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**The Effect of Different Feed on the Growth Rate and Behaviour of
Rabbit (*Oryctolagus cuniculus*)**

By

Mismohid Bin Mohd Ishak

F14A0135

Supervisor

En. Zulhisyam Bin Abdul Kari @ Abdullah

A proposal submitted in fulfillment of the requirements for the degree of
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**Faculty Of Agro Based Industry
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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.

Name: MISMOHID BIN MOHD ISHAK

Date:

I certified that the Report of this final year project of this final year project entitled “The Effect of Different Feed on the Growth Rate and Behaviour of Rabbit (*Oryctolagus cuniculus*)” by Mismohid Bin Mohd ishak, matric number F14A0135 has been examined and all the correction recommended by the examiners have been done for the degree of Bachelor Of Applied Science (Husbandry) with Honours, Faculty of Agro Based Industry, University Malaysia Kelantan.

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The Effect of Different Feed on the Growth (Weight and Length) and Behaviour of Rabbit (*Oryctolagus cuniculus*)

ABSTRACT

The thesis presents an improved approach and study on the effect of giving different feeds such as pellet and vegetables on domestic rabbit (*Oryctolagus cuniculus*). Rabbits are now more commonly known amongst the community as an alternative source of food product as for their rich content of protein source as well as being domesticated worldwide. However, it is kind of complicated to rear rabbits as they required specific care attention on their needs regularly. The proposed experiment is divided into three segments where the first segment consists of rabbits which are test with certain solid rabbit feed which is pellet where pellet is easily digestible by rabbits as these type of food is suitable for the age of rabbits which are 7 months. Commonly, using pellets as feed for rabbits are mostly useful where it contains almost all the basic nutrition needed by rabbits. The proposed segment uses only rabbit pellet specifically timothy-based pellet to be served to the rabbits as rabbit feeds and no other feed type is given to them. In the second segment, vegetables type of food such as cabbage and carrot are served to the rabbits in contra of the first where soft type of food is given to test the survivability and growth rate of the rabbits compared to the first. The third part set up by giving rabbits both type of food as a constant and zero indicator. These experiments have been run for three months in suitable condition where they are under shelter to make sure another factor does not affect them. The experimental results show that these methods constantly and constructively point out effect and changes on rearing rabbits caused by change of surrounding and feed type. The results of experiment show that rabbits do easily depends on their feed and nutrition as the biggest factor on affecting growth and survivability as well as their behaviors which also prove that timothy-based pellet is better than vegetables feed. The experimental results on real time events will build more awareness amongst farmers to emphasize on their choice of feeds which are given to the rabbits as these will necessarily affect the rabbits in many ways in bigger rearing events.

Keywords: *Oryctolagus cuniculus*, domestic rabbit, segment, timothy-based pellet, survivability,

Kesan Makanan yang Berbeza pada Pertumbuhan (Berat dan Panjang) dan Kelakuan Arnab (*Oryctolagus cuniculus*)

ABSTRAK

Tesis ini membentangkan pendekatan yang lebih baik dan kajian mengenai kesan memberi makanan yang berbeza seperti pelet dan sayuran pada arnab domestik (*Oryctolagus cuniculus*). Arnab kini lebih dikenali di kalangan masyarakat sebagai sumber alternatif produk makanan untuk kandungan sumber protein mereka yang kaya dan juga dijaga di seluruh dunia. Walau bagaimanapun, ia agak rumit untuk membela arnab kerana mereka memerlukan perhatian khusus terhadap keperluan mereka secara berkala. Eksperimen yang dicadangkan dibahagikan kepada tiga segmen di mana segmen pertama terdiri daripada arnab yang diuji dengan makanan arnab pepejal tertentu yang merupakan pelet di mana pelet mudah dicerna oleh arnab kerana jenis makanan ini sesuai untuk umur arnab yang berumur 7 bulan. Secara umum, menggunakan pelet sebagai makanan untuk arnab kebanyakannya berguna di mana ia mengandungi hampir semua nutrisi asas yang diperlukan oleh arnab. Segmen yang dicadangkan hanya menggunakan pelet arnab khusus pelet berasaskan timothy untuk diberikan kepada arnab sebagai makanan arnab dan tiada jenis makanan lain diberikan kepada mereka. Di segmen kedua, jenis sayuran makanan seperti kubis dan lobak merah disampaikan kepada arnab sepertimana kontra dengan yang pertama di mana jenis makanan yang lembut diberikan untuk menguji kebolehan surviviti dan pertumbuhan arnab berbanding dengan yang pertama. Bahagian ketiga ditubuhkan dengan memberikan arnab kedua-dua jenis makanan sebagai penunjuk berterusan dan sifar. Eksperimen-eksperimen ini telah dijalankan selama tiga bulan dalam keadaan yang sesuai di mana mereka berada di bawah perlindungan untuk memastikan faktor lain tidak mempengaruhi mereka. Hasil percubaan menunjukkan bahawa kaedah ini secara berterusan dan sekukuhnya membuktikan kesan dan perubahan dalam membela arnab disebabkan oleh perubahan persekitaran dan jenis makanan. Hasil percubaan menunjukkan bahawa arnab mudah bergantung pada makanan dan nutrisi mereka sebagai faktor terbesar yang mempengaruhi pertumbuhan dan kebolehan hidup serta tingkah laku mereka. Keputusan

percubaan pada realitinya akan meningkatkan kesedaran di kalangan petani untuk menekankan pada pilihan makanan mereka yang diberikan kepada arnab kerana ini akan mempengaruhi arnab dalam banyak cara dalam acara pembesaran arnab yang berskala lebih besar.

