Effects of physical pretreated oil palm frond on body weight and feed convertion ratio of the Boer goats

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Thesis Declaration

I hereby declare that the work embodied in this report is the result of the original research and has not been submitted for a higher degree to any universities or institutions. Zaid Ahmad B. Mohd Zamri, F14A0418, 29/9/2017. I certify that the report of this final year project entitled Effects of combination physical pretreated oil palm fronds on body weight and feed conversion ratio of the Boer goats by Zaid Ahmad, F14A0418 has been examined and all the correction recommended by examiners have been done for the degree of Bachelor of Applied Science (Agriculture Technology) with Honours, Faculty of Agro-Based Industry, Universiti Malaysia Kelantan

Approved by

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Mrs Nor Dini Rusli

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Abstract

Ruminant livestock production in tropical country such as Malaysia has lack of grazing pasture and difficulty to provide feed with sufficient quantities and nutrient through the years. This makes the feed cost at the market is expensive. Oil palm frond (OPF) has been used as one of the alternative biomasses for animal feed because it's low cost and readily available daily. However, OPF cannot be fed solely due to its poor nutrition content and low digestibility. OPF also contains high lignocellulosic content. Thus, OPF has to be pretreated to improve its nutrition contents. The objective of this study is to evaluate the physical pretreatment of OPF on body weight (BW), body score condition (BCS) and the feed conversion ratio of the goat. The OPF were collected and transported to the Agro Technopark, UMK Campus Jeli, Kelantan. The whole OPF underwent physical pretreatment by pressing OPF using sugarcane machine. The goats were divided into three group; control group (70% Napier grass, 30% pellet) treatments 1 (50% Napier grass, 30% pellete, 20% chopped OPF) and treatment 2 (50% Napier grass, 30% pellete, 20% pressed OPF) for 168 days. All groups were fed with napier grass and commercial goat pellet to make it isonitrogenous. For performance evaluation, the goats were weighed for every two weeks while the body condition score assessed once per month. Based on the finding, T1 and T2 groups show high significantly ($p<0.05$) different than control group. This shows that OPF give positive affect to the body weight gain of Boer goat. In addition, the average daily gain and feed conversion ratio in physically pressed OPF group was higher than chopped OPF and napier grass treatment.

Keywords: Oil Palm Frond (OPF), Body weight (BW), Body score condition(BCS)

Kesan kelapa sawit pretreated fizikal pada berat badan dan nisbah penukaran makanan pada kambing Boer

Abstrak

Pengeluaran ternakan ruminant di negara tropika seperti Malaysia mempunyai kekurangan rumput padang rumput dan sukar untuk menyediakan makanan dengan jumlah yang mencukupi dan nutrien sepanjang tahun. Ini menjadikan kos umpan di pasaran mahal. Kembang kelapa sawit (OPF) telah digunakan sebagai salah satu biomassa alternatif untuk makanan haiwan kerana ia adalah kos rendah dan tersedia setiap hari. Walau bagaimanapun, OPF tidak boleh dimakan semata-mata kerana kandungan nutrien yang kurang baik dan penghadaman yang rendah. OPF juga mengandungi kandungan lignoselulosa yang tinggi. Oleh itu, OPF perlu dipersiapkan untuk memperbaiki kandungan pemakanannya. Objektif kajian ini adalah untuk menilai pretreatment fizikal OPF pada berat badan (BW), keadaan skor badan (BCS) dan nisbah penukaran makanan kambing. OPF dikumpulkan dan diangkut ke Agro Technopark, Kampus UMK Jeli, Kelantan. Keseluruhan OPF menjalani pretreatment fizikal dengan menekan OPF menggunakan mesin tebu. Kambing terbahagi kepada tiga kumpulan; (50% rumput Napier, 30% pellet, 20% cincang OPF) dan rawatan 2 (50% rumput Napier, 30% pellet, 20% ditekan OPF) selama 168 hari . Semua kumpulan diberi makan rumput napier dan pelet kambing komersil untuk menjadikannya isonitrogenous. Untuk penilaian prestasi, kambing ditimbang untuk setiap dua minggu manakala skor keadaan badan dinilai sekali sebulan. Berdasarkan penemuan, kumpulan T1 dan T2 menunjukkan tinggi ($p < 0.05$) yang berbeza daripada kumpulan kawalan. Ini menunjukkan bahawa OPF memberi kesan yang positif kepada kenaikan berat badan Boer kambing. Selain itu, nisbah purata harian dan nisbah penukaran makanan dalam kumpulan OPF secara fizikal adalah lebih tinggi daripada OPF cincang dan rawatan rumput napier

Kata Kunci : Pelepah Kelapa Sawit (OPF), Berat Badan (BW), Skor Badan (BCS)

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OPF	Oil Palm Frond
BW	Body Weight
BCS	Body Condition Score
ADG	Average Daily Gain
FCR	Feed Conversion Ratio
°C	Degree Celcius
%	Percentage
>	More than
<	Less than

CHAPTER 1

1.0 Introduction

Ruminant livestock production in tropical country such as Malaysia has lack of grazing pasture and lack of feed with sufficient quantities and nutrient through the years. The utilization of available indigenous material or agricultural byproduct resources has become the alternative way for feed production and livestock production. The OPF is one of agricultural byproduct resources that can be used as animal feed. Malaysia produce high amount of OPF which is 90 milion tonnes per year (Ebrahimi *et* al., 2013). OPF can be a great nutrient material and potential as source of roughage for ruminant (Dahlan, Islam, & Rajion, 2000).

Branches, stems, and leaves of oil palm tree are rich in fibre (Ebrahimi *et* al., 2013). However, OPF have low metabolism energy value as well low in crude protein. Therefore, high proportion of OPF to the feeds or into ruminant diet would negatively affect the production but it can level up to 50 and 30% in beef and dairy rations (Dahlan *et* al., 2000). OPF might have an added value in relation to fat metabolism apart from the relatively poor macronutrient. There several pretreatment techniques to improve the feed for example using urea and molasses, alkali treatment, pelletizing and enzymatic degradation (Wan Zahari & Wong, 2009).

Goat are important meat producing animals in the tropics and people who consume goat meat has been increasing through year. Goat meat and dairy is rich in Saturated Fatty Acids (SFA) that could give negative effect to the human health. The increase of OPF proportions will increase the polyunsaturated fatty acid (PUFA) in sheep plasma (Dahlan *et* al., 2000). Thus, the OPF feed might increase the enrichment of adipose tissue with PUFA and improve the human health. In Malaysia, there is no information on physical pretreated OPF or pressed OPF fibre on goat feeding and goats performance. Hence, this current study was conducted to evaluate the effect of physical pretreatment of OPF on body weight and feed conversion ratio (FCR) on Boer goats.

