Bagi Kumpulan 1, haiwan hanya diberi makan rumput cincang, *Pennisetum purpureum* sahaja. Untuk kumpulan 2, haiwan telah diberikan diet *Pennisetum purpureum* yang dicincang (1000 g untuk setiap haiwan) dan daun *T. gigantea* kering yang dicincang (200 g untuk setiap haiwan) setiap hari dalam nisbah berikut (daun *T. gigantea* : rumput napier yang dicincang, 17:83). Jumlah berat badan diukur pada penghujung setiap hari dalam tempoh 11 hari. Sebelum memulakan proses memberi makan, berat awal biri-biri direkodkan. Untuk tujuan pemerhatian, berat biri-biri (kg), dan jumlah makanan yang diberi (kg) diambil atau direkodkan setiap hari untuk melihat perkembangan. Selepas 21 hari, berat akhir biri-biri direkodkan untuk menilai berat. Secara keseluruhan, tidak terdapat perbezaan yang signifikan dalam pengambilan daun *T. gigantea* ($P>0.05$). Walaupun tahap daun *T. gigantea* yang diberi makan kepada kambing biri-biri secara amnya tidak menjejaskan jumlah pengambilan rumput. Prestasi haiwan ini tidak boleh diandaikan sama sekali sehingga kajian pemakanan jangka panjang telah dilakukan kerana tahap daun dalam pelet baru meningkat.

Kata kunci: *Trichanthera gigantea, Bebiri Barbados Blackbelly.*

1.0 Introduction

Trichanthera gigantea is one of the protein-rich foliage widely distributed in humid tropical regions, which the leaves and twigs are used as livestock feed during drought and feed scarcity. Studies conducted on the effect of feeding *T. gigantea* leaves have revealed variable response indifferent livestock species (Balraj *et al.,* 2018).

T. gigantea is a tree belonging to the Acanthaceae family and it is native to Colombia's Andean foothills. However, it is also found near rivers and in wetlands from Costa Rica to northern South America, as well as in wet forests from Central America to Peru and the Amazon basin. *T. gigantea* has been utilised in animal feed with mixed results, possibly because of the lack of knowledge about its nutritional value (Rosales, 1997).

It's an excellent fodder tree for a variety of environments. Its geographic range has been recorded as ranging from 0 to 2,000 metres above sea level, 800 to 1,600 metres above sea level, and 500 to 1,800 metres above sea level. It is well adapted to the humid tropics with annual rainfall ranging from 1,000 to 2,800 mm, but it has been observed growing in the Cocho region with annual rainfall ranging from 5,000 to 8,000 mm/year. It thrives on acidic (pH 4.5) and low-fertility soils with good drainage. It's commonly seen around streams and springs (Rosales, 1997).

The nutritional content of pastures declines rapidly as they mature, and the available feed is lignified throughout the dry season. The chemical makeup and degradability of any feedstuff, as well as the forage and its habitat, determine its nutritional value.

Several investigations on the agronomy and production of *T. gigantea* as well as their use in ruminant animals have been done. The nutritional value of these plants' leaves in sheep, on the other hand, is unknown (Ly *et al.*, 2004).

As a response, the aim of this research is to begin to understand how substituting *T. gigantea* leaves for supplement feed could boost growth of sheep and reduce reliance on other commercial supplements.

2.0 Research Problem

In the past two decades, due to a sharp decline in agricultural activities and crop production, the livestock sector's dependence on imported corn-soybean meal-based diets has increased, leading to increased cost of livestock production. Therefore, finding alternative feed resources as supplements and improving their utilization as partial substitutes for imported feed ingredients is an emerging necessity to keep the livestock sector economically viable and sustainable. Although *T. gigantea* leaves feeding to ruminant livestock under drought and food scarcity is a practice, studies to assess its potential as a supplement for commercial sheep ration are too few (Balraj *et al.,* 2018). There is a considerable potential to develop feeding strategies based on strategic supplementation that result in 'enhanced' nutritive value. The suggested mechanisms of the associative effects reported in the literature may not be the same for fodder tree leaves as they are chemically more complex than hays and silages.