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LIST OF ABBREVIATIONS

BW	Body Weight
FCR	Feed Conversion Ratio
T ¹	Test 1
T ²	Test 2
T ³	Test 3



LIST OF SYMBOLS

g

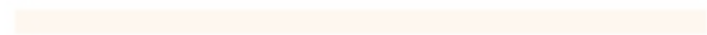
Gram

kg

Kilogram

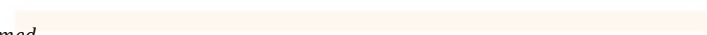


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$$\text{Growth Rate} = \frac{\text{"BW}_2 - \text{BW}_1\text{"}}{\text{Period of experiment}}$$



$$\text{FCR} = \frac{\text{Total feed consumed}}{\text{BW}_2 - \text{BW}_1}$$

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CHAPTER 1

1.0 RESEARCH BACKGROUND

Rabbits are small mammals with fluffy, short tails, whiskers, and distinctive long ears. They are normally a wild animal and live in the wild nature environments. In the wild, rabbits emerge from their burrows at dusk and spend most of the night above ground. They spend much of their time and energy on foraging, mainly at dusk and dawn.(Rommers, Bracke, Reuvekamp, Gunnink, & C, 2014) However, humans start to hunt rabbits for alternative protein source and food source. In spite of that, rabbits start to be reared and domesticated by farmers for food source causing the rabbits to change in behavior and feeding type. By contrast, domesticated rabbits often receive food which is easy to consume(Berthelsen & Hansen, 1999) but often the food do not fulfill the nutritional value needed by the domesticated rabbits(*Oryctolagus Cuniculus*). Rabbits (*Oryctolagus Cuniculus*) although greatly increasing in popularity, are still hard to be reared perfectly and often death occur caused by disease or lack of nutrition also failing on adaptation on behavioral change. Because of that, this study is made to show whether different type of feed intake does affect the growth and behavior of domesticated rabbits (*Oryctolagus Cuniculus*).

New human companions of these delightful animals often find themselves at a loss when attempting to interpret their rabbit's behavior and feed requirement. While there are some books available on rabbit care, few are specific for rearing domesticated rabbit care. The internet abounds with rabbit's website, some of which have a good information on rabbits, while others providing erroneous and misleading information. The search of knowledge can become

frustrating. (Lucile C. Moore,2004). As for that, it is important to investigate the effect of different feed on the growth rate and behavior of rabbit (*Oryctolagus Cuniculus*).

1.1 Problem Statement

Most of the information provided to the current society regarding the effect of different feed on the growth rate and behavior of rabbit (*Oryctolagus Cuniculus*) are mostly far from being backed credibly by credible scientific data and usually confusing making them not trustable. For this reason, research is carried out to determine the true effect of different feed on the growth rate and behavior of rabbits with different type of feed which is pellet and vegetables which obviously will have different results on the growth and behavior of them. The rabbit is quite simple to be taken care of as it can adapt to various kind of situation and condition but after being domesticated, caged and treated with different type of feeds, it will surely give big impact on behavioral change on the rabbit thus effecting the growth of the rabbits based on the weight and length. Being on top of that, rabbits are very intelligent beings and originally wild animal which live in nature and search their own food, thus behavioral change and growth change will be observed thoroughly after changing their wild nature characteristics and habitat which will test the effect of different feed type given to them.

1.2 Hypothesis

H₀: The rabbits which are given with rabbit pellet feed and the rabbit which is given with soft vegetables feed (carrots and cabbages) both have the same results which are the same behavior and range of growth (weight and length).

H_a: The rabbit which are given with rabbit pellet feed have better results which are better behavior and higher range of growth (weight and length) than rabbit which are given with soft vegetables feed (carrots and cabbages).

1.3 Research Question

1. Do the different feeds which are rabbit-pellet feed and soft vegetables have their own different effect on the growth rate of the rabbits?
2. Do the different feeds which are rabbit-pellet feed and soft vegetables have their own different effect on the behavioral change of the rabbit?
3. Do the rabbits survive thoroughly through the period of experiment or die because of different feed type?
4. What behavioral change will be shown by the rabbits?
5. How does the different type of feed effect the growth rate and behavior of the rabbits?

1.4 Objectives

1. To determine the effect of different feed (timothy-based pellet, carrot and cabbages) on the growth rate of rabbit in a period of three months and determining which is better as rabbit feed by referring to the higher measurement of weight and length of rabbit.
2. To determine the aggressiveness of rabbit through competition on survivality as an effect of different feed (timothy-based pellet, carrot and cabbages) in a period of three months.

