EFFECT OF SUBSTITUTE PELLET WITH NAPIER GRASS ON FEED INTAKE, GROWTH PERFORMANCE AND CARCASS COMPOSITION IN WEANED RABBIT

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A report submitted in the fulfilment of the requirement for the degree of Bachelor of Applied Science (Animal Husbandry Science) with Honours

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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.

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I certify that the report of this final year project entitled "Effect of Replacing Pellet with Napier Grass on Feed Intake, Growth Performance and Carcass Composition in Weaned Rabbit" by Mastura Nazirah Binti Mustapher, matric number F15A0078 has been examined and all the correction recommended by examiners have been done for the degree of Bachelor of Applied Science (Animal Husbandry Science) with Honours, Faculty of Agro-Based Industry, Universiti Malaysia Kelantan.

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ABSTRACT

EFFECT OF SUBSTITUDE PELLET WITH NAPIER GRASS ON FEED INTAKE, GROWTH PERFORMANCE AND CARCASS COMPOSITION IN WEANED RABBIT

As the population in Malaysia rise year by year, the demand for quality food also increasing especially animal protein. Nowadays, rabbit farming is gaining popularity in smallholder farmers as an alternative source of animal protein. However, a feed is one of the major constraints to make a profitable rabbit farming. Therefore, most of the farmer in Malaysia feed their livestock with forage like Napier grass to reduce the feed cost. But, the excessive intake Napier grass containing oxalic acid can cause health problems to a rabbit. This study was conducted to observe the effect of substituting the pellet with Napier grass (*Pennisetum purpureum*) that contain oxalic acid on feed intake, growth performance and carcass composition of rabbits (*Oryctolagus cuniculus)*. Nine early weaned rabbit was treated with three different treatments. Treatment 1 was given 50% concentrate and Napier grass ad libitum. Treatment 2 was given 75% concentrate and Napier grass ad libitum. Treatment 3 was given with 100% concentrate. To measure the feed intake of the rabbits, the amount of dry matter of feed consumed by the rabbit was weighed daily. The body weight of the subject was weighed weekly to measure the growth performance. The weight of feet, head, spleen, lungs, heart, kidneys, liver, stomach, intestine and tail were weighed to make a comparison of carcass composition of these three treatments. The results showed that total dry matter intake by treatment 2 were the highest. The growth rate of treatment 3 was the highest which is 77.169%, followed by treatment 2 which is 74.278% and treatment 1 which is 46.023%. In conclusion, the best way to increase the amount of dry matter intake by the rabbit while reducing the amount of concentrate is by providing supplementary feed like Napier grass on the rabbit diet although it only giving moderate growth performance.

KEYWORDS: Rabbit, Napier grass, oxalic acid, growth performance, carcass composition

ABSTRAK

KESAN PENGGANTIAN RUMPUT NAPIER KEPADA PELET KEATAS PENGAMBILAN MAKANAN, PRESTASI PERTUMBUHAN DAN KOMPOSISI ARNAB MUDA.

Populasi Malaysia semakin meningkat dari tahun ke tahun, permintaan bagi makanan berkualiti juga meningkat lebih-lebih lagi terhadap protein daripada haiwan. Dewasa kini, peternakan arnab semakin popular dalam kalangan petani yang berniaga kecil-kecilan sebagai alternatif untuk sumber protein haiwan. Walaubagaimanapun, makanan haiwan merupakan salah satu masalah utama bagi memperoleh keuntungan dalam peternakan arnab. Oleh itu, kebanyakkan peternak di Malaysia memberi makanan kepada haiwan ternakan dengan tumbuhan seperti rumput Napier bagi mengurangkan kos makanan. Tetapi, pengambilan rumput Napier yang mengandungi asid oksalik yang melampau boleh menyebabkan masalah kesihatan terhadap arnab. Kajian ini dijalankan bagi tujuan pemerhatian terhadap kesan penggantian rumput Napier (*Pennisetum purpureum*) yang mengandungi asid oksalik kepada pelet keatas pengambilan makanan, prestasi pertumbuhan dan komposisi arnab (*Oryctolagus cuniculus*). Sembilan arnab muda telah dirawat dengan tiga rawatan berbeza. Rawatan 1 diberi makan 50% pelet dan rumput Napier ad libitum. Rawatan 2 diberi makan 75% pelet dan rumput Napier ad libitum. Rawatan 3 diberi 100% pelet. Utuk menilai kadar pengambilan makanan, jumlah bahan kering dalam makanan yang dimakan oleh arnab telah ditimbang setiap hari. Berat badan subjek telah ditimbang seminggu sekali untuk menilai prestasi tumbesaran. Berat kaki, kepala, limpa, paru-paru, jantung, buah pinggang, hati, perut, usus dan ekor ditimbang bagi membuat perbandingan keatas komposisi arnab untuk ketiga-tiga rawatan. Keputusan menunjukkan keseluruhan jumlah pengambilan bahan kering oleh rawatan 2 adalah tertinggi. Prestasi pertumbuhan rawatan 3 adalah paling tinggi iaitu sebanyak 77.169%, diikuti oleh rawatan 2 sebanyak 74.278% dan rawatan 1 sebanyak 46.023%. Konklusinya, cara terbaik bagi meningkatkan jumlah pengambilan bahan kering sementara mengurangkan jumlah pelet adalah dengan menyediakan tambahan makanan seperti rumput Napier keatas diet arnab walaupun prestasi pertumbuhan adalah sederhana.

KATAKUNCI: Arnab, rumput Napier, asid oksalid, prestasi pertumbuhan, komposisi daging

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LIST OF ABBREVIATION AND SYMBOLS

°C	Degree Celsius
%	Percent
Kg	Kilogram
g	Gram
M	Meter
Cm	Centimetre
Mm	Millimetre
ha	Hectare
Mg	Magnesium
Ca	Calcium
CaC_2O_4	Oxalic acid
DM	Dry matter
LSR	Leaf to stem ratio

CHAPTER 1

INTRODUCTION

1.1 Research Background

Malaysia ranks number 45th in the world for the country with the largest number of population of 32,042,458 citizens (American Library Association, 2018). It is estimated that rabbit farming can replace more than 20% of poultry meat consumption. But there is not enough study on rabbit's meat market, breeds of rabbit, breeding programme, nutrition requirement, diseases, management and production system that suitable with Malaysia climate (Dahlan, 1993).

In Malaysia, the first Agriculture Minister that inspire Malaysian to join the venture of rabbit production is Tan Sri Sanusi Junid as he believes that the rabbit is a productive animal, have satisfying lean quantity and quality, low in fat, high in protein, and can be an alternative halal product for Muslim consumers. Some of the organization that related to the rabbit farming in Malaysia is Selangor Agriculture Development Corporation (PKPS). Rabbit in Malaysia was imported from Australia, France, Italy, US and New Zealand. In 2003, the production of rabbit meat is over-

supply due to low demand in the local market causing the farmers to export their products to France, Italy and China (Kee, 2003).