3.0 Research Questions

3.1 Does the *T. gigantea* have a high nutritional content as compared to other fodder tree leaves in Malaysia?

3.2 Does *T. gigantea* have the potential to substitute other fodder tree leaves in terms of growth performance?

4.0 Research Hypothesis

4.1 The nutritional value *T. gigantea* does not have a potential dietary supplement in the diet of sheep.

4.2 The *T. gigantea* leaves have an effect on the growth performance of sheep when used as a dietary supplement.

5.0 Research Objectives

The major objective of this research is to explore the use of *T. gigantea* leaves as sheep diet supplement. Thus, the study's particular goals were as follows;

5.1 To study the effect of *T. gigantea* as a potential feed supplement in growth performance of sheep.

6.0 Literature Review

6.1 Distribution and Growth Condition of *T. gigantea*

T. gigantea may be farmed at altitudes ranging from sea level to 2,000 metres. It thrives on a broad variety of soils, including ones with a pH as low as 4.5 that are acidic and unproductive. *T. gigantea* thrives in regions with high average temperatures (about 30°C) and yearly precipitation between 1500 and 3000 mm. It may flourish in areas with less rainfall (1000 mm), but sheds its leaves during dry spells. It can withstand significantly greater precipitation (5000-8000 mm) if the soil is well-drained (Tran *et al*., 2016).

6.2 Chemical Composition and Nutritive Value of *T. gigantea*

Table 1 summarises the *T. gigantea* leaves and stems chemical composition. The thin stems are included since the animals eat them as well. The crude protein content of the leaves fluctuates between 15 and 22 percent, with the majority of it being genuine protein. When compared to other fodder trees, the calcium content has been determined to be unusually high. The presence of cystoliths in the leaves, which are characteristic of the Acanthaceae family, can explain this. This could explain why Colombian campesinos utilise *T. gigantea* as a lactogenic drink, and it suggests that the plant has a lot of potential for nourishing lactating animals (Rosales, 1997).

T. gigantea had no alkaloids or condensed tannins, and the saponin and steroid levels were low in a qualitative screening test (biochemical preliminary test) for anti-nutritional substances. Total phenols and steroids were determined to include 450 ppm and 0.062 percent, respectively, in additional, more precise testing (Rosales, 1997). *T.*

gigantea 's nutritional value has lately been thoroughly characterised. Table 1 shows the results.

When compared to other fodder trees and shrubs, this plant possessed the highest quantities of water-soluble carbohydrates, total and reducing sugars in its carbohydrate component. It also included an unusually high proportion of starch, with its neutral detergent fibre being the lowest. The superior biological effects seen with monogastric may be explained by the high amounts of non-structural and storage carbs mixed with the low levels of structural carbohydrates. Table 3 only shows the presence of phenols with a high ability to react with protein. There were no condensed tannins found (tests included a characterisation of phenolic peaks by means of a spectrophotometer). This suggests that the tannins found in *T. gigantea* are hydrolysable.

As seen in Table 1, the protein in the leaves has an excellent amino acid balance.

Table 1 T. gigantea chemical composition (g/kg)

DM	Crude Protein	True Protein	Ash	Crude Fibre	NDF	Ca	P	K	Mg	Total phenols (ppm)
	Leaves									
-	152.5	-	-	-	-	38.0	2.6	31.8	11.4	450a
	200	179.3	--	-	- 23.4		3.7	37.6	7.5	- b
-	166.2	141.3	167	167	-	-	-	-	-	-b
-	150.9	-	-	-	-	-	-	-	-	22,200c

224	169.3	-	-	-	-	24.0	3.8	24.2	9.0	50,288 d
269	225.0	-	171	-	297	-	-	-	-	- e
-	182.0	-	199	183	-	43.0	9.2	-	-	- f
	Leaves and Young Stems									
191	223.0	-	220	440	-	-	-	-	-	- e
	Stems									
-	11.9	-	313	300	-	64.0	2.1	-	-	- f
	Thin Stems									
170	86.7	-	-	-	-	26.1	4.2	69.6	7.2	- b
	Thick Stems									
270	46.25	-	-	-	-	21.9	3.6	38.0	4.8	- b

Sources: (Rosales, 1997).

Table 2 T. gigantea chemical composition (g/kg) (on the basis of dry matter).

Crude protein	178.2
Water soluble protein	35.4
Soluble protein as % of crude protein	19.8
Water soluble carbohydrates	43.2

Starch	248.2
Total sugars	170.1
Reducing sugars	91.6
Cell walls (NDF)	294.1
Lignocellulose (ADF)	217.6
Ether extract	31.2
Organic matter	804.1
Protein precipitation activity (cm2/g)	323.5
Condensed tannins (optical density/g)	0
Total phenols (optical density/g)	208.8

Source**:** (Rosales, 1997).