1.5 Scope of Study

The study will be carried out to test the effect of different feed on the growth rate and behavior of rabbit (*Oryctolagus cuniculus*). Three sets will be set up in which each set will have two domestic rabbits (*Oryctolagus cuniculus*). One set will be taken care with rabbit-pellet type feed specifically the timothy-pellet feed while another one set will be taken care with soft vegetables feed only such as carrots and cabbages and the last set will be given both type of feed which is timothy based-pellet and soft vegetables to be made as constant variable in this experiment. These sets will be set up in a cage under shelter and safe environment to make sure that feed type is the only factor that affect the behavior change and growth rate of the rabbits in all the sets. The behavioral changes and growth rate will be observed to determine whether different type of feed does have effect or not on the results.

1.6 Significance of Study

The significance of this study is to reveal that different type of feeds which are timothy-based pellet and soft vegetables (carrots and cabbages) can affect the condition of

domestic rabbits (*Oryctolagus cuniculus*) by producing different results on growth rate of rabbits in each set and behavior of the rabbits in each set.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Rabbit Introduction

The ancestors of small rodent so known as rabbit originally originated in the Western Hemisphere and from there, they migrated to Asia and eventually to Europe. These rodent fossils also known as Lagomorph fossils have been found in late Eocene and early Oligocene deposits in North America, Europe, and Asia. The earliest rabbits of the variety *Oryctolagus*,

from which present modern domestic rabbits are descended, likely originated in Iberia before the Pleistocene and moved northward into Europe.

Rabbits were all spread across the board in Europe by the mid- Pleistocene, yet after the Pleistocene glaciation rabbits were pushed southward back to the Iberian Peninsula. The Phoenicians found them there around 1000 BCE thus took some back to their nation. From that point rabbits started to spread around the Mediterranean (Moore et al., 1990). Rabbits are unique in western culture as they are one of the animals that can be pets and also bred for meat production. Though rabbits are also kept as pet just like the dogs and cats but the privileged own by rabbits as pets are not fully extended yet as dogs and cats. As for rabbits, the farming and meat industry for these animals are not the same as chicken and calves as they have more problems and complicated issue regarding their feed choice and behaviors as well as the rabbit industry just make a small fraction of whole industry. (Welfare, Rights, Magazine, & Pet, 1943)

2.2 Domestic Rabbits (*Oryctolagus cuniculus*)

Rabbits (*Oryctolagus cuniculus*) make wise, inviting and calm animals. The normal life expectancy for a bunny is 7 to 10 years with records of up to 15 years old revealed.(Dr. Susan E. Brown, 2000). In their natural environment, rabbits are always active and reproductive successfully. They are completely herbivorous animals which only eat plant only and most actively searching for food at nighttime and twilight hours. Their behavior consists of digging burrows in the ground for shelter and protection as well as they rarely stand their ground when threatened but instead use their considerable fast speed and perfect maneuverability to escape from their enemies and harms. Domestic rabbits or kept in captivity, however, can display an amazing degree of aggression when upset or threatened. (Bolet et al., 2011) Remotely, the European rabbit is recognized from the greater part of the other five leporids in Europe by its

littler size, moderately shorter ears lacking dark tips and the white underside to its tail; likewise, not at all like *Lepus*, young rabbits are normally conceived underground furthermore, are exposed, visually impaired and vulnerable. The European rabbit takes after the American cottontails, *Sylvilagus* spp. what's more, is isolated from them on biochemical and behavioral grounds.

As its Latin name infers, the European rabbit is ordinarily a tunneling creature living collectively in warrens. These qualities are not in themselves analytic, in any case. Wild rabbits infrequently live for all time over the ground, shielding by day in thick vegetation, and just breed underground. At low thickness secluded sets are normal. This changed way of life in various territories underlines the species 'checked flexibility. (M. Delibes et. al., 1979). *Oryctolagus Cuniculus* make great pets. They are generally simple to tend to and can be litter-box-prepared. Their critical nature, unaggressive conduct and calm way make them progressively prominent house pets. Pregnancy keeps going 29-35 days (normal of 31-32 days) and litters normal 4-10 bunnies.



Figure 2.1: Domestic Rabbit (*Oryctolagus Cuniculus*)

Classification of domestic rabbits: (Linnaeus, 1758)

Kingdom : Animalia

Phylum : Chordata

Class : Mammalia

Order : Lagomorpha

Family : Leporidae

Genus : *Oryctolagus*

Species : *O. Cuniculus*

Binomial name: *Oryctolagus Cuniculus*

Traits of Domestic Rabbits:

Lifespan : 9 years

Length : 13 - 20 inch

Tail Length : 1.6 – 3.1 inch

Mass : 2.4 – 5.5 inch

Gestation time : 29 – 35 days

2.3 Domestic Rabbits (*Oryctolagus cuniculus*) Behavior

Domestication and, in particular, intensification of rabbit production are relatively recent phenomena in the evolution of this species. (Rougeot,1981). The social behavior of the

domestic rabbit (*Oryctolagus cuniculus*) is as complex as that of the wild rabbit (Vastrade, 1986). Caged rabbits display a series of behaviors, with resting, standing up, moving about, feeding, gnawing, and drinking occurring within short periods of time. They have frequent activity breaks and this change from one behavior to another occurs more often in caged rabbits than in rabbits kept under semi-natural conditions. (Lehmann, 1987). However, conventional cages without any enrichment give rabbits little opportunity to perform other elements of their natural behavior repertoire such as digging and gnawing. This may lead to frustration and abnormal behavior as bar biting, excessive grooming and stereotypies. (Love, 1994). By providing enrichment material will surely help these animals perform natural behaviour and ameliorate the effect of stressors in the environment. Besides, they have a basic need for chewing to wear down their open-rooted and continuously growing teeth. (Poggiagliolmi et al., 2011). If they don't have the opportunity to chew on appropriate materials, they may chew on any cage component. (Stauffacher, 1992). This can lead to tooth abnormalities or abscesses (Poggiagliolmi et al., 2011).