Rabbit or scientifically known as *Oryctolagus cuniculus* own small and fragile bones that frequently damaged causing difficulties to trace the origin and evolution of the rabbit. It needs 40%-50% fibrous feed to encourage feed smoothly pass through the gut. Enteritis might happen if the rabbit consumed too much highly digestible ingredients in feed that lead to death (Hernández et al., 2017).

It is mammals with small size that related with hares and picas that can be grouped into the Lagomorphs. One of the important agricultural enterprises is rabbit production and the rabbit was considered as hedonistic meat. Besides, a rabbit was rise for the production of high-quality wool or pelts, for laboratory use, medical research, show, pet and exhibition (Killman, 2009). It commonly known as arnab in Malaysia, kelinci in Indonesia, konijn in Dutch, coniglio in Italy and Kani in Finland (Chewy, 2016).

Rabbits were fed with a mixture of legumes and maize concentrate to get an optimal performance of weaner rabbits. This diet contains high digestible protein and energy for the rabbit. Example of legumes are *Myrianthus arboreus, Gmelina arborea,Tridax procumbens, Pannicum maximum and Pennisetum purpureum* (Amata & Okorodudu, 2016).

Napier grass (*Pennisetum purpureum*) is a tropical grass that generally used as feedstuffs and originated from East Africa (Halim, Shampazuraini, & Idris, 2013). Napier grass is also known as elephant grass, Uganda grass and merker grass and it can last long up to eight years with a good farming management practices and to take on the challenge of ministry of agriculture and agro-based industry Malaysia; to provide feed for livestock with high quality, most of the farmer fed their livestock with pasture like Napier grass

about 12,775kg/year (Sidek, 2017). Napier grass contains anti-nutritional factor such as oxalic acid or calcium oxalate or calcium salt of oxalic acid with chemical formula CaC_2O_4. In plants, the envelope-shaped crystal is known as raphides (Gwaltney-Brant, 2013). The excessive intake of oxalic acid can cause health problems to rabbits such as kidney stones, calculi or urolithiasis and dental problems. In some cases, the livestock may die if consume too much oxalic acid (Rahman et al., 2017).

1.2 Problem Statement

Rabbit is also known as a hindgut fermenter as it's large caecum comprises of microorganisms that can ferment all roughage that ate by the rabbit. But, the rabbit digestive system differs from ruminants as the ruminants can degrade oxalate using rumen bacteria but rabbit enable to do that. Most of the farmers used to feed their rabbits with Napier grass that contains oxalic acid that can cause health problems to rabbits such as kidney stones, calculi or urolithiasis and dental problems. Next, we want to reduce the rate of mortality due to oxalate poisoning in the rabbit that may reduce the profitability in rabbit farming. When rabbit was fed with Napier grass, level of calcium-oxalate in its body will increase causing its calcium level to drop. Oxalic acid is one of the anti-nutrients in forage that may bind with calcium (Ca) and magnesium (Mg) to form Ca oxalate or Mg oxalate that was insoluble.

1.3 Hypothesis

H0 : The feed intake, growth performance and carcass composition of weaned rabbit not affected by the consumption of Napier grass containing oxalic acid.

H1 : The feed intake, growth performance and carcass composition of weaned rabbit affected by the consumption of Napier grass containing oxalic acid

1.4 Objectives

The objectives of this study were:

a) To study the effect of feed intake of weaned rabbit that consumes Napier grass.
b) To monitor the effect of intake of Napier grass to the growth performance of weaned rabbit.
c) To observe the significance difference of carcass composition among the rabbit that consumes different level of Napier grass intake.

1.5 Significant of Study

In this study, the body weight of nine early weaned rabbit at the AgroTechno park was considered as the indicator of health condition by rabbit's feed intake. Feed intake and growth performance of rabbit were measured in this study.

CHAPTER 2

LITERATURE REVIEW

2.1 General background of *Oryctolagus cuniculus*.

Rabbits are lagomorphs that own long and soft fur that covers its whole body including feet, have massive ears that can be moved around for cooling and alerting to danger, large eyes for seeing in the dark, paired upper and lower incisors and long strong hind legs that help to run away from dangers. There are more than 50 strains of rabbit today that have different in coat colour and quality (Jesen, 2002).

Figure 2.1: The differentiation of external genitalia female (left) and male (right) of *O. cuniculus.*

Sources: Banks, Sharp, Doss, & Vanderford (2010)

Table 2.1 show the taxonomies class of *O. cuniculus*

Domain	**Eukayota**
Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Lagomorpha
Family	Leporidae
Genus	Oryctolags
Species	Cuniculus

Source : A-Z Animals (2018)

The most essential features for does that used as breeding stock is liveability as the does can be used for a longer period, the number of kittens or litters it might produce, the ability to change feed into meat at a higher percentage, have the best pelt quality and low mortality percentage of kittens. The new-borns litters are hairless, blind and deaf. Early weaned rabbits aged one month can be separated with the does and placed into colony pens for preparing the does to rebreed again after two to three days. The bucks were fed according to the numbers it was served or the breeding programme. Hay and water should be supplied ad libitum to it. It is not recommended for a rabbit to be in darkness, so, artificial light must be provided if no daylight (Harrison, 2013).

2.2 Anatomy and physiology of *Oryctolagus cuniculus*

From the previous study as reported by Lebas, Coudert, Rochambeau, & Thebault (1997), they stated that the alimentary canal of adult rabbit length 4.5 to 5 m comprises of 70% of adult rabbit body weight. The feed will enter the mouth and pass through a short oesophagus then go to a simple stomach that can store 90-100 g of feedstuffs, then it will go to the small intestine that length 3 to 3.5 m long and joining with caecum which is 40-45 cm long. Caecum connected with colon length 1.5 m.

Feedstuffs will reach and keep in the stomach that contains acid for three to six hours to undergo chemical changes. Next, it will enter the small intestine and the processed feedstuffs will be diluted by the bile and pancreatic juice. Bile from the liver comprises of bile salts and organic substances, while the pancreatic juice

comprises trypsin (for protein breakdown), amylase (for starch breakdown) and lipase (for fat breakdown). Elements in the feedstuffs will be unbound and can easily pass through the small intestine wall to be accepted by bloodstream and pass to body cells. Some particles that might not be broken down after one and a half hours in the small intestine will enter the caecum and stay there for two to 12 hours to break down by enzymes produced by bacteria.

The product of this process (mainly volatile fatty acids) will exit to the bloodstream. The remaining particles that were not be broken down in caecum will pass into the colon. If the particles enter the colon early in the morning, the secretion of mucus by the colon will wrap the particles forming soft or night faeces that scientifically known as caecotrophs. Rabbit will twist its body to simplify the process of swallow caecotrophs that being ejected from the anus (Lebas et al., 1997).

If the remaining particles exit the caecum during the day, the particle will enter caecum twice and most of liquid part and small particles less than 0.1mm will enter caecum. The solid residue will form hard faeces that will be ejected into the colon. The hard faecal will excrete by the rabbit, while the soft faecal will be consumed back by the rabbit directly from the anus. These two types of faeces (hard and soft) have a different composition as shown in Table 2.2 as below.