1.1 Problem Statement

Feed consumption is very important to the Boer goat production. Without the proper balance of diet would affect the result record and goat performance. Next, the cost of feed that sold in the market is expensive. The alternative way to reduce the feed cost is by using agricultural byproduct which is OPF for ruminant feedstuff. OPF was selected because it easily available and palatable. However, OPF can't be used as sole feedstuff because OPF have low nutritional such as metabolism energy and crude protein with high lignin and low digestibility. This will reduce the rumen degradability of the livestock animals. In Agro Technopark, the goat's body condition score is not in the optimal stage through the observation.

1.2 Hypothesis

It was expected that average body weight gain (AVG) of goats in experimental groups are higher than AVG in control goat. Therefore, this study is also hypothesised the higher AVG, the lower feed conversion ratio (FCR), indicating better dry matter intake utilisation.

1.3 Objective of study

The objective of this study were :

1- To evaluate the effect of physical pre-treatment of OPF on the body weight, and body condition score of goats
2- To evaluate the effect of combination pre-treatment of OPF on the feed conversion ratio of goats

1.4 Significant of study

In this study, the body condition of 3 group of boer goats at the Agropark farm were assessed as the indicator of feed by management. The study evaluated the effect of OPF on the goat performance. The parameters of goats performance used are body weight gain, body condition score and feed conversion ratio of goats.

1.5 Scope of study

Twelve Boer goat from small ruminant farm at Agro Technopark UMK Campus Jeli and the use of OPF in the goat diet

CHAPTER 2

2.0 Literature Review

2.1 Current issues on the use of agriculture by-products as animal feed

The Malaysia livestock industry has not make improvement in the last two decades. The local beef industry and livestock industry failed to meet growing demand due to the perception of high domestic resource cost (Ministry of Agriculture, 1992). Ninety percent (90%) of the livestock industry or farm are traditional small farmers with scattered and poorly organized farm (Gabdo & Abdlatif, 2013). The high cost can be reduced by making cattle production under palm oil that will increase intensity of land or maximization the use of land, reduce the cost of oil palm maintenance and ensuring higher returns for both joint oil palm and livestock enterprise (Latif and Mamat, 2002). Furthermore, the cattle oil palm integration may save the economy by foreign exchange.

Roughage such as fresh cut grass, fresh cut maize, maize silage and rice straw is the main feed for livestock. Rumen pH will slightly increase when roughage is subsequently fed. This will cause fluctuation in rumen pH and reduce microbial activity. Complete feed and total mixed ration cause a slightly increase of rumen pH. Combination of roughage with concentrates will make the feed well balance diet. Bagasse, cassava chip, extracted rice bran meal, molasses, brewers' grain and soya meals is the selected ingredient in agricultural by-products. This ingredient has high potential that improve aerobic shelf-life to use as feed (Lounglawan, Khungaew, & Suksombat, 2011).

The growth of ruminant sector is massive important of feed. Malaysia is highly dependent on feed imports especially for non-ruminant and aquaculture. Maize and soya bean meal are the main important feed of energy and protein. The dependence of imported feed will causes price fluctuations and high cost production. Other than that, the rapid increase in global oil prices led to shortages of feed supply and high feed prices. World global warming also give negative impact on grain production. Researchers intensify to look for alternatives and substitute feed in poultry and ruminant rations to reduce the burden of feed imports. The researchers have found the availability nutritive content, optimal inclusion levels and treatment method to enhance nutrient value of many locally available feed ingredients in practical. Feed rice, palm kernel cake (PKC), broken rice, bran, sorghum, cassava, sago, fishmeal and commercial gain corn is the list as alternatives and substitute of feed. PKC, feed rice, local maize and others has potential to be viable feed energy but local fish meal have high protein feed source and it maximizing use of locally available agro-industrial by products and crop residues for the production of cost effective feeds. Agro-industrial by products and crop residues from the oil palm and rice industries supply is highly dependent for local feed resources. Development of practical and low cost feeds by utilizing local forages, tree folders, crop residues and agro-industrial by product is used for maximum and strengthened the local feed production.

2.2 OPF as animal feed

The oil palm industry has become the backbone of Malaysia economic and social development. The oil palm industry rapidly develop due to high global demand for palm oil, oleo-chemicals and biodiesel. Oil palm fronds (OPF), oil palm trunks (OPT), palm press fibre (PPF), empty fruit bunches (EFB), palm kernel cake (PKC) and palm oil mill effluent (POME) is one of example of oil palm industry that can be utilized as animal feed (Ramli et. al., 2010). OPF has been successfully utilized as feedstuffs such as silage or process into pellets and cubes. Oil palm products can fulfil the level of inclusion for ruminant feeding and digestibility can be further increase. OPF available to obtain during harvesting or pruning and felling of palms every years. OPF always became major resource material for extraction of vitamin E, paper pulp and animal feed. The large quantity of oil palm fronds make large amount source of roughage for ruminants. There were three main components in OPF which is petiole, rachis and leaflets. Most of DM in OPF can be obtain from the petiole and some from the leaves and rachis. The leaves contain more crude protein (CP) and ether extract (EE) than the petioles. The amount percentages of hemicellulose is depend on the age of the OPF. OPF could feed directly to ruminant if the degradability value is 40% or more at 48 hours incubation. However, there should have some improvement the nutrition value to increase the degradability level. Urea and molasses treatments, preservation as silage, alkali treatment, steaming under high temperature and high pressure, pelletizing and enzymatic degradation are one of several techniques to improve the feeding qualities of OPF. Treatment OPF of urea and molasses can achieve the maintenance requirements of ruminants for energy and protein, and dry matter intake and digestibility. Steaming under high temperature and high pressure can increase OPF digestibility. Other than that, mix the fermentation OPF with rice bran and rice husk enhanced the feeding value by improving the CP content, reducing the NDF and improving the DMD of the feed (Ramli et. al., 2010).

2.3 Plant cell wall characteristics of oil palm frond (OPF)

Malaysia is the largest producer of oil palm. Seventy percent (70%) of the overall oil palm industry waste in Malaysia is contributed by oil palm frond (Eng et al. 2004). OPF is one of the important crop in Malaysia. The total area of coconut palm increased year by year. Coir fibre or coconut fibre can be obtained from the coconut husk and its one of the hardest natural fibres because it has high content of lignin. OPF fibres contain various size of vascular bundles. The vascular bundles were imbedded in thin walled parenchymatous ground tissues and each bundle was made up of fibrous sheath, vessels, fibres, phloem, and parenchymatous tissues. Xylem and phloem tissues are distinguishable and phloem divided into two separate areas in each bundle. Parenchyma cell layer divide the protoxylem and metaxylem vessels in the bundle and form a living barrier to transfer the gas bubbles between protoxylem and metaxylem vessels within the stem and leaf (Tomlinson et al. 2001).