More extensive study shows that rabbits which are housed in cages often spent more time laying and sat around than rabbits living in pens and the wild. Caged rabbit also spent more time eating food than those living in pens and in their natural environment. Penned rabbits showed more rearing, digging, stretching, hopping, and running behaviors than those in cages. rabbits spent about 16-17% of the time grooming themselves, and scraping and gnawing on objects, walls, or floors and rabbits which live in cages seem to be more restless than the penned one. (Podberscek, Blackshaw, & Beattie, 1991).

Different type of enrichment materials has been studied such as different types of wood (Pincz et al., 2007; Pincz et al., 2008a and b; Zucca et al., 2012), hay (Lidfors, 1997; Berthelsen

and Hansen, 1999; Maertens and Van Oeckel, 2001), grass cubes (Lidfors, 1997), straw (López et al., 2004; Pol et al., 2006), grass and coarse mix feeds (Leslie et al., 2004), a variety of food items (Brown, 2009), metal can (Brooks et al., 1993; Lopez et al., 2003), bunny stick, bunny block, nylon rod, kong (Harris et al., 2001), parrot toys, copper wire ball (Huls et al., 1991), cardboard rings and balls, rubber ball (Poggiagliolmi et al., 2011), stainless steel rabbit rattle on spring clips (Johnson et al., 2003) and basal components, wood mash and chicory pulp (Maertens et al., 2013). These studies showed that rabbits prefer food-related items over non-food related items and that enrichment materials increased chewing and reduced stereotypies as well as skin lesions (especially on the ears) (Princz et al., 2009). Rabbits preferred roughage over wood (Lidfors, 1997; Pol et al., 2006), and they preferred soft wood over hard wood (Baumans, 2005; Princz et al., 2008b). However, Maertens and Van Oeckel (2001) reported higher mortalities when straw was provided to meat rabbits, as well as problems with evacuation of droppings. The temporal structure of their behavior can be disrupted if the response received from behavior is not suitable usually and commonly because of environmental limitations on the full expression of the behavioral repertoire. This could result in an increased state of stress, in an animal being more restless also changing its behavior more frequently (Lehmann 1987; Metz 1987)

There are several behavior elements that can be recorded from the rabbits and categorized into few specific acts of behavior. The examples of behavioral acts are:

- a) Active-head - sniffing at the surroundings with movement of the head and/or forelimbs.

The

- b) hind limbs stay in the same place.
- c) Ambulate - moving around the cage, although non-locomotor activity is not possible due

- d) to the confined space. This category also involves 'circling', where the rabbit attempts to run
- e) around in the cage.
- f) Consumption - eating rabbit pellets from the food-hopper, drinking or coprophagy.
- g) Gnawing - gnawing of the immediate environment such as bars, the wooden brick, nest box
- h) and plastic plate, occasionally interrupted by rapid scratching with the forelegs.
- i) Grooming - licking, scratching or nibbling of the body.
- j) Inactive - this was subdivided into three sub-categories:
- k) Lying - resting with the trunk on ground, and limbs tucked under the body or outstretched
- l) and belly exposed.
- m) Rearing - sitting/standing on the hind limbs with both forepaws off the ground.
- n) Sitting - rear end and forepaws on the ground with the forelimbs straight, the thorax and
- o) abdomen clear of the floor and visible. Ears down or erect.
- p) Use of hay - stretching to reach hay, pulling straws down from the roof, eating hay while
- q) sitting. (In the conventional cage the rabbit could reach the hay while sitting stretched, but in
- r) the enriched cage the rabbit had to stand stretched.)

All of these elements can be observed specifically to record their behavioral act and changes in behavior.

2.4 Care of Rabbits

2.4.1 Diet

A great quality rabbit pellet might be offered day by day yet in constrained amounts. The uncontrolled sustaining of a pelleted eating routine can prompt corpulence, heart and liver sickness, perpetual looseness of the bowels, and kidney illness which comes about because of the high centralization of sugars, low fiber what's more, high calcium levels. Ensure that the purchased pellets are high in fiber at least 18% and that the purchase is in little amounts. Keep the pellets refrigerated or cool and dry to avert waste. Old foul pellets can make a rabbit quit eating. Table 2.1 shows the daily amounts for rabbits up to eight months.