6.3 Barbados Blackbelly Sheep as Animal Model

The Barbados Blackbelly sheep (BB) is a Caribbean sheep breed that gets its name from the Caribbean Island of Barbados. Crosses of African hair sheep and European wooled sheep are considered to have produced it. BB sheep are noted for their tropical adaptation, high reproductive efficiency, year-round breeding ability, lean and mild-flavoured meat, and illness and parasite tolerance. BB sheep were introduced directly from Barbados into Malaysia in the early 1990s and are popular among Malaysian sheep breeders and farmers (Mohd Adhan et al., 2009). The Barbados Blackbelly sheep is suitable to be used as animal model due to Barbados Blackbelly sheep

characteristic of being able to produce meat efficiently in a challenging tropical environment.

The nose of BB sheep is typical of "Roman" sheep. The insides of the ears are black and pointy. A large black marking runs down each side of the animal from the tip of the nose to the crown of the head. The legs are long and straight. The tail is lengthy and reaches all the way to the tops of the hocks. The hair coat on the specimens is usually coarse. The underside is black, and the body colour ranges from pale fawn to reddish brown (Mohd Adhan *et al.,* 2009).

6.4 Influence of *T. gigantea* on Growth Performance

Sheep production has recently increased, primarily to supply the growing demand for fresh meat for personal consumption and to provide additional money to farmers. *T. gigantea* has a high non-structural and storage carbohydrate content while having a low structural carbohydrate content, resulting in high rumen degradability (Rosales & Rios, 1999). *T. gigantea* also possesses cystoliths on its leaf and stem surfaces, which result in a high ash content and a high calcium content (usually greater than 20% DM). In the tropics, where mineral shortages in tropical grasslands are common, the greater ash concentration could be employed to boost mineral concentrations in cattle feeds (Jack *et al.,* 2021).

7.0 Materials and Methods

7.1 Production of *T. gigantea*

7.1.1 Sample collection

The leaves of the *T. gigantea* were acquired from the farmers who were growing the fodder in Bachok, Kelantan. The leaves were purchased every seven days for 21 days.

7.1.2 Harvesting

T. gigantea leaves were collected 3 days prior to the study period from the plantation. To have the best feed quality and dry matter output, harvesting should be done as often as possible. Forage regrows slowly in the first few days after cutting because it has few leaves to photosynthesize and relies heavily on root reserves. This is followed by a few weeks of rapid growth and high-quality feed output. Plants create more lignin and the digestibility of leaves and young stems decreases when left uncut for lengthy periods of time.

7.1.3 Processing

To remove the moisture, the *T. gigantea* leaves were dried in the sun. *T. gigantea* leaves were dried for a set period of time to speed up the drying process. After the *T. gigantea* leaves were gathered, a chopper machine was used to chop.

7.2 Evaluation of growth performance of Barbados Blackbelly sheep

An experiment with sheep was carried out in Casa Salina Farm, Ketereh, Kota Bharu, Kelantan (Appendix B:1). All animal handling and procedures were approved by the UMK Animal Care and Use Ethics Committee (UMK/FPV/ACUE/FYP/010/2022).

The same 6 ewe lambs of Barbados Blackbelly, aged 3-4 months, were used in both Group 1 and Group 2 (Group 1 is control and Group 2 is experimental) to measure the body weight gained of intake of the supplement diets of *T. gigantea* leaves.

The experiment was conducted for 21 days (2 days as adaptation period, and 19 days as growth trial) using six ewe lambs of Barbados Blackbelly sheep. All lambs were kept to well-ventilated individual pens (1.22 x 1.22 m) and had unlimited access to water during the trial.

The initial average body weight of sheep consisting of Group 1 was 30.17 ± 5.83 kg and Group 2 was 24.83 ± 3.57 kg were recorded. The study was held in a farm, Casa Salina Farm that is located in Ketereh, Kota Bharu, Kelantan. Two groups of sheep that consist of three (3) sheep in each group from that farm were needed to evaluate the growth performance based on feed given. A total of 6 ewes were randomly divided into 2 groups as follows (n = 3 ewe lambs in each group). Group 1 is a negative control consists of the sheep which was fed with chopped grass forage, *Pennisetum purpureum* only and without *T. gigantea* leaves while group B consists of the sheep which was fed with chopped *Pennisetum purpureum* and *T. gigantea* leaves. Before starting the feeding process, the initial weight of the sheep was recorded. Then, the group B of sheep was fed with that type of feed for 21 days. For observation purposes, the weight of the sheep (kg), and the amount of feed given (kg) were taken or recorded every day to see the progression. After 21 days, the final weight of the sheep was recorded to evaluate the weight.