OPF are agricultural by product and economical natural fibres resources. Cellulose is the main constituent in plant cell wall that can be found in the wood or non wood resources and cellulose attached in lignin matrix and associated with hemicellulose. It affected by its crystalline structure. Pulping and bleaching process is to extract cellulose from natural fibres, lignin and hemicellulose. $C6H10O5$ which called anhydroglucose (AGU) is the basic molecular format in cellulose. AGU is connected by hydrogen bonding to form super molecular cellulose. Cellulose polymer chain consists of crystalline region and amorphous region. Cellulose crystal structural has modulus of elasticity and the modulus of elasticity depends on its crystallinity and the interaction of amorphous and crystalline region (Cabrera et al. 2011). Then, cellulose has high tensile strength, functioned as reinforcing agent in wood, and potential to be utilized as reinforcing agent in composite products.

2.4 Pretreatment strategies of OPF

Pretreatment process mainly involve the effective separation of complex interlinked fractions and it increases the accessibility of each individual component. Pretreatment strategies can be classifies into physical, chemical and biological pretreatments.

2.4.1 Physical pretreatment

There are few example of physical pretreatment which are mechanical extrusion, milling, microwave and pressing method. Mechanical extrusion is the most conventional method where the feedstock materials been heat at more than 300°C under shear mixing. This pretreatment process will produce gaseous products and char from the pretreated lignocellulosic biomass residues. The combination of high temperatures and shearing force by rotation screw blades can maintain in the barrel and the crystalline cellulose matrix in biomass residue is disrupted. This method require high amount of energy.

Next, milling is mechanical grinding (milling) that used for reducing the crystallinity of cellulose. The technique other than milling is chipping, and grinding. Chipping reduce the biomass size and the heat and mass transfer limitations while grinding and milling reduce the particle size and cellulose crystallinity due to the shear forces generated during milling. There few type of milling method such as two roll milling, hammer milling, colloid milling and victory milling to improve the digestibility of lignocellulosic materials (Kumar & Sharma, 2017). Victory milling is found to be effective in reducing cellulose crystallinity and improving the digestibility of spruce and aspen chips compared to the ordinary milling process. Other than that, wet disk milling became popular mechanical pretreatment because of its low energy consumption, enhances cellulose hydrolysis by producing fibre and more effective to produce finer bundles than other type of milling (Zhua et. al., 2008).

Microwave method is widely used for lignocellulosic feedstock pretreatment because of easy operation, low energy requirement, high heating capacity in short duration of time, minimum generation of inhibitors and degrades structural organization of cellulose fraction (Hu and Wen 2008).

Last physical pretreatment is by pressing using the sugarcane press machine. In the present study, some use sugarcane press machine to pressed the OPF to get the extraction of OPF juice. The OPF juice was extracted by pressing the frond using a conventional sugarcane press machine Other than that, hydaraulic pressing machine also can extracted the OPF juice from OPF petiole. Pressure were set at 30 MPa. Then, the juice been filtered to remove fibrous solid and scum. The juice were further clarified by withdrawing solid particles using centrifuge for 15 minutes. The filtrate been stored at temperature -20 °C before sugar analysis.

2.5 Body weight of goat

The body weight of an animal is essential for trade, routine animal health monitoring and health assessment. The goat will separate in different groups based on sex and age. The measurement is according the sex, age, live weigh, chest girth, height at withers, body length, rump height, pelvic width, ear length and neck circumference. Live weigh was measured using a hanging scale. Body measurements were taken using measuring tape to the nearest centimetre (cm). Chest girth measured the distance around the animal measured directly behind the front legs. Height at withers measured the height of a standing goat perpendicular to the ground on flat surface. Rump height measured perpendicular distance from Spina illiaca to the ground. Body length measured the distance between the base of neck which is first thoracic vertebrae to the base of the tail. Pelvic width measured the distance between the two pelvic bones across dorsum. Ear length measured the distance between the point of attachment of the ear to the head to the tip of the ear while neck circumference measured the circumference around neck.

The live weight and body measurement should be taken early in the morning. The goat should being kept comfortably and quietly at standing position on a flat surface. Goat with physically healthy and free from any disease can be measurement but pregnant animals were excluded because pregnancy has effect on some morphometric parameters especially those of the thoracic and rump region (Yakubu et al., 2011).

2.6 Body condition score of goat

Body condition score is important tool in assessing the body condition of cattle, sheep, and goats because body score condition is the best simple indicator to recognize the animals in term of decrease fertility, increased disease or internal parasite, decrease milk production and know the operating and medicine costs. The range of body condition score from 1.0 to 5.0. Body condition score of 1.0 is an extremely thin goat with no fat reserves and a Body condition score of 5.0 is a very over-condition goat (obese). Healthy goats should have body condition score between 2.5 to 4.0. Body condition score of 1.0, 1.5, or 2.0 indicate a management or health problem. The animal must be touch or felt than simply looking at an animal in body condition score method. The first body area to feel in determining body condition score is the lumbar area which is the area of the back behind the ribs. Scoring in that area is to determining the amount of muscle and fat over and around the vertebrae. Lumbar vertebrae have two type which is vertical protrusion (spinous process) and two horizontal protrusions (transverse process) and both process are used to determining body condition score. The second body area is the fat covering on the sternum (breastbone). Third area is the rib cage and fat cover on the ribs and intercostal spaces.

The goat characteristic body condition score of 1.0 is the visual aspect of the goat emaciated and weak animal. The backbone is highly visible and forms a continuous ridge, the flank is hollow, ribs are clearly visible, and there is no fat cover. Other than that, the spinous process and transverse process of the lumbar vertebrae is rough, prominent and can be grasped easily between the thumb and forefinger. It's easily to feel the sternal fat, cartilage and joints joining ribs and sternum.

The goat characteristic body condition score of 2.0 is slightly raw-boned and the backbone is still visible with a continuous ridge. Some of the ribs can be seen and have small amount of fat cover. The spinous process of the lumbar vertebrae can still be grasped but a muscle mass can be felt between the skin and bone while transverse process outline is difficult to see. One-third to one-half of the length of transverse process is discernible. The sternal fat is wider and thicker and the fat layer can still move slightly from side to side.

The goat condition body score condition of 3.0 is the backbone is not prominent. The ribs are barely discernible and have layer of fat covers. The intercostal spaces will felt when using pressure. The spinous process of lumbar vertebrae cannot be easily grasped because the tissue layer covering is thick. There is a smooth slope in the transition from the spinous to transverse process and slightly hollow felt when running finger over the spinous process. The transverse process outline is slightly discernible. Sternal fat is wide and thick, still be grasped but has very little movement and the joints joining cartilage and ribs are barely felt.

The goat conditions of body condition score of 4.0 is the backbone cannot be seen. The side of the animal is sleek in appearance. Thick layer of muscle and fat covering around the lumbar vertebrae and it is impossible to grasp the spinous process while the trasverse process outline is no longer discernible. The transverse process forms a smooth, rounded edge with no individual vertebrae discernible. Sternal fat is difficult to grasp due to its width and depth and cannot be moved from side to side.