Table 2.1: Daily Amounts for rabbits up to 8 months:

BODY WEIGHT	FEED AMOUNT
2-4 lbs.	1/8 cup daily
5-7 lbs.	1/4 cup daily
8-10 lbs.	1/2 cup daily
11-15 lbs.	3/4 cup daily

Try not to refill the bowl regardless of the possibility that every one of the pellets are eaten before the following day. Overloading of pellets is the main source of medical issues that we see. Keep your rabbit sound by not exaggerating it. Timothy hay should be offered daily in unlimited sums. It is critical that hay be accessible constantly for your pet. Rabbits have a tendency to eat little measures of feed as often as possible for the duration of the day and withholding hay for as long as they can will promptly to intestinal damages. Always choose free long strands of feed rather than the squeezed cubes or chopped hay. The fiber in the hay is

critical in advancing process of digestion and for the counteractive action of hairballs. Hay likewise contains different supplements fundamental to the great health of the rabbit. it should never have been recommended again to prescribe the utilization of alfalfa hay, especially on the off chance that it is being utilized alongside pellets since it might give excessively calcium and starches which may prompt genuine wellbeing issues and stomach related problems.

Fresh sustenance ought to be given day by day. In the event that your pet is not used to getting any solid sustenance, at that point begin progressively with green verdant veggies and include another feed thing from the rundown each 5-7 day. In the event that the expansion of anything prompts looseness of the bowels or unformed stools in 24 to 48 hours, then expel it from the eating regimen. Youthful rabbit ought to likewise be acquainted with new feed bit by bit (and at no other time than four months of age). The aggregate sum of solid sustenance that can be given day by day is around one storing container per 5 pounds of body weight.

Treat food should be given in little sums (around 1 level teaspoon for every 5 lbs. of body weight). You can give one of these treat sustenances day by day: Strawberries, papaya, pineapple, apple, pear, melon, raspberries, peach, banana, dried organic product, or entire grain bread. Water should always be served to the rabbits and always kept in observation to be changed daily. Stagnant water container can promote the breeding of bacteria thus causing disease to the rabbits. Try to use water bottle or heavy crock for water container to make sure that the container is not easily tip as rabbit behavior cannot be predicted. Vitamin or other supplement should not be mixed into the water to make sure that the taste of the water does not change as rabbits may not like the taste of it thus not drinking it.

Vitamins are not felt to be important if the rabbit is getting pellets, roughage and new nourishments in the eating regimen. Actually, the unpredictable utilization of vitamins may

prompt overdose and genuine infection. Night droppings as it might appear to be interesting to rundown this as a feature of the eating regimen, however these "extraordinary droppings" are a basic piece of rabbit nourishment. Amid specific circumstances of the day ordinarily in the night, you may watch your pet licking the butt-centric zone and really eating a portion of the dropping all the while. These cecal pellets are gentler, greener and have a more grounded smell than the ordinary, minstrel, dry, round waste droppings. Rabbit knows when these dropping are being created and will deal with eating them himself. These cecal pellets originate from the cecum, which is a piece of the stomach related framework and they are rich in vitamins and supplements. This propensity may seem disagreeable; however, it is typical and imperative for your bunny

2.4.2 Environment

The main stimulus for the use of metallic cages was the need for higher productivity at lower cost, the control of parasitism and consequently, a more uniform product (Morisse and Maurice, 1994). Although cage housing is not considered as having strongly modified most of the behavioural and physiological reactions in rabbits (Lo'ligier, 1992; Verga, 1992.), it is obvious that it impairs behaviours like locomotory movement, floor scrapping and hole digging. Therefore it has been proved that rabbits were less active in the barren environment of cages than when housed in floor pens with litter.(Morisse, Boilletot, & Martrenchar, 1999)

A metal cage should be used with a wired flooring and the size of the cage should have enough space for the rabbits to move around to make sure that it does not stress out. The space and size of the cage should depend on the numbers of rabbit reared in one cage to estimate the suitable size for the rabbits to be comfortable enough. A solid floor is strictly

recommended to make sure that the rabbit does not get sore hocks and to provide area for resting. Concerning physical integrity, wire cage floors are considered an important factor in the development of foot pad injuries in breeders. (Drescher and Schlender-Bobbis, 1996; Marcato and Rosmini, 1996; Rommers and Meijerhof, 1996.). Use a towel or solid wood to cover the floor area unless one of the rabbit behavior is to chew the towel, avoid putting towel as a floor as to make sure that no fabric strands will block the intestine of the rabbits. Do not use wall or closed cage as air circulation will be blocked and the rabbit will easily have respiratory disease. Equip the cage with litter box to make sure that the rabbit will be well trained to litter and the litter box as rabbits are easily well trained. Handling the rabbit also should be done carefully as rabbit is one of the animals that is easily injured and rabbits have some sort of behavior which they love biting and gnawing depending on how calm it is and the size of the rabbit. The main thing to remember is to always support the hind quarters to prevent serious spinal injuries.

2.5 Medical problems in rabbits

Females: The main source of death in the female rabbit is malignancy of the uterus. This tumor is preventable by having your pet spayed between 6 months and 2 years old.