Table 2.2 shows the average composition of hard and soft faecal

Components	**Hard Faecal (Average Percentage)**	**Soft Faecal (Average Percentage)**
Moisture	110	103
Dry Matter	223	214
Proteins	197	120
Crude Fibre	134	121
Fats	202	210
Minerals	24	20
Nitrogen-free extract	43	53

Source: Lebas et al., (1997)

Commercial rabbit farming makes rabbit meat sufficient and easy to get in the market as 50%-60% world's rabbit farmers are working on commercial rabbit farms. Italy, France, Spain, China and CIS are the leading countries with commercial systems while the other countries production is usually in backyards farming. Up to 12,000 does were risen in large farms but usually, farmers rise less than 1,000 does in their farm. Although the main product of rabbit production was meat, Angoras

rabbit production grew the rabbit for its wool that can be obtained by hand plucking, shaving and harvested at slaughter (Gregory & Grandin, 2017).

Rabbit farming facing some welfare problems which are a high level of ammonia in the atmosphere, doe violent behaviour, hypothermia, hyperthermia and inappropriate nesting facilities. Naturally, a doe will attack intruders aggressively if it disturbs its nest site due to strong territorial and maternal instinct. Therefore, in commercial rabbit farming, a farmer need to confine a doe in an individual cage to ensure their safety and comfortability to rears their litter in the nest box (Gregory & Grandin, 2017).

Gregory & Grandin (2017) stated that in a breeding programme, the female breeding stock needs to be placed into the buck's cage for a short period as the kits might be eaten by the buck if the stay together. Two weeks later, the does should be palpated to check the pregnancy. Next, before the doe starts kindling, a clean nest box was given and after kindling, its litter was checked if needed. After one to two weeks later the doe can rebreed again. Rabbit in commercial rabbit farm was differed from the wild rabbit as it always visits its nest box that can cause kit trampling and crushing.

Hyperthermia can happen usually on a sunny day. Wild rabbit can move into the burrow and take a breath inside it to cooling down while the commercial rabbit cannot do that. It can face the heat stress and problem due to a high concentration of ammonia in the atmosphere. Hypothermia can happen when there are too much or too little kits in the nest box that can cause the kits to escape from the nest box. The kits need to keep warm and the doe rarely put back its kits into nest box if it kits escape from the nest box. The implications are hypothermia and starvation (Gregory & Grandin, 2017).

The purpose of a rabbit being rise will influence the cage size although it has no relation to the rabbit's space requirement. The new atmosphere was stressful to rabbit, while heat stress (32–34°C) and noise stress might influence the level of corticosterone and ascorbic acid in the rabbit. Improper cage size prevent the commercial rabbit to express its normal behaviour which is erect the ears, stand on its hind legs and jumping around the cage (Broom & Fraser, 2017)

In rabbit farming, 75% or more of the overall cost covers the feed cost. Feed cost can be diminished by culling non-productive does or bucks, handle the feed with care to avoid breakage of feed, prevent from the rabbit to scratching feed, prevent the kits from playing and dropping their feed, control rodents from entering the farm and avoid buck buying of feed to avoid wastage. Besides, the mortality rate also will influence the rabbit farming profitability. To decrease the mortality rate with low cost, a farmer needs to prevent all the rabbit from fall sick so he/she can reduce the cost for the treatment (McNitt, Lukefahr, Cheeke, & Patton, 2013).

2.2.1 Feeding behaviour of rabbits

Oryctolagus cuniculus is generally herbivores that can consume a plant waste or plant that have no benefits to human and change it into valuable animal protein. It can convert 20% of proteins from feed into edible meat. The feeding behaviour of new-born rabbits is depending on the dam. Once in every 24 hours, the doe will feed her kits (sometimes twice a day) for only two or three minutes. If the doe cannot produce sufficient kinds of milk, it will give signals by hold back her milk when its

kits try suckling every time it enters the nest box. At the age of three weeks, the kits start to moves around, reduce the quantity of milk suckling and drink the drinking water if available and also consume solid and liquid feed. The quantity of feed intakes constant until it reaches 12 weeks of age and starts to decrease slightly (Lebas et al., 1997).

Generally, the amount of solid and liquid feed consumed by the young rabbit in the dark is more than in the light. When the rabbit becomes adult, its consumption of feed and water depends on types of feed, their breed, aged and its production. During the reproduction cycle, a doe's feeding cycle is varied. The intake will have reduction during late pregnancy and after kindling the feed and water uptake rise rapidly (Lebas et al., 1997).

Rabbit's digestive system differs from other mammals due to incisors teeth, large hindgut for the process of fermentation and coprophagy process. Usually, the rabbits ingest their feed at the dawn and in the night. It also more prefer to eat leaf, young plant and fresh feed. This diet was high in protein, high in digestible energy and low in fiber. Besides, a rabbit is sensitive to feed changes and refuse to receive new diet. Commonly, it will consume fed according to its energy requirement. Rabbit will eat more feed if the feed low in energy content and vice versa although the total caloric intake is similar. Through the nervous system, a rabbit can control its energy intake. The feed intake by the rabbit mainly control by energy in the diets, palatability of feed and surrounding temperature (Lukefahr, Cheeke, & Patton, 2013).

2.3 General review of Napier grass (*Pennisetum purpureum*)

It has been recorded that Napier grass (*Pennisetum purpureum)* was familiarized in Malaysia from East Africa and now it is the most popular fodder grass. There were varieties of Napier grass such as the Taiwan Napier, Dwarf 'Mott' Napier, King grass, Common Napier, Uganda Napier, Indian Napier, Australian Dwarf Napier, Red Napier, Napier 3rd Generation, Kobe Napier and Zanzibar Napier that can be classified as tall or medium height (>130cm) and short or dwarf height (<95cm). (Halim, Shampazuraini, & Idris, 2013;Haryani H., F. Norfadzrin, A. Aswanimiyuni, S. A. Syed Hussein, 2012).

Total oxalate concentrations in Napier grass that fertilized using Ca-fertilizer is lower compared to unfertilized Napier grass and the level of Ca in animal blood that fed with Ca fertilized Napier grass is higher than unfertilized Napier grass Dwarf Napier has low dry matter yield same or less than four tonnes/ha/cut unrelatedly of its height. It is grows best in area that receive high-rainfall (>1,200mm rainfall/year) but not in flood area. The different height of Napier grass due to the length of internodes. Dwarf Napier had highest leaf to stem ration and nutritive value compared to tall cultivars. The leaf to stem ratio (LSR) can determine the quality of Napier grass. A better nutritive value of Napier grass is when the proportion of leaves is higher than stem. But, Dwarf Napier has low yielding although the crude protein contents was the highest (Zailan, Yaakub, & Jusoh, 2018;Rahman, Nakagawa, Niimi, Fukuyama, & Kawamura, 2011)

Table 2.3: Taxonomy Hierarchy of Napier grass

Domain	Eukaryota
Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Monocotyledonae
Order	Cyperales
Family	Poaceae
Genus	*Pennisetum*
Species	*Pennisetum purpureum*

Source: Julissa Rojas-Sandoval, Department of Botany-Smithsonian NMNH, Washington DC, (n.d.)