The goat characteristic of body condition score of 5.0 is the backbone and rib cage is been cover with excessive fat. The thickness of the muscle and far is excellent that reference marks on the spinous process and transverse process are lost. There a bulging transition from the spinous to transverse process and depression along the backbone is form. The sternal fat extend and cover the sternum, joining fat covering cartilage and ribs (Villaquiran, Gipson, & Merkel, 2004).

2.7 Body Measurement

Body measurement are used to know several characteristic of animal. These measurement provide important evidences for the growth of the breed and the properties that change with environmental effects and feeding factors. Other than that, body measurement is important data source that can reflecting the breed standards and give information about the morphological structure and development ability of the animals (Riva et al., 2002). There few factors such as breed, gender, yield type and age in the body measurement. The common parameters used for body measurement in goat is head length, head depth, frontal with, ear length, body length, withers height, rump height, body depth, heart girth, width at withers, shank circumference, tail length and width. Different statistical analysis in body weight estiminations are done using body measurement (Gurcan, 2000).

Body weight and body measurement is not only to monitor the growth of the sheep but also to estimate genetic correlations between body weight and body measurement. Genetic and non-genetic components for the growth parameters must estimated to improving better selection strategies to the growth and development of the goat. Body weight not only to evaluate carcass yield and condition of the animal but also can determine suitable medication dosage during health and required feed amount of the animal (Kunene et al, 2009). Body measurement also act an indicator of breed standards (Pesmen and Yardimci, 2008). Different growth of the goat result in different body weight and body measurements (Mohammad et al., 2012).

Next, live weight also act as important role in determining several characteristics of the livestock animals. Identify the live weights of several stages of the goat caould predict birth weight, early growth, feed conversion ratio and feed requirement (Restitrisnani, Purnomoadi, & Rianto, 2013). Live weight using body measurement is practical, faster, easier and cheaper in the rural areas where the sources is limited and insufficient for the breeder (Nsoso et al., 2003). Estimated values of quantitative characteristics is useful in developing appropriate selection criteria (Restitrisnani et al., 2013). The yields and the parameters can easily determined and inexpensive in animal breeding. Indirect measurements could be an alternative way if the data of the yield properties are difficult to obtained and expensive method (Boztepe and Dag, 2000).

2.8 Feed Conversion Ratio

The feed conversion ratio (FCR) is an indicator that is commonly used in all types of farming, as well as in the field of research. It can provide a good indication of how efficient a feed or a feeding strategy. FCR is a ratio or rate measuring of the efficiency which the bodies of livestock convert animal feed into desire output. The present study of (Ko *et al.*, 2000) show that they used corn-manure silage as their alternative feeding and observe the growth performance of Korean native goats. The treatments where divided into three group which is whole whole crop corn silage (CS silage), whole crop corn ensiled with cage layer manure (CLM; Manure silage or MS silage) and whole crop corn silage supplemented with urea (US silage) during feeding time. The content of crude protein, lactic acid and the ratio of ammonia nitrogen to total nitrogen in MS silage increase and have different significantly ($p<0.05$) different in all observations. The body weight gain of goats for 90 days also increased but decreased about 30% in CS silage treatments group.

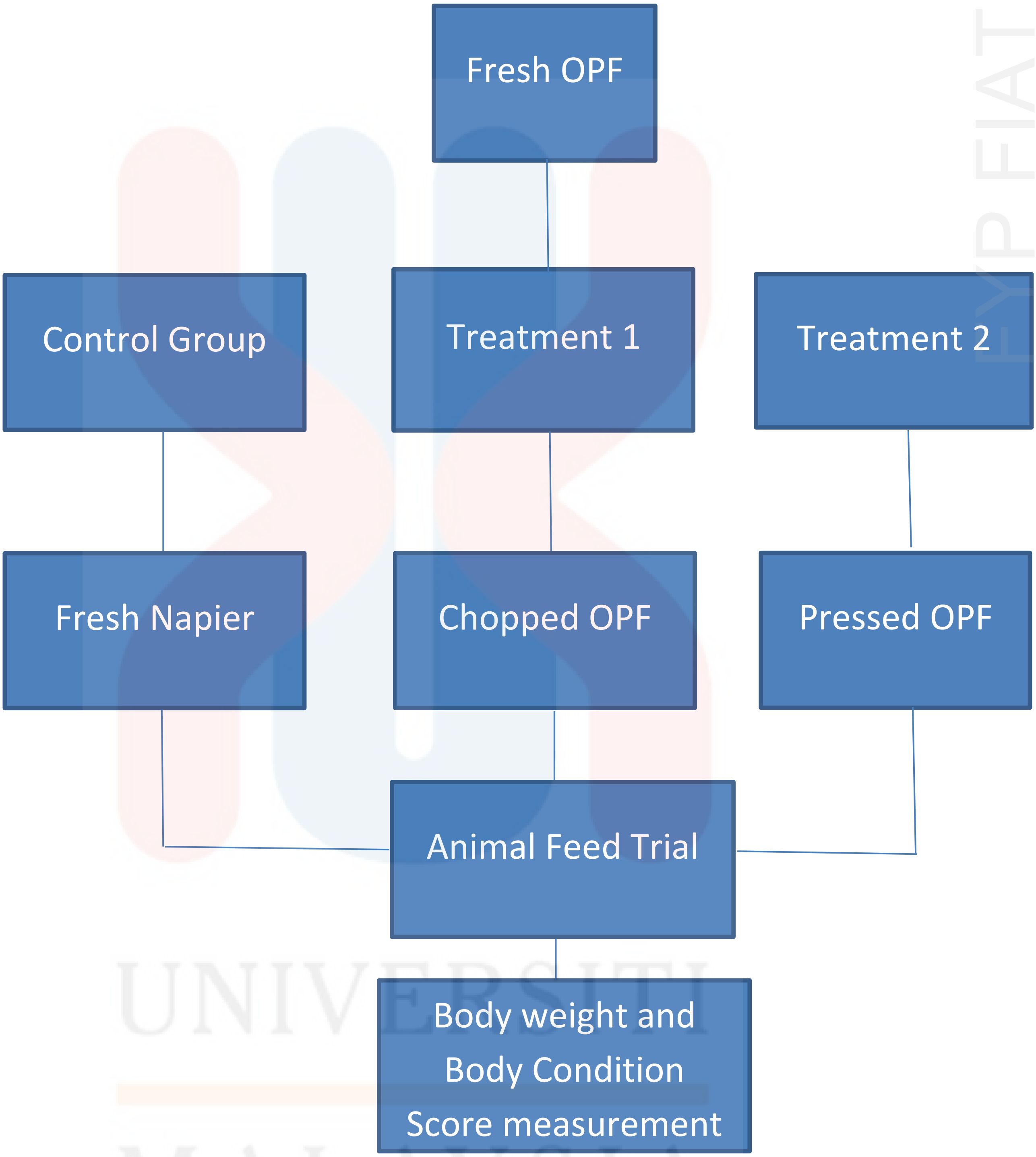
During the experiment in the journal report, The MS and US silage in the present research suggested show that MS silage and US silage can lower the cost of feed for 30% and 8% for three month compare to the CS silage alone. (Ko *et al.* 2000) reported that the gross income was higher with the addition of cage layer excreta up to 30% of corn silage. The study show that there were no benefit effect of urea addition to corn silage on feed intake and body weight gain. The finding is supported by (Ra *et al*. 2001) who reported that the feed conversion ratio of Korean native goat is high and the level of nutrition is low.