Male: Some male bunnies may turn out to be to a great degree forceful when they achieve sexual development. There might be over the top gnawing and splashing of pee outside the standard litter box region. The pee may build up a solid and disagreeable smell because of the nearness of male hormones and these little young men may not prepare themselves well. Creating recolored and untidy tail zones. The best arrangement to these behavioral issues is to have your pet fixed by an accomplished vet. This technique should be possible at whatever time following 5 months of age. Congested teeth: Overgrown incisors are normally brought about by

an innate deformity. Different causes can be damage or injury to the teeth. Rabbits teeth develop always for the duration of their life. In the event that the incisors or molars are not arranged legitimately they don't get exhausted, which brings about excess. Congested teeth can bring about mouth diseases, ulceration of lips or tongue. What's more, powerlessness to get and eat sustenance. The most widely recognized treatment for these abundances is to have the teeth cut occasionally every 3 two months. We don't prescribe the utilization of nail trimmers for this strategy since it can without much of a stretch outcome in the break of the incisor profound under the gum where there is potential for contamination. Your veterinarian will utilize a unique instrument to trim the teeth securely. A perpetual cure for congested incisors is the entire evacuation of the incisors under a general analgesic. Rabbits can eat regularly a while later (with cut up veggies and verdant parts of roughage) and teeth trimming will never again be important

Loss of Appetite: There are an assortment of reasons why rabbits will lose their hunger. The most regular reason we would say is an eating regimen low in fiber and high in calories. This mix can prompt weight, greasy liver ailment, drowsy development of the intestinal tract, and collection of hair and nourishment in the stomach. We view hairballs as a manifestation of different issues (generally a less than stellar eating routine) and not an essential ailment in itself. Another normal condition which can bring about craving misfortune is dental infection. Congested molars that have sharp edges or abscesses may bring about torment when endeavoring to eat. Less normal, however intense conditions that can likewise prompt hunger misfortune incorporate uterine diseases, abscesses, respiratory contaminations, gastrointestinal diseases, center ear diseases, bladder and kidney contaminations and ingesting lethal or toxic materials. Loss of craving is something that ought to be explored by your veterinarian inside 48 hours. Rabbits quickly build up a breaking down state of the liver when they abandon

sustenance. On the off chance that the liver decays too much there might be no real way to turn around the procedure. Early conclusion and treatment is the most ideal approach to spare its life.

Pasteurellosis: A huge rate of rabbits harbors a microbe in their sinuses called *Pasteurella multocida*. This microscopic organism doesn't bring about an issue in many bunnies with a solid resistant framework. In any case, under specific conditions, for example, less than stellar eating routine, high ecological temperatures, poor dissemination, packing, moving, and so forth., this microscopic organism can recreate quickly and cause possibly genuine malady. This microorganism may bring about contaminations of the upper respiratory tract, uterus, kidney, bladder, tear pipes, center ear or lungs. Kindly have your rabbit analyzed on the off chance that you watch releases around the eyes, or butt-centric zone, or if there is lost hunger, discouragement, looseness of the bowels, head tilt, loss of adjust, or worked breathing. Never endeavor to utilize anti-toxins without veterinary supervision. Your rabbit's gastrointestinal tract is an amazingly fragile organ, subject to sound microscopic organisms to process the nourishment. In the event that anti-infection agents are given aimlessly, passing may come about since the anti-microbial murdered the typical microscopic organisms which prompted an abundance of destructive microorganisms.

Looseness of the bowels: True the runs is not normal in the rabbit. This is a condition where all stool being passed is in a fluid shape. This is an intense condition and your veterinarian ought to be counseled promptly. What the vast majority allude to as looseness of the bowels is a discontinuous going of delicate fluid or pudding like stools. There is an assortment of purposes behind this condition, yet by a long shot the most regular reason is an absence of adequate fiber in the eating regimen and weight. Dispensing with the pellets from

the eating routine and nourishing great quality grass feed just for 1-3 months may clear up the issue. Counsel your veterinarian if your pet has this condition before rolling out improvements in the eating regimen.

CHAPTER 3

3.0 MATERIALS AND METHODS

3.1 Material

Domestic rabbits, timothy-based pellet, carrots, cabbages and water

3.2 Apparatus

Steel cages, plastic bowl, plastic water bowl, litter boxes, newspaper, clothes, wooden blocks, dust pans and white vinegar.

3.3 Domestic rabbit

Six domestic rabbits (*Oryctolagus cuniculus*) at the age of six months were prepared and fully scanned to make sure that these rabbits are in good health and conditions as well as not having any diseases or injuries. Then, all of the rabbits were bathed and cleaned to make sure that they were free of flea infections.

3.4 Setting up the environment

There were three set up of experiments where each of the set up was labeled as T¹, T² and T³. All six of the rabbits were put into three different cages which were the three set ups. First set up which was T¹ consist of two domesticated rabbits which were put together inside a steel cage with size of 60 cm wide x 70 cm length x 60 cm height and was the constant manipulator. Second set up which was T² also consist of two domesticated rabbits which was put together inside another steel cage with the same size as T¹ and was the first manipulator variable. Third set up, T³ was same as T¹ and T² where two domesticated rabbits were put into another cages with the same size and was the second manipulator variables. All three cages in all three set ups were equipped with plastic bowl, plastic water bowl and litter boxes. Newspapers were put on the floor of each cages as cover for the surface of the cages. Clothes were put in the corner of all three cages as resting area for the rabbits and wooden blocks were put into these cages as for chewing toys. Dust pans also were prepared for each of the cages for cleaning purpose.