2.4 Oxalic acid / oxalate content in Napier grass

High level in oxalates in the forages mainly halophytes were requires by plants for osmoregulation purpose although it may causes toxic to livestock. The direct consequence of fed livestock with soluble oxalate is makes oxalate absorbed and accumulates in the kidney that will cause intoxication. Besides, insoluble oxalate can cause indirect effect such as attraction to calcium (Ca) and magnesium (Mg) that will

result to Ca and Mg deficiency for microflora and the animal. Oxalate rich plants can causes drop of feed intake, rise water intake and urination (Rahman et al., 2017)

Impact of fed sheep with grass that contain high oxalate is lowered blood Ca level compared to fed sheep with grass that contain low oxalate(Rahman et al., 2011). Although total Ca consumption of sheep was same between treatment, lower concentration of soluble oxalate in Cafertilized grass causing sheep to have higher blood Ca level than sheep fed control grass as combination of soluble oxalate with free Ca becoming insoluble oxalate in the rumen. Soluble oxalate combines chemically with free Ca to become insoluble oxalate in the rumen causes absorption of Ca to be dropped. Besides, soluble oxalate may also be absorbed from the rumen into the blood stream where it can combine with serum Ca to form insoluble Ca oxalate crystals and then precipitate in the kidneys. Oxalic acid binds with Ca to form Ca oxalate, a non-soluble, non-digestible compound sheep fed Ca-fertilized grass had higher blood Ca level than sheep fed control grass, even though total Ca intake was similar between the treatments. (Rahman et al., 2011)

Onyeonagu et al. (2013) stated that during rainy season the oxalate and phytate contents is significantly higher in the grasses species and oxalate content in *Pennisetum purpureum* is the highest between *Andropogon gayanus, Cynodon nlemfuensis* and *Panicum maximum*. Besides, the oxalate content in *Panicum maximum* during dry season is similar with *Pennisetum purpureum.*

With pKa values of 1.3 and 4.3, oxalic acid can be considered as one of the strongest organic acid. The concentration of oxalic acid in plants was the highest commonly in the leaves and the bottommost roots and can be differs depends on its age, season, climate and soil type (Çalişkan, 2000).

2.5 Minerals contents in rabbit

In rabbit, the metabolism of Ca is unique because Ca is absorbed in the direct proportion to its concentration in the diet, nevertheless the metabolic need and if Ca is excess it will be eliminated through urine causing the chalky white deposits seen beneath the cages. The calcification of soft tissues can rise and the absorption of phosphorus and zinc will reduce if Ca level is excess (>15g/kg) that can lead to lack of those minerals. Rabbit milk has three to five times more Ca compared to cow's milk (Halls, 2010)

Table 2.4 :The rabbit's nutrient requirement.

Fibre	>20%
Protein	12-14%
Fat	1-4%
Calcium	0.6-1.0%
Phosphorus	0.4-0.8%
Vitamin A	10,000-18,000 IU/kg
Vitamin D	800-1,200 IU/kg
Vitamin E	40-70 mg/kg
Magnesium	0.3%
Zinc	0.5%
Potassium	0.6-0.7%

Sources: Buseth & Saunders, (2015)

2.6 Rabbit carcass analysis

The liver, lung, heart and bile weight is similar between rabbit that fed with concentrate, *Tridax* and elephant grass. Rabbit that fed with concentrate has similar weight of hind leg, breast and rib with the rabbit that fed with mixture of *Tridax* and *Pueraria* with 30 g concentrate. The weight of foreleg, loin and abdominal wall weight of rabbit that fed concentrate is significantly 39.79% more than rabbit that fed with Elephant grass supplemented with 30 g concentrate, *Tridax* supplemented with 30 g concentrate, mixture of *Tridax* and *Pueraria* (60:40) with 30 g concentrate and mixture of Elephant grass and *Pueraria* (60:40) with 30 g concentrate. (Oloruntola;Daramola and Omoniyi, 2015)

The pre-slaughter weight, carcass weight, dressing percentage, weight of lungs, kidneys, stomach, intestines, head, skin, feet, tail, shoulder, loin and thigh has no significant differences between rabbit that fed on 40% *Delonix regia* seed diets and rabbit that not fed with any alternative to groundnut in their diet formulation. *Delonix regia* seed can be included in ration formulation for rabbit as the level of *Delonix regia* seed insertion in the feed give no significant difference but it can reduce the cost as it was an agro-industry by products. (Kaga, 2013)

CHAPTER 3

MATERIALS AND METHODS

3.1 Experimental design

Study site

The research was conducted at Agro Techno Park, UMK Jeli Campus, Kelantan, Malaysia. The climate of the research location has defined wet and dry seasons. The mean minimum (night) and maximum (dry) temperatures are 22°C and 36°C, respectively. The relative humidity ranging between 77% and 90% and mean day length was 12 hours.

Animals

The experimental animals were mixed breed rabbits, which were housed individually in metal cages in a complete house with open windows covered with wire mesh.

Forage planting

The plot site used to plant Napier grass pandan types were ploughed and harrowed. Grasses were established in 40ft x 10ft plots in a randomised block design with four replications. All grasses expected to get 1.36kg/m² goat manure at planting. All plants were irrigated at critical time for irrigation which was three days after planting. The plants were harvested in the morning for everyday for 20-35 of plant-maturity to be fed to rabbits.

Experiment

Nine (9) early weaned rabbit comprising crossed breed of both sexes were used for this experiment. The rabbits were given an adjustment period for them to be familiar with new environment and their feed were changed gradually to reach the required amount for experiment as immediate changes can cause shock to the rabbit. The grass samples were analysed using standard procedures for chemical composition for dry matter (DM) according to AOAC (1990) procedure.

3.2 Planting Napier grass

Napier grass planting started after land preparation processes. The land has to be cleaned from bushes, thorns and weeds as it may take nutrients provide for Napier grass later. Then, the land needs to be ploughed by digging the soils and removes the clods (a lump of earth or clay).Then, limestone needs to put to the lands for 30g per m², where 3.6576kg is needs for 37.161 m² plot size before puts organic fertilizers with the amount of 4.46kg/m²/year or 55.2584kg/37.161 m²/4months. Next, we prepare the seedbed with interval 50cm x 50cm space before sowing seeds of Napier pandan Grass (*Pennisetum purpureum*) with 1ft size. Finally, we installed fences using bamboo and black nets to prevent from wild boar attacks. The first irrigation was done at the time of planting and the life irrigation on the third day after planting. The irrigation depends upon the soil quality and the frequency of irrigation depends upon the rainfall and weather conditions.

3.3 Feeding trial

Nine rabbits (A,B,C,D,E,F,G,H and I) were divided into three different treatments.

Treatment 1: 25% concentrate plus Napier grass ad libitum (rabbit A, rabbit B, rabbit C)

Treatment 2: 50% concentrate plus Napier grass ad libitum (rabbit D, rabbit E, rabbit F)

Treatment 3: 100% concentrate/ control (rabbit G, rabbit H, rabbit I)

When all nine rabbits arrived in UMK, they were provided with clean water and pellet ad libitum. The weight of pellets fed was recorded to know the average pellets consumed by all rabbits daily. Napier pandan grass was introduced ad libitum and 5% pellet were reduced daily until pellet percentage is 50% for second treatment and 25% for third treatment from the average fed by rabbits. The experiment were proceed for 90days. Feed intake was determined daily and body weight was taken before start of the experiment. One week interval and all the end of the experiment.