CHAPTER 3

3.0 Materials And Methods

3.1 Experimental Design

The animal feed trial was conducted for 4 month. A total of 12 Boer goats were used for feed trial and were divided into 3 groups based on randomized complete block design (RCBD). The flow chart of the experiment carried out is as Figured 1. The experimental design of different dietary treatments is shown in Table 1.



Figured 1: Flowchart of study

Groups (4 goats/group)	Dietary treatment			
	Napier grass (50%)	Goat pellet (30%)	Oil palm frond (20%)	Total feed (kg)
Control	1.75kg	0.75kg	None	2.5kg
Treatment 1	1.25kg	0.75kg	Fresh OPF/0.5kg	2.5kg
Treatment 2	1.25kg	0.75kg	Physical pretreated OPF/0.5kg	2.5kg

Table 1: Experimental design of animal feed trial

3.2 Collection of Oil Palm Frond

In this experiment, the agricultural by-product used was whole OPF. The OPF were collected and transported to the Agropark, UMK Campus Jeli, Kelantan. The whole OPF were pressed using sugar cane machine as it cause low physical technique. The sugarcane machine was cleaned after been used to avoid contamination of the sample.

3.3 Fresh OPF (Non pre-treatment OPF)

Whole OPF consists of petiole and leaflet was collected and chopped into small fractions. The freshly chopped OPF were mixed with napier grass and were fed to the goats in the afternoon while the pellete feeding were fed during morning.

3.4 Physical pre-treatment of OPF

The freshly OPF were chopped, pressed using sugar cane pressed machine. Following the pressing method, we obtained pressed fibre and OPF juice. However, only pressed OPF was investigated and fed to the goats

3.5 Assessment of OPF feeding on goats performance

3.5.1 Body weight changes

Body weight changes was determined on the first day of feeding trial followed by two weeks interval until the end of feeding trial. The goats were weighed by using hanging scale. The average daily gain was calculated by dividing the initial and final body weight differences by total number of experimental days (120 days)

Body weight formula:

Mean (g/d): Final body weight (kg) – Initial weight (kg) ÷ Feeding day (d)

Average Daily Gain formula:

ADG: Final body weight (kg) – Initial weight (kg) ÷ Total days (d)

3.5.2 Body Condition Score

Body score condition (BCS) is rating of animal fat using score from 1 to 5 with score 1 is very thin and score 5 is very fat. This information can be used to plan the activities of the animal husbandary annual cycle. For example does with a BCS 3-4 are more likely to become pregnant, conceive earlier and have more twins. Birth is likely to be easier, kids healthier and more milk produced. This is the ideal BCS for conception and kidding while doe with BCS 1 or 5 are more likely develop pregnancy toxaemia.

Since all the boer goat is male, the experiment target BCS for feed trial gain is 2-4 BCS.

The diagram over the page shows how and where to condition score goats and sheep in the rib area

Body Score Condition	Description the rib area
1	Very thin, ribs felt easily; cannot feel covering tissue
2	Thin, ribs felt easily; with slight amount of covering tissue
3	Moderately thin, ribs felt with covering tissue present
4	Moderately fat, ribs felt but covering tissue prominent
5	Fat, ribs difficult to feel, covering tissue prominent and may feel fluid.

(Villaquiran et al,. 2004)

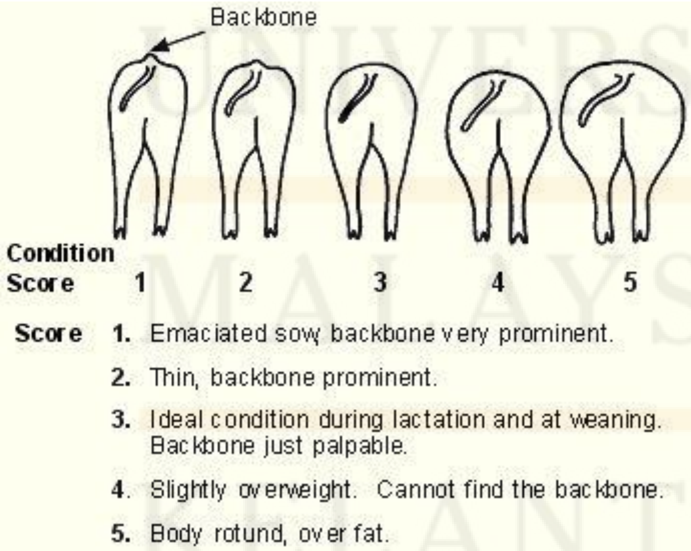


Figure 2: Body Condition Score

3.5.3 Feed conversion ratio (FCR)

Throughout the 120 of feeding trial, daily feed offered and refused were weighed and recorded for individual goat. Daily feed were measured as the difference of the amount of feed offered and feed refused. The sample of feed offered and refused were collected every day from each goat for dry matter analysis to determine daily DMI. Feed conversion ratio (FCR) was expressed the amount of feed needed (in kg) to obtain one kg of weight increase of the production animal.

Feed Conversion Ratio formula:

FCR: Dry matter intake (g/d) ÷ ADG (g/d)

Treatment	Goat ID	Total Dry Matter (DM)	Total Mean (g)	FCR
Group Control	151	70.47	420	21
	156	60.86	360	30
	158	70.11	420	14
Treatment 1	147	90.02	540	15
	159	88.20	530	11.04
	152	81.94	490	9.61
	150	83.74	500	10.42
Treatment 2	143	85.68	510	8.95
	153	80.94	490	16.53
	144	90.59	540	11.25
	154	80.04	480	13.33

CHAPTER 4

4.0 Result

4.1.1 Body Weight

Table 4.1 shows the body weight changes between treatments. There were significant different ($p<0.05$) of body weight changes between treatment at day 70 of feeding trial. During this period, body weight in T2 (25.75± 0.67 kg) was significantly higher ($p<0.05$) as compared to control group (22.33 ± 0.77 kg). However, body weight in control and T1 (24.25± 0.67) did not differed significantly ($p>0.05$). However at day 84 to day 126 have no significant different ($p>0.05$) of body weight between treatment. At day 140, there were significant different ($p<0.05$) of body weight changes between treatment. During this period, body weight in T2 (29.00± 0.92 kg) was significantly higher ($p<0.05$) as compared to control group (25.67± 1.06 kg). However, body weight in control and T1 (27.13± 0.92 kg) did not differed significantly ($p>0.05$). There were no significant different ($p>0.05$) at day 154. At day 168 there were significant different ($p<0.05$) of body weight between treatment. Body weight in T1 (30.13± 0.93 kg) and T2 (31.25± 0.93 kg) were significantly higher ($p<0.05$) than control group (26.67± 1.07 kg) but in T1 and T2 did not differed significantly ($p>0.05$).