3.5 Feeding

All the rabbits were fed at 10 am and 5 pm with 100 gram of rabbit feed daily. Rabbit feeds also were put in the plastic bowl to make sure that they can eat whenever they want. Water also were filled and changed daily to make sure the rabbits get constant clean water. In T¹, both the rabbits were fed with timothy-based pellets and vegetables daily as it acted as constant. In T², both the rabbits were fed with only timothy based pellets only while in T³, both of the rabbits were fed with vegetables such as carrots and cabbages only.

Table 3.1: Nutritional value of Timothy-based pellet

Parameter	Timothy-based pellet
Crude Protein (min)(%)	8.0%
Crude Fat (min) (%)	1.5%
Crude Fiber (max) (%)	32.0%
Moisture (max) (%)	14.0%

3.6 Cleaning the cages

The litter boxes of these rabbits were cleaned on the last day of every week for three months. The litter boxes were cleaned with water and all the excrements were thrown away. The litter boxes then were spritzed with white vinegar to clean and deodorize. The surrounding area also will be spritzed with white vinegar to make sure that the rabbits do not litter around the cage area except the litter boxes.

3.7 Observation of the rabbits for 90 days and analyzation of data.

T¹, T² and T³ were observed for 90 days and all the data on the growth rate and behavioral changes were analyzed. The body weight for the rabbit and amount of feed consumption for the rabbit were recorded on the day at end of the week. The data recorded than were analyzed.

The growth rate was analyzed by using formula of:

$$\text{Growth Rate} = \frac{\text{"BW}_2 - \text{BW}_1\text{"}}{\text{Period of experiment}} \quad (3,$$

1)

To get the growth rate of each rabbits in T¹, T² and T³, the data on body weight of each rabbits that has been recorded during the observation for 90 days need to be list out. Then, the initial body weight value on the first day of the duration of observation need to be subtracted by the last body weight value on the last day of the duration of observation for each rabbits. The value of the result of the subtraction then need to be divided by the duration of observation which is 90 days thus we get the growth rate value for each rabbits. Than the growth rate value

for both rabbits in each experiment T¹, T² and T³, need to be sum up and divided by two to get the mean value of growth rate value thus we get the growth rate value of the T¹, T² and T³ as the equation must be done for each T¹, T² and T³.

FCR of the rabbits then were analyzed using formula of:

$$FCR = \frac{\text{Total feed consumed}}{BW_2 - BW_1}$$

(3, 2)

To get the Feed Conversion Ratio (FCR) value of T¹, T² and T³, the data on feed consumed for each rabbits must be list out for duration of observation which is 90 days. For each rabbits in T¹, T² and T³, the value of feed consumed of the rabbits for duration of observation which is 90 days must be sum up to get the total feed consumed value for each rabbit. Than the value of total feed consumed must be divided with the value of initial body weight value of the first day subtracted by the body weight value of the last day of observation which is day of 90. The result of the calculation will be the Feed Conversion Ratio (FCR) of each rabbit. Than the Feed Conversion Ratio (FCR) value of both rabbits in each experiment T¹, T² and T³ must be sum up and divided by two to get the result of Feed Conversion Ratio of each T¹, T² and T³.

The behavioral change than will be recorded, analyzed and calculated using how many times that these rabbits repeat the action of active-head, ambulate, consumption, gnawing, grooming and also inactive.

Research Flow Chart

Process of getting six domestic rabbits

Process of bathing of rabbits to avoid flea infections

Setting up the environment for these rabbits to live in

Process of rearing of the rabbit by feeding different type of feed to each set of rabbits for 90 days or four month

Process of observing the rabbits for during rearing for 90 days to record and analyze of the rabbits

The data of the observation is taken and recorded and the result is made from the data recorded.

CHAPTER 4

4.0 RESULTS AND DISCUSSION

4.1 Results on weight of rabbits

During observing the experiment T^1 , T^2 and T^3 for 90 days or three months, the data on the weight of all the rabbits in all three experiments have been taken weekly and recorded as well as analyzed. The data on the weight of all the rabbits that has been recorded is then constructed into table 4.1 below and figure 4.1 below

Figure 4.1: Graph of weight of Rabbit1 and Rabbit 2 in T^1 , T^2 and T^3 for 12 weeks