All the animals were fed twice daily at 09:00 h and 19:00 h. For Group 1, animals were provided only chopped grass forage, *Pennisetum purpureum* only. For group 2, animals were assigned to a diet of chopped *Pennisetum purpureum* (1000 g for each

animal) and chopped dried *T. gigantea* leaf (200 g for each animal) per day in the following ratios (*T. gigantea* leaves: chopped napier grasses, 17:83). Total forage offered and refused for each animal were recorded daily to calculate intake of each component of the diet. All the information of the schedule to feed and type of feed that have been given to Group 1 and 2 of ewe lambs are stated in Table 3.

Table 3 The schedule to feed (hour) and type of feed for Group 1 and 2 of ewe lambs.

Schedule to feed (hour)	Type of feed	Group of ewe lambs	
		1	2
09:00	Chopped *Pennisetum purpureum*	600 g	500 g
	Chopped dried *T. gigantea* leaves	-	100 g
19:00	Chopped *Pennisetum purpureum*	600 g	500 g
	Chopped dried *T. gigantea* leaves	-	100 g

7.3 Statistical Analysis

Independent T test was used to analyse the input in order to determine the effect of diet given to the growth performance of Barbados Blackbelly sheep. The data will be statistically analysed by using Statistical Package for Social Science (SPSS) software version 26.

8.0 Results

8.1 Evaluation of growth performance of Barbados Blackbelly sheep

Body weight of the sheep were taken at Day 0 before the animals were fed with specific diets. The amount of feed to be given to sheep was calculated during this experiment. The growth performance of body weight of sheep including initial, day 11 and final body weight, total weight and daily weight gain were presented in table 2.

Table 4 Growth performance of sheep between control and experimental group

Parameter	Group		*p*-value
	1	2	
Initial body weight (kg)	30.17 ± 5.83	24.83 ± 3.57	0.215
Day 11 body weight (kg)	30.67 ± 5.83	25.33 ± 3.67	0.215
Final body weight (kg)	31.10 ± 5.1	26.50 ± 3.5	0.267
Total weight gain (kg)	0.93 ± 10.2	1.67 ± 19.7	0.267
Daily weight gain (kg)	0.04 ± 0.5	0.07 ± 1.0	0.277

9.0 Discussion

The type of feed offered had no effect on the sheep's average body weight ($p>0.05$). In comparison to group 1 which is control group with the group 2 which were provided with the *T. gigantea* leaves as supplement feed had a higher body weight on day 15, and a higher end weight. This could be owing to the fact that diet has effect on the sheep's dry matter (DM) intake. The typical weight of 3–4-month-old Barbados Blackbelly sheep breed in Malaysia is around 20-35 kg. In this project, both groups achieved normal average body weight. This could be related to the fact that during the growth phase, ad libitum amounts of feed were supplied. During the growing phase, 3–4-month-old sheep in the post-weaning phase require a lot of crude fibre (CF) and crude protein (CP).

The results from this study showed a slight increase in body weight. This can be attributed to several factors such as duration of feed intake is too short and the dry matter of the *Pennisetum purpureum* that have been provided is the same compared to *T. gigantea* dry matter. Therefore, the feed supplementation and utilization by the animal in each group is not at optimum level.

The average total weight gain and daily weight gain sheep were not significant ($p>0.05$) by the type of diet given. This result may be due to there were no significant difference of nutritive value of diets consists of crude protein (CP), crude fibre (CF), ether extract (EE) and neutral detergent fibre (NDF) in the *T. gigantea* leaves and the napier grasses that are given daily. In addition, the leaves have slightly high in CP, CF, EE and NDF compared to napier grasses. This result showed that the *T. gigantea* leaves can be substituted as an alternative feed to sheep or other small ruminants.

10.0 Conclusion

In conclusion, feeding the sheep with green forage only, the napier grasses and combination of *T. gigantea* leaves and green forage, the napier grasses showed almost similar results. Adding the *T. gigantea* leaves as a supplement feed does not have any adverse effect on growth performance but will cause slightly increase of body weight of sheep.

11.0 Recommendations and Future Work

Several limitations were observed during this project. For future study, it is wise to plant the *T. gigantea* plants in large scale due to difficulty to get the leaves. Secondly, this study can be improved by increase the number of animals used (n=20) to produce significant result on growth performance. In addition, the duration of experimental study on animal also should be extend at least three months to produce meaningful results on growth performance based on type of diet given. This due to short period of time does not give impact on growth performance of Barbados Blackbelly sheep breed.

Appendices

Appendix 1 T. gigantea leaves was obtained from local farmers

Appendix 2 T. gigantea leaves were weighed before chopped

Appendix 3 Experimental design was carried out in Casa Salina Farm

Appendix 4 Group B was fed with chopped T. gigantea leaves

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