Table 4.1: Body weight changes between treatments (Mean±SE)

Period (d)	Group Control	Treatment 1	Treatment 2
0	23.17± 0.77[a]	23.75± 0.66[a]	24.13± 0.66[a]
14	19.67± 1.22[a]	21.75± 1.05[a]	23.00 ± 1.05[a]
28	21.67 ± 0.98[a]	22.75 ± 0.85[a]	24.00 ± 0.85[a]
42	22.00± 1.16[a]	24.00± 1.00[a]	25.00 ± 1.00[a]
56	22.67 ± 0.67[a]	23.00 ± 0.57[a]	24.00 ± 0.57[a]
70	22.33 ± 0.77[a]	24.25± 0.67[ab]	25.75± 0.67[b]
84	22.33± 0.80[a]	23.75± 0.69[ab]	26.00± 0.69[a]
98	24.33± 1.03[a]	24.38± 0.89[a]	26.88± 0.89[a]
112	24.67± 1.09[a]	26.00± 0.95[a]	27.00± 0.95[a]
126	25.33± 1.47[a]	26.75± 1.28[a]	27.75± 1.28[a]
140	25.67± 1.06[a]	27.13± 0.92[ab]	29.00± 0.92[b]
154	29.25± 1.33[a]	29.33± 1.07[a]	29.50± 1.07[a]
168	26.67± 1.07[a]	30.13± 0.93[b]	31.25± 0.93[b]

[ab] Means with different superscripts in the same row are significantly different ($p<0.05$)

Control – 1.75 kg Napier + 750 pellete, T1- 1.75 kg Napier + 750 pellete + 500 chopped OPF, T2- 1.75 kg Napier + 750 pellete + 500 pressed OPF

4.1.2 Average Daily Gain (ADG)

Table 4.2 and figure 4.2 show the average daily gain change between treatments. The average daily gain in T1 (42.75± 4.79 g/d) and T2 (45.75± 4.79 g/d) were significant higher ($p<0.05$) than control group (20.67± 5.53 g/d) but in T1 and T2 did not differed significantly ($p<0.05$).

Table 4.2 Average daily gain between groups

Control Group	Treatment 1	Treatment 2
20.67 ± 5.53^{a}	42.75 ± 4.79^{b}	45.75 ± 4.79^{b}

[ab] Means with different superscripts in the same row are significantly different ($p<0.05$)

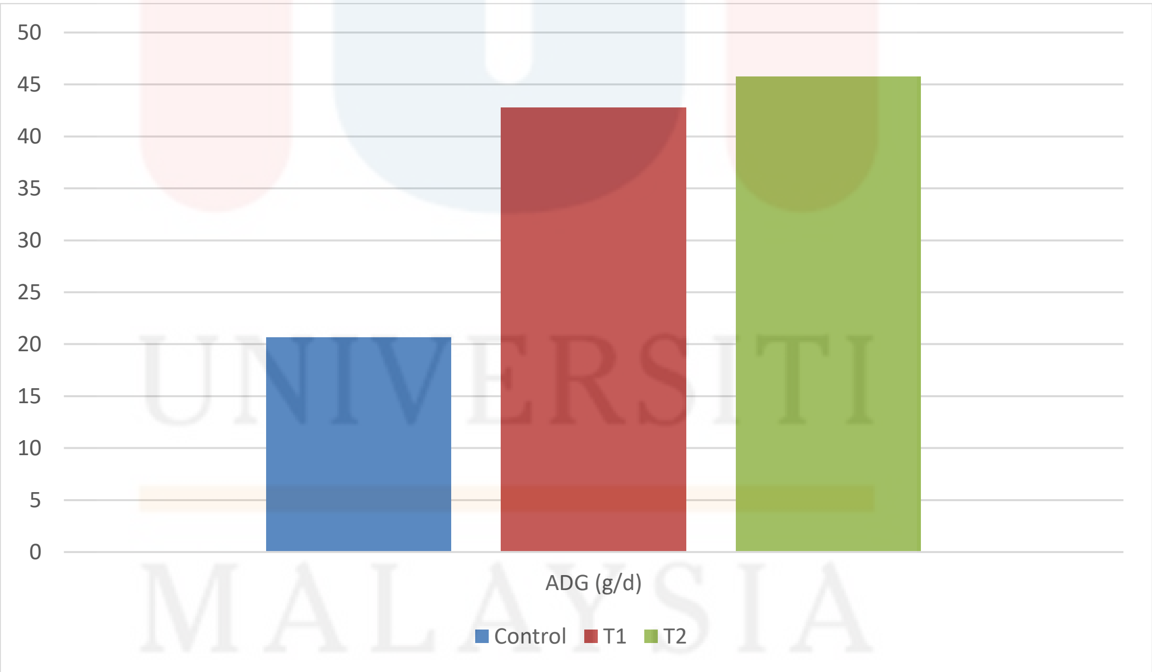


Figure 4.2 Comparison of Average Daily Gain (ADG) between groups.

4.1.3 Feed Conversion Ratio (FCR) (g/d±SE)

Table 4.3 show the feed conversion ratio between treatments. In the table, the feed conversion ratio in control group (21.67± 2.70 g/d) was significantly higher ($p<0.05$) than T1 (11.52± 2.34 g/d) and T2 (12.47± 2.34 g/d) but in T1 and T2 did not differed significantly ($p>0.05$).

Table 4.3 Feed Conversion Ratio between Groups

Group Control	Treatment 1	Treatment 2
21.67 ± 2.70^{b}	11.52 ± 2.34^{a}	12.47 ± 2.34^{b}

^{ab} Means with different superscripts in the same row are significantly different ($p<0.05$)

4.1.4 Body Condition Score (BCS)

Table 4.4 show the body condition score between treatments. There were no significant different ($p>0.05$) of body condition score between treatments from day 0 to day 124. However, the body score condition increase from day 93 until day 155. There were significant different ($p<0.05$) of body condition score between treatments at day 155. The table show that T1 (2.88± 0.21) and T2 (3.13± 0.21) was significant higher ($p<0.05$) compared than control group (2.00± 0.24) but in T1 and T2 did not differed significantly ($p<0.05$).