3.4 Data analysis

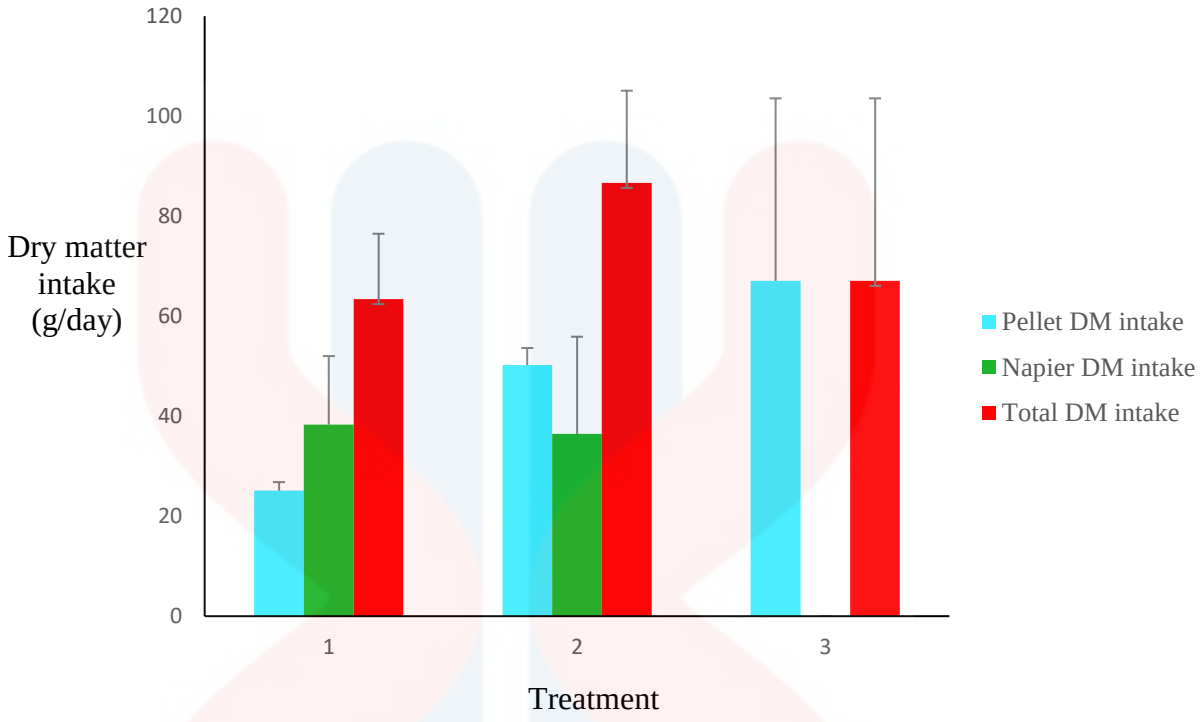
All data obtained were analysed using analysis of variance (ANOVA) from IBM SPSS statistics version 20. The significant difference was considered at 5% confidence level.

CHAPTER 4

RESULT

4.1 Collected Data

This experiment was conducted at AgroTechno Park, Universiti Malaysia Kelantan, Jeli Campus. The feed intake of nine (9) early weaned rabbits were taken daily, the body weight of rabbits were taken weekly and the rabbits carcass composition were taken after slaughterd.



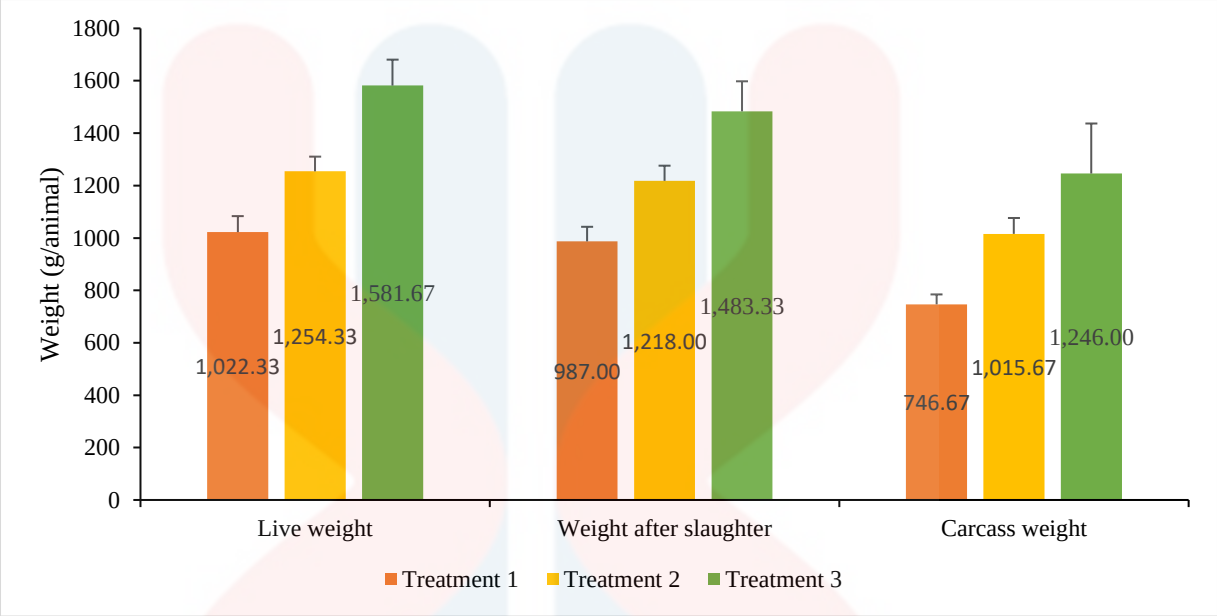
Graph 4.1 shows the average dry matter intake of *Oryctolagus cuniculus* in three different treatments. Error bar indicates standard deviation.

Table 4.1 shows the concentrate, Napier grass and total dry matter (DM) intake by *Oryctolagus cuniculus* in 80 days during feeding trial on different percent of concentrate.

Parameter	Treatment (% of concentrate)		
	25%	50%	100%
Concentrate DM intake (g/d)	25.104 ± 1.717^{a}	50.207 ± 3.435^{b}	67.068 ± 36.499^{c}
Napier DM intake (g/d)	38.314 ± 13.708^{a}	36.450 ± 19.453^{b}	0^{b}
Total DM intake (g/d)	63.417 ± 13.077^{a}	86.658 ± 18.436^{b}	67.068 ± 18.436^{a}

*^{a,b,c} Means with different superscripts within the same row differ significantly (P<0.05)

4.2 The growth performance of *O. cuniculus*

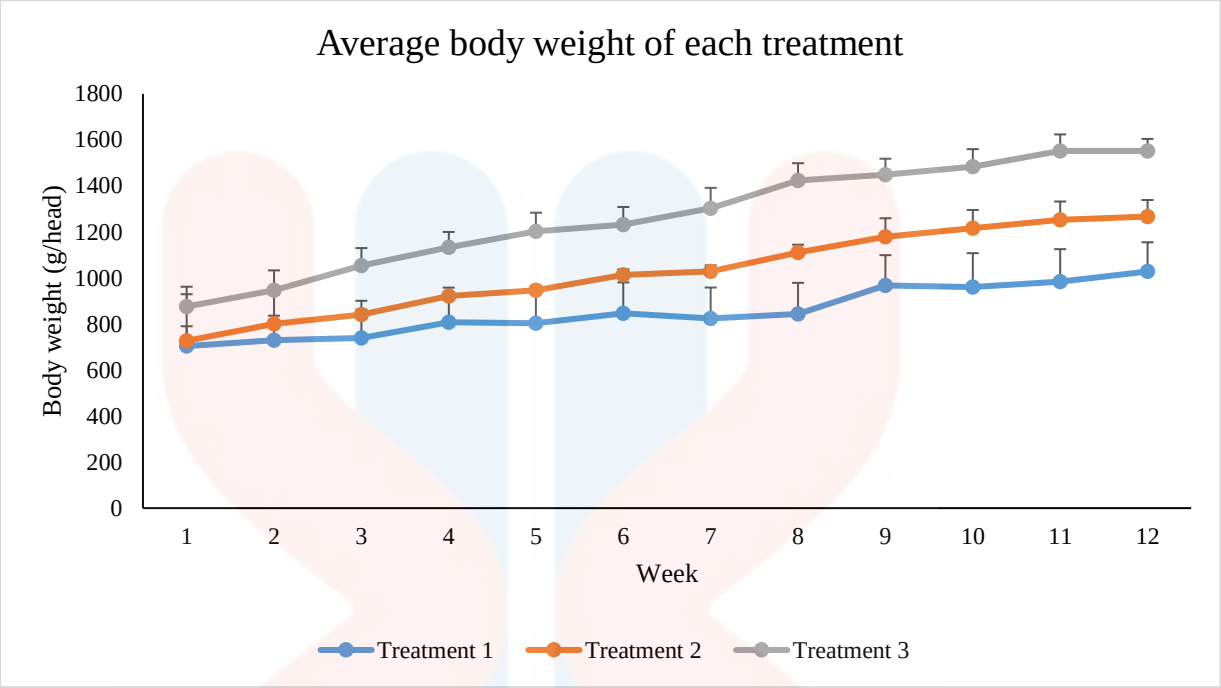


Graph 4.2: shows that the mean live weight, mean weight after slaughter and mean carcass weight of rabbit in three different treatments. Error bar indicates standard deviation.

Table 4.2 shows the live weight, weight after slaughter, carcass weight and percentage of carcass.

Treatment	Live weight (g)	Weight after slaughter (g)	Carcass without pelt (g)	Percentage of carcass (%)
1	1022 ± 61[a]	987 ± 56[a]	747 ± 38[a]	26.908
2	1254 ± 56[b]	1218 ± 58[b]	1016 ± 61[b]	18.979
3	1582 ± 99[c]	1483 ± 115[c]	1246 ± 191[b]	21.239

*[a],[b],[c] Means with different superscripts within the same row differ significantly (P<0.05)



Graph 4.3 shows the average weekly body weight of rabbit in each treatment. Error bar indicates standard deviation.

4.3 The carcass composition of *O. cuniculus*

Table 4.3 shows the carcass composition in different treatment.

Parameter	Treatment			Level of significance
	1	2	3	
Live weight (g)	1022 ± 61	1254 ± 56	1582 ± 99	
Weight after slaughter (g)	987 ± 56	1218 ± 58	1483 ± 115	
Carcass without pelt (g)	747 ± 38	1016 ± 61	1246 ± 191	
Feet (g)	32 ± 2.4	33 ± 1.8	36 ± 1.0	NS
Head (g)	108 ± 7.6	117 ± 13.7	133 ± 2.6	NS
Spleen (g)	0.5 ± 0.2	0.9 ± 0.4	0.5 ± 0.3	NS
Lungs (g)	3.9 ± 0.9	5.1 ± 0.3	5.7 ± 1.2	NS
Heart (g)	2.9 ± 0.4	3.2 ± 0.1	3.7 ± 0.6	NS
Kidney (g)	6.1 ± 0.4	7.5 ± 0.7	8.0 ± 0.4	NS
Liver (g)	26 ± 3	32 ± 6	34 ± 1	NS
Stomach (g)	51 ± 6.5	44 ± 0.4	53 ± 5	NS
Intestine (g)	117 ± 29	144 ± 9	128 ± 15	NS
Tail (g)	5	5	5	NS

NS=non-significant (P>0.05)

CHAPTER 5

DISCUSSION

5.1 Feed intake of *Oryctolagus cuniculus*

Based on Graph 4.1, the average dry matter of Napier grass intake by treatment 1 and treatment 2 was almost the same and treatment 3 was not given any Napier grass. As the quantity of pellet (concentrate) given to rabbit, *Oryctolagus cuniculus* increases, the amount of dry matter of concentrate intake also increases. The amount of concentrate given to rabbit did not affect the amount of Napier grass intake by the rabbit. From the previous study by Amata & Okorodudu, (2016), it stated that rabbits that fed with Napier grass gained the highest weight compared to rabbits that fed with *Panicum maximum*, *Myrianthus arboreus* and *Gmelina arborea*. The rabbit that consumes Napier grass achieved higher body weight gain as it feeds conversion ratios. From this statement, we can conclude that rabbit in treatment 1 and treatment 2 gain most of their weight from the

Napier grass. Napier grass has DM percentage up to 90% (Tavirimirwa, Manzungu, & Ncube S., 2011).

From Table 4.1, the amount of concentrate DM intake did not affect the total DM intake by the rabbits. Although treatment 1 had the lowest percentage of concentrate given, it's Napier grass consumption was only differed about 2g DM intake with treatment 2. Besides, the treatment 2 had the highest DM intake compared to others. Rabbit requires 2,100-2,200kcal/kg for body maintenance and 300-500 kcal/kg more than maintenance requirement for reproduction and growth. Too low digestible energy in feed can cause a rabbit to eat more and too much digestible energy can disturb the energy distribution in the body as fat and protein (Halls, 2010). According to this report, we can conclude that the rabbit that's not got enough energy can cover their energy requirement by the intake of Napier grass. Like treatment 1 and treatment 2, if they get enough energy from the concentrate, they will not consume Napier grass during the feeding trial.

5.2 Growth of *Oryctolagus cuniculus*

The differences in live weight, weight after slaughter and carcass weight in Graph 4.2 and Table 4.2 shows that treatment 3 had the highest quantity followed by treatment 2 and treatment 1. Live weight or pre-slaughter weight is the weight of the rabbit before removing the blood during the slaughtering process. Weight after slaughter is the weight of the rabbit without blood and carcass weight is the rabbit's weight without pelt, head and feet. The percentage of a carcass is the percentage of lean from a live rabbit.