Table 4.4 Body Condition Score between Groups

Period (d)	Group Control	Treatment 1	Treatment 2
0	2.00± 0.13[a]	2.13± 0.11[a]	2.13± 0.11[a]
31	2.00± 0.13[a]	2.13± 0.11[a]	2.13± 0.11[a]
62	2.00± 0.88[a]	2.00± 0.77[a]	2.13± 0.77[a]
93	2.17± 0.21[a]	2.25± 0.19[a]	2.38± 0.19[a]
124	2.33± 0.43[a]	2.50± 0.37[a]	2.75± 0.37[a]
155	2.00± 0.24[a]	2.88± 0.21[b]	3.13± 0.21[b]

[ab] Means with different superscripts in the same row are significantly different ($p<0.05$)

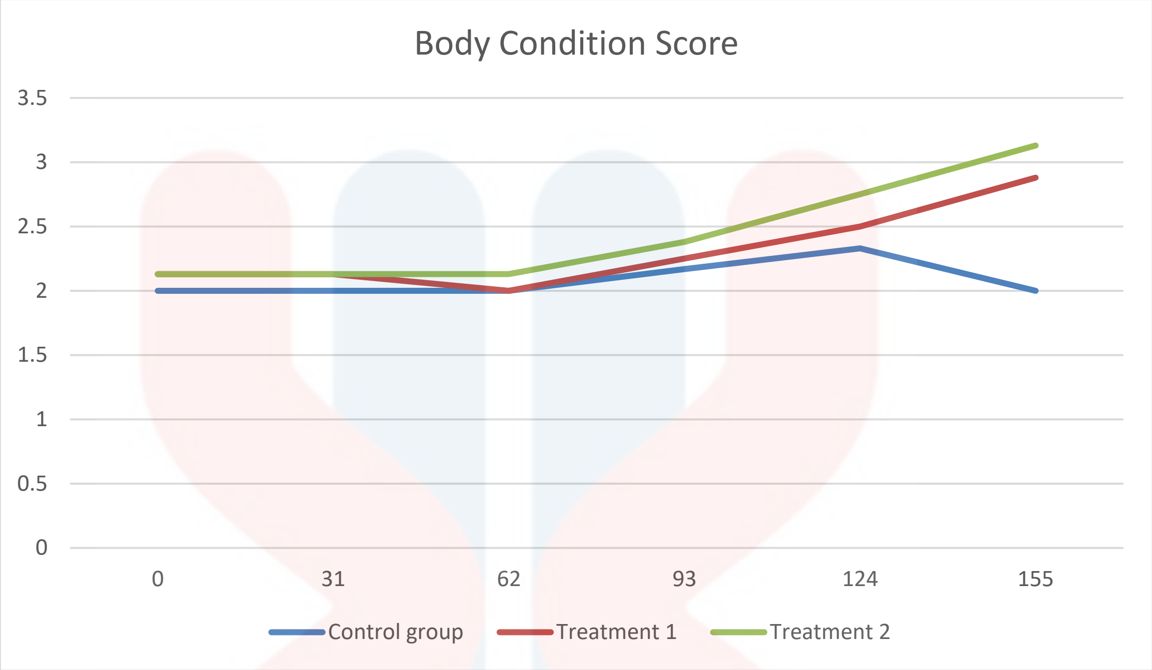


Figure 4.4 The changes body condition score between groups

CHAPTER 5

5.0 Discussion

Oil palm frond is largest produce and recently been used as alternative for feed dietary of ruminant animals. OPF composed of 70% of fibre and contain 20% nitrogen cell wall free extract which represent soluble carbohydrates in feed. In vivo dry matter digestibility in OPF about 45% (Ishida & Abu Hassan (2000). Lean meat production was not significantly reduced by the incorporation of up to 30% oil-palm frond silage in the diet on a dry matter basis. This show that oil palm frond could be ultilized as feed source and lower feeding cost. According to the result show that the OPF in feed dietary give a positive effect to the goat body weight and body condition score. This finding support (Alimon and Hair Bejo 2001) report show that OPF can be used as roughage for ruminants due to the chemical analysis and metabolizable energy (ME) value of oil-palm fronds indicate that they are suitable as a roughage source.

In the present study show that oil palm is one of natural resources in Malaysia and Indonesia. The utilization of OPF been used for various techniques for processing and supplementation to improved the nutrient intake and digestibility of the feeds (Rahman, Abdullah, Wan Khadijah, Nakagawa, & Akashi, 2013). The experiment was carried out to determine whether napier grass and OPF with supplemented with chopped OPF and pressed OPF can be used efficiently to the goat body weight (BW) and body condition score (BCS). The result show that the supplemented chopped OPF and pressed OPF in napier grass and pellete feed dietary improved the parameters BW and BCS of the goats. The finding is support by (Joo *et al*., 2012) who reported that the napier grass and OPF combination is more fermentable and represents higher in vitro dry matter (DM) digestibility than napier grass or OPF alone.

On other hand, (Dahlan *et al.* 2000) who reported that OPF is low in voluntary intake and that it can only provide the required amount of energy and protein for maintenance. Other than that, animals on the OPF group showed a lower BW gain compared to the animals on the napier grass group. These result show that OPF is low-quality roughage in term of BW gain. However, the experiment that conduct show the result that goat on OPF treatment 1 and 2, BW have more significant different ($p<0.05$) and higher BW record than control group that only have napier grass and pellete. This show that OPF can improve the goat BW. This finding is support by (Joo *et al.* 2012) who suggested that the feeding of napier grass with OPF combination to goats can represent better results in certain aspects compared to the feeding of napier grass or OPF alone, which would reduce feed cost as well as environmental waste.

Napier plant grass increased with maturity along with leaf length, plant height, number of leaves and number of tillers. Plant height increased by approximately 53% from early to late stage (Ansah *et al*. 2010). The greater the number of leaves and number of tillers produced from the newly emerging tillers may produce good quality of maturity (Amin, 2011). The plants approached maturity when numerous fine branches appeared, growing out from the leaf axils of the main stems (Wilsie & Takahashi,2002). The dry matter (DM) in napier increase when the napier grass maturity increase (Ansah *et al*. 2010). However, the DM and nutrient in napier grass low if the napier grass is too old and too dry. Old napier grass also low crude protein (CP) level. This finding support by (Kramberger & Klemencic, 2003; Bayble, 2007; Sultan et al., 2007; Ansah et al., 2010; Jusoh et al., 2014) reported that CP content of napier grass also decreased with maturity. The final concentration exceeded the minimum CP level (7.5%) required for rumen function despite the decline CP content with increasing stage of maturity (Jusoh *et al*., 2014). Therefore, OPF and pellete indicated the possibility of improving feeding of animals to meet the target animal growth performance.

The high moisture of napier lead to depression of the grass intake. High moisture may cause a decrease in palatability which lead to decrease in roughage dry matter intake. This finding is support by (Chanjula *et al*., 2011).