Treatment 2 had the lowest percentage of carcass followed by treatment 3; and treatment 1 had the highest percentage. The mixture of diet between concentrate and forage met the nutrient requirement of rabbit (Oloruntola, Daramola and Omoniyi, 2015)

From Graph 4.3, the body weight of all treatment increased, but with a different rate. The rate of growth can be indicated by the steepness of the graph. Treatment 3 had the highest rate followed by treatment 2 and treatment 1. Oloruntola et al., (2015) stated that a rabbit has a high growth rate, high efficiency in transform forage into the meat and low production cost. Treatment 1 and 2 had a lower growth rate due to the intake of Napier grass that contains an anti-nutritional factor, oxalic acid. Plant with high oxalate is acutely toxic to the animals. It can form oxalate crystals and urinary stones (Çalişkan, 2000).

5.3 *Oryctolagus cuniculus* carcass composition

From Table 4.3, live weight, weight after slaughter, carcass without pelt, feet, head, lungs, heart, kidney, liver, stomach and intestine of treatment 3 were the highest, but it was not found any significant difference. Oloruntola et al., (2015) state that weight of liver, lungs, heart and bile were not affected by the diets but only specifies by the physiological and anatomical functions of that organs.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The accessibility of Napier grass by local farmers in Malaysia can reduce the production cost of rabbit farming by fed the Napier grass to the rabbits, and can reduced the concentrate given. It can increased the DM intake of rabbit, but farmers cannot totally depend on the forage like Napier grass to fed their rabbits as the growth rate performance was not too worthy. Although it contains oxalic acid, there is no problem with rabbit farming as rabbit needs to slaughter at the age of three months. Besides, there were no significant differences in organ of rabbit that consumed Napier grass with rabbit that consumed totally concentrate.

6.2 RECOMMENDATION

In the future study, proper ration formulation should be done to increase rate of growth in early weaned rabbit. It is because in rabbit farming, the feed cost needs to reduce and rabbit needs to rise in shorter period of time. Next, in the future we should run a study to improve rabbit genetically. When the genetic of rabbit will be improved, rabbit farming can success to compete with other livestock industry.

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APPENDICES

Table A.1: One way ANOVA of pellet DM intake, Napier grass DM intake and total DM intake between treatments.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Pellet_DM_intake	Between Groups	214043.188	2	107021.594	238.371	.000
	Within Groups	321911.627	717	448.970		
	Total	535954.814	719			
Napier_DM_intake	Between Groups	224002.055	2	112001.028	593.302	.000
	Within Groups	135352.254	717	188.776		
	Total	359354.309	719			
Total_DM_intake	Between Groups	74974.366	2	37487.183	61.019	.000
	Within Groups	440489.766	717	614.351		
	Total	515464.133	719			

Table A.2: Normalility Test on weight of rabbit.

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Treatment	Statistic	df	Sig.	Statistic	df	Sig.
Live_weight	Treatment 1	.328	3	.	.871	3	.298
	Treatment 2	.360	3	.	.809	3	.136
	Treatment 3	.188	3	.	.998	3	.911
Weight_after_slaughter	Treatment 1	.353	3	.	.823	3	.172
	Treatment 2	.382	3	.	.757	3	.016
	Treatment 3	.346	3	.	.838	3	.209
Carcass_weight	Treatment 1	.337	3	.	.855	3	.253
	Treatment 2	.346	3	.	.836	3	.205
	Treatment 3	.213	3	.	.990	3	.809

a. Lilliefors Significance Correction

Table A.3: One way ANOVA weight of rabbit.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Live_weight	Between Groups	473824.889	2	236912.444	42.546	.000
	Within Groups	33410.000	6	5568.333		
	Total	507234.889	8			
Weight_after_slaughter	Between Groups	370109.556	2	185054.778	28.292	.001
	Within Groups	39244.667	6	6540.778		
	Total	409354.222	8			
Carcass_weight	Between Groups	374748.222	2	187374.111	13.519	.006
	Within Groups	83157.333	6	13859.556		
	Total	457905.556	8			

Figure A.1: One of the rabbit in the cage on the first day of feeding trial

Figure A.2: Carcass of rabbit after 80days of feeding trial.

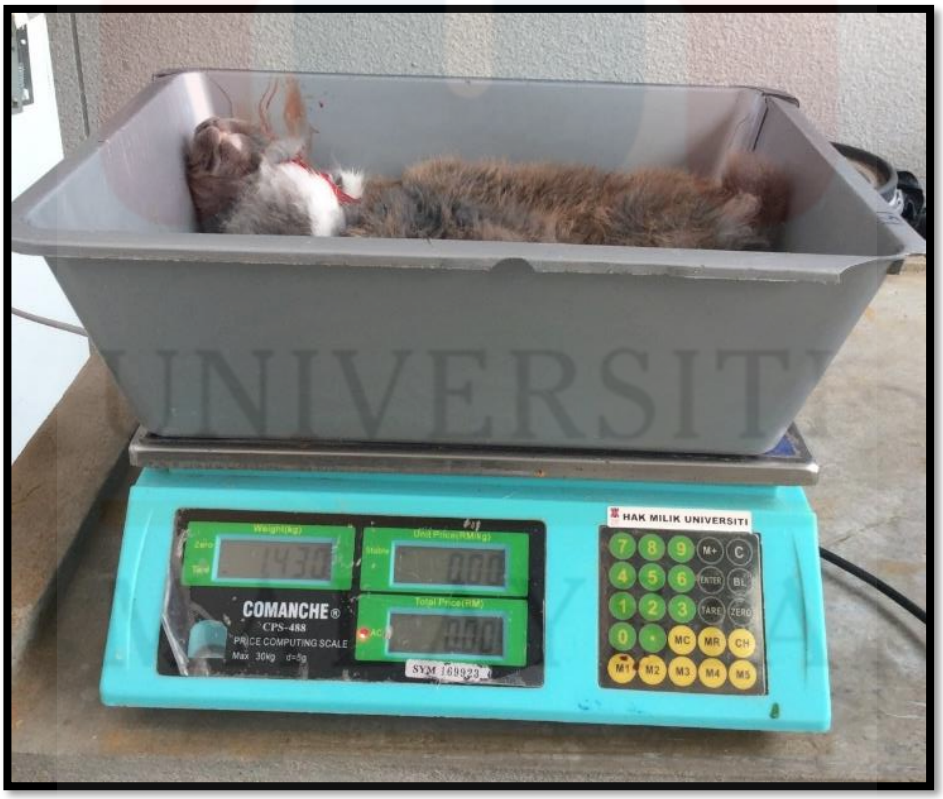

Figure A.3: Post-slaughtered weigh is taken by using weighing balance

Figure A.4: During the process of pelt removing

Figure A.5: Weighing of pelt

Figure A.6: Head, tail and feet of rabbit

Figure A.7: The pelt of rabbits

Figure A.8: Weighing of carcass before removing internal organs

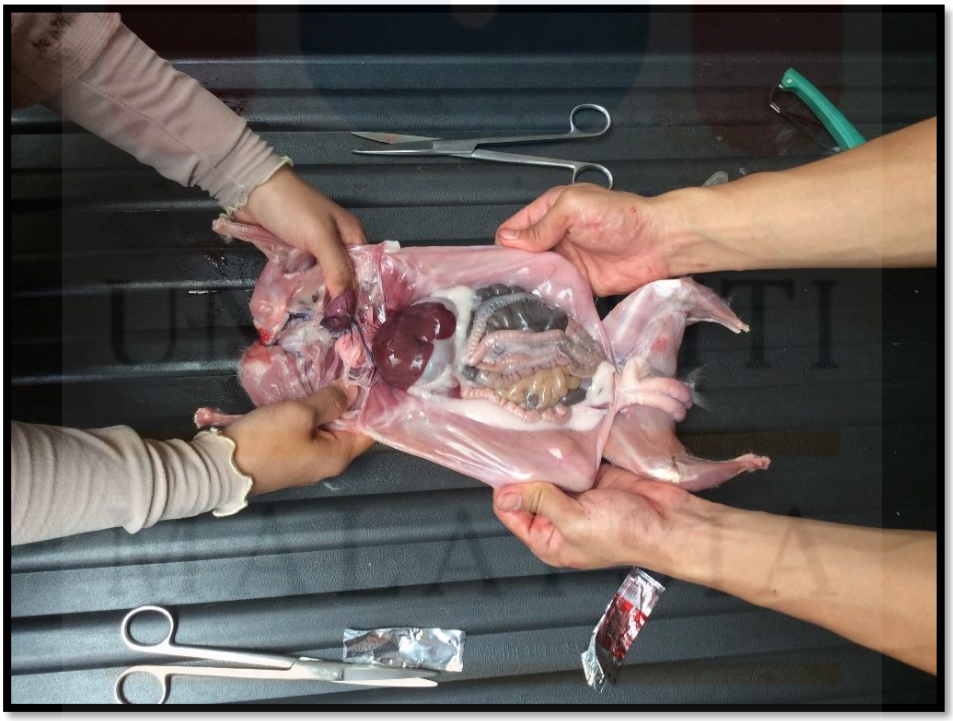

Figure A.9: During the process of removing the internal organs.

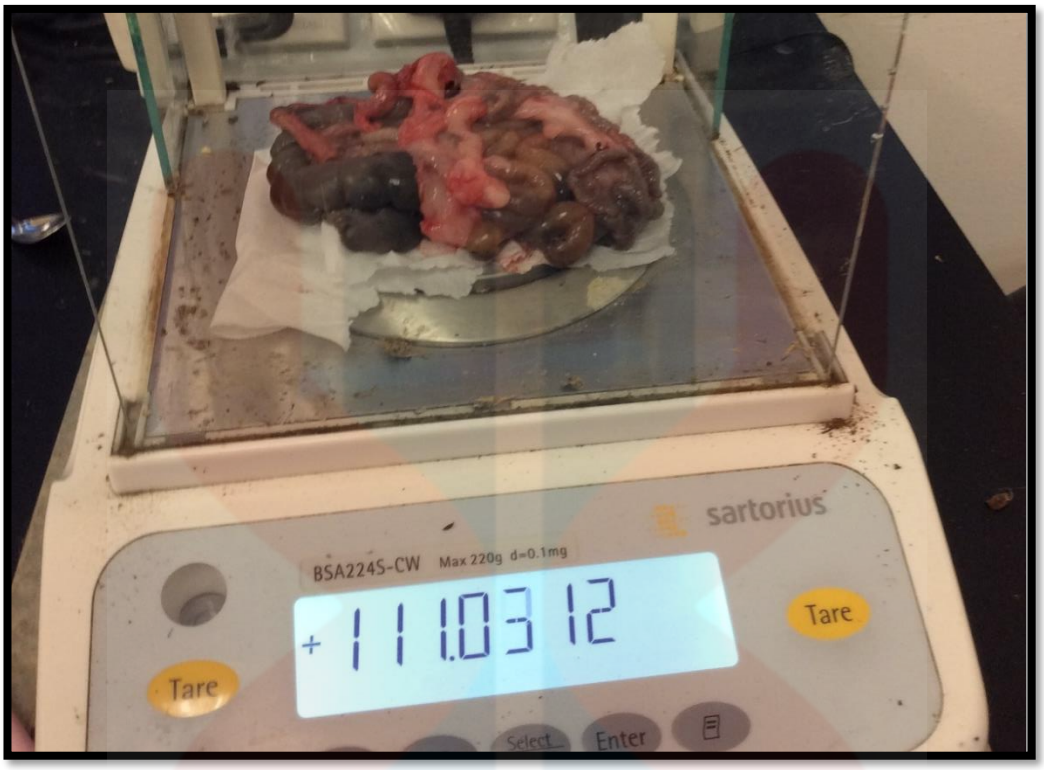

Figure A10: Weighing intestines using balance

Figure A.11: All of the organs that need to record its weight

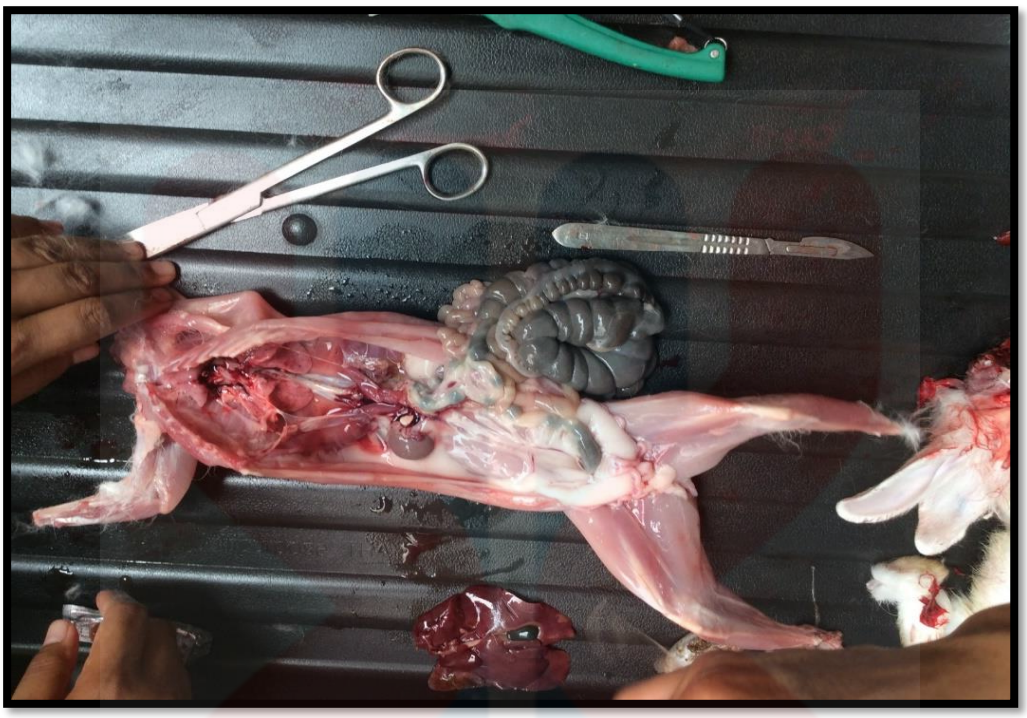

Figure A.12: The condition of carcass during the process of organ removal

Figure A.13: The process of drying using oven