A study showed that upper end of the thermoneutral (UCT) zone defined as the ambient temperature above which thermoregulatory evaporative heat loss process of a resting thermoregulating animal are recruited (Lu, 2002). The goat has low body weight (BW) and body condition score (BCS) record data during adaptation period due to stress and low feed quantity to make the goat adapt to the new environment. This finding support by (Lu, 2002) show that stress is a result of environmental forces continuously acting upon animals which disrupt homeostasis resulting in new adaptation that can be detrimental to production. Heat stress also can decrease the productivity and energetic efficiency of goats.

Environmental factors such as humidity, solar radiation, wind, rain, housing condition and dugouts can cause UCT. Suppression of feed intake occurs when evaporating heat loss mechanism are stimulated. During the experiment, most goat have low feed intake during day 14 to 56 and from day 84 to 126. The BW and BCS record data show the lowest during that period due to the temperature is high during sunny season at day 14 to 56 and the temperature drop during rainy season at day 84 to 126. This make the goat have suppression feed intake and reduce the productivity performance due to the nutrient supply is below requirements for production. This finding support by (Lu, 2002) concluded that UCT of goat maintenance is 25 °C to 30 °C and heat stress occurs when they exposed to the ambient temperatures above 30 °C. Animals may completely stop eating during exposure to the extremely hot environments.

One previous study, (Lu, 2002) observed that eating and rumination period decrease when goat exposed to 35 °C ambient temperature. Rate of passage of digesta in the gastro-intestinal tract is became slowed during heat stress. (Lu, 2002) reported that lower rate of intake, reduced rumen motility, reduced thyroid activity, lower saliva flow and their combinations during heat stress when the rate of passage is low.

The present study, (Lu, 2002) reported that the goats spent less time lying and more time being active and eating in the cold than in the moderate temperature period which indicates that the goats are using behavioural strategies to cope with the low temperature in a similar way as sheep. The study support that all treatment goat body weight start to improve at day 112 to 168 due to the cold temperature (rainy season) at Jeli every end of the year. The goat feed intake increased as they need large amount of heat during cold season. This finding support by (Lu, 2002) reported the fatty acids indicated a mobilisation of body fat to produce more heat.

In the present study summaries the parasitism lead to depletion of resources of affected animals, as well as, in many cases, in decreased feed intake, resulting in reduced production. (Fthenakis & Papadopoulos, 2017) reported the effect of the gastrointestinal parasitism in goat-kids show that growth rate of goat-kids increased after administration of an effective anthelmintic or during supplementation with dietary protein providing nutritional protection for the animal's body against parasites. In the experiments show that the level of parasitism in the goat is high during the adaptation period because the BW, BCS and feed intake data is lowest. One of the goat dead during adaptation period due to parasitism, diarrhea and heat stress. This finding support by (Peng *et al.,* 2016) reported that the infected young goat resulting in increased neonatal mortality or, if affected kids survive, in suboptimal growth rate and hence reduced meat production by animals. (Fthenakis & Papadopoulos, 2017) show that hypodermosis significantly reduced the body weight of growing goat-kids.

CHAPTER 6

6.0 Conclusion And Recommendation

In conclusion, the goat fed with napier grass with pressed OPF presented higher body weight gain than Napier grass with chopped OPF. Feeding based on Napier grass only resulted a slightly lower body weight gain. These variations in intake and body weight can be attributed to the OPF effect.

OPF feeding have positive effect on body weight, body condition score and feed conversion ratio and able became alternative feed. This should further more research on pressed OPF

7.0 References

Dahlan, I., Islam, M., & Rajion, M. A. (2000). Nutrient intake and digestibility of fresh, ensiled and pelleted oil palm (*Elaeis guinensis*) frond by goats. *Asian-*Australasian Journal of Animal Sciences.

Ebrahimi, M., Rajion, M. a., Goh, Y. M., Sazili, a. Q., Soleimani, a. F., & Schonewille, J. T. (2013). Oil Palm (*Elaeis guineensis Jacq*.) Frond Feeding of Goats in the Humid Tropics. Journal of Animal and Veteriniary Advances. https://doi.org/10.3923/javaa.2013.431.438

Fthenakis, G. C., & Papadopoulos, E. (2017). Impact of parasitism in goat production. Small Ruminant Research. https://doi.org/10.1016/j.smallrumres.2017.04.001

Gabdo, B. H., & Abdlatif, I. Bin. (2013). Analysis of the Benefits of Livestock to Oil Palm in an Integrated System: Evidence from Selected Districts in Johor, Malaysia. Journal of Agricultural Science, *5*(12), 47–55. https://doi.org/10.5539/jas.v5n12p47

Kumar, A. K., & Sharma, S. (2017). Recent updates on different methods of pretreatment of lignocellulosic feedstocks: a review. Bioresources and Bioprocessing, *4*(1), 7. https://doi.org/10.1186/s40643-017-0137-9

Lounglawan, P., Khungaew, M., & Suksombat, W. (2011). Silage production from cassva peel and cassava pulp.pdf. Journal of Animal and Veterinary Advances. https://doi.org/10.3923/javaa.2011.1007.1011

Lu, C. D. (1989). Effects of heat stress on goat production. Small Ruminant Research, *2*(2), 151–162. https://doi.org/10.1016/0921-4488(89)90040-0

Rahman, M. M., Abdullah, R. B., Wan Khadijah, W. W., Nakagawa, T., & Akashi, R. (2013). Feed intake, digestibility and growth performance of goats offered napier grass supplemented with molasses protected palm kernel cake and soya waste.

Asian Journal of Animal and Veterinary Advances, *8*(3), 527–534. https://doi.org/10.3923/ajava.2013.527.534

Rambau, M. D., Fushai, F., & Baloyi, J. J. (2016). Productivity, chemical composition and ruminal degradability of irrigated Napier grass leaves harvested at three stages of maturity. South African Journal of Animal Sciences, *46*(4), 398–408. https://doi.org/10.4314/sajas.v46i4.8

Villaquiran, M., Gipson, T. a, & Merkel, R. C. (2004). Body Condition Scores in Goats. American Institute for Goat Research, 1–8.

Wan Zahari, M., & Wong, H. K. (2009). Research and development on functional foods in Malaysia. *Wartazoa*, *19*(4), 171–179.

Mohammad, M. T., Rafeeq, M., Bajwa, M. A., Awan, M. A., Abbas, F., Waheed, A., … Akhtar, P. (2012). Prediction of body weight from body measurements using Regression Tree (RT) method for indigenous sheep breeds in Balochistan, Pakistan. Journal of Animal and Plant Sciences, *22*(1), 20–24.

Pesmen, G., & Yardimci, M. (2002). Estimating the live weight using some body measurements in Saanen goats. Archiva Zootechnica, *11*(4), 30–40.

Restitrisnani, V., Purnomoadi, A., & Rianto, E. (2013). The production and body composition of kacang goat fed different quality of diets. J Indonesian Trop.Anim.Agric, *38*, 163–168.