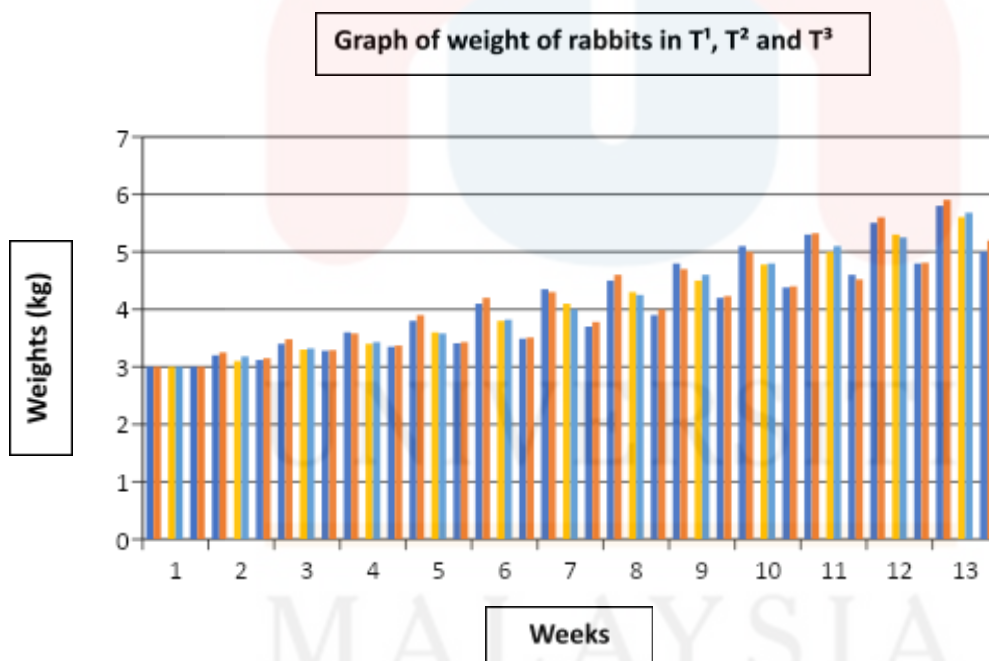


Table 4.1.1: The recorded weight of rabbit 1 and rabbit 2 in T¹, T² and T³ for 12 weeks.

WEEKS	T ¹ (pellet and vegetables)		T ² (pellet)		T ³ (vegetables)	
	RABBIT 1	RABBIT 2	RABBIT 1	RABBIT 2	RABBIT 1	RABBIT 2
	(KG)	(KG)	(KG)	(KG)	(KG)	(KG)
0	3.00	3.00	3.00	3.00	3.00	3.00
1	3.20	3.25	3.10	3.18	3.12	3.15
2	3.40	3.48	3.30	3.32	3.28	3.29
3	3.60	3.58	3.40	3.43	3.35	3.37
4	3.80	3.90	3.60	3.58	3.41	3.43
5	4.10	4.20	3.80	3.82	3.49	3.51
6	4.35	4.30	4.10	4.00	3.70	3.75
7	4.50	4.60	4.30	4.25	3.90	4.00
8	4.80	4.70	4.50	4.60	4.20	4.23
9	5.10	5.00	4.78	4.80	4.38	4.40
10	5.30	5.32	5.00	5.10	4.60	4.52
11	5.50	5.60	5.30	5.25	4.80	4.81
12	5.80	5.90	5.60	5.68	5.00	5.20

Table 4.1 above shows the data of the weight of rabbits 1 and rabbits 2 in all three experiments T¹, T² and T³. The data shows that both rabbits 1 and rabbit 2 in T¹ which are given timothy-based pellet and vegetables such as carrot and cabbages have the highest weight increment along the twelve weeks and also the weight of them at the end of week 12 are the highest among all three experiments which is 5.80(kg) for rabbit 1 and 5.90(kg) for rabbit 2. This maybe because of by giving both type of feed which are pellet and vegetables to the rabbit increase their appetite thus eating more and more of the feed given where studies have shown that increasing the food variety can increase food and energy intake(Lb, M, Flint, Martens, & Raben, 2003). Besides that, the sufficient nutrition from the timothy based pellet which contain crude protein, crude fiber and crude fat which are crucial for growth and vegetables which act as supplements make a perfect diet for the rabbit to have a maximized growth. It is obvious where diets such as crude protein and fat in the rations might improve growth rate.(Atti, Rouissi, & Mahouachi, 2004) For the rabbit 1 and rabbit 2 in T², the data from table 4.1 shows that the weight of both rabbits also have high increment and the weight of the rabbits at the end of week 12 both are 5.60(kg) for rabbit 1 and 5.68(kg) for rabbit 2 which are also high. This is because of the feed given to the rabbits in T² is the timothy-based pellet which has multiple nutritional value which is suffice to support the weight growth of the rabbits. Table 4.1 also shows the data for T³ in which the rabbits have the lowest increment amount of weight and have the lowest quantity of weight which are 5.00(kg) and 5.20 (kg). This may be caused by the type of feed given to the rabbits which is vegetables only such as carrots and cabbages. Both of these types of feed only act as supplement and do not contain any crude protein which is crucial for the rabbits to grow maximally. As for these, loss of appetite can be one of the issues which caused the weight of the rabbits to be low to due to the unattractive type of feed given to them.

For the weight of rabbits in T¹, T² and T³, a one-way anova has been done to analyze the significance difference between rabbits in T¹ which were given the timothy-based pellet and vegetables such as carrot and cabbages as feed, T² in which the rabbits were given timothy-based pellet feed and T³ where the rabbits were given vegetables such as carrots and cabbages only as feed. The result is as in the table 4.1.2 below

Table 4.1.2: One-way anova analysis between rabbits weight in T¹, T² and T³

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
Weight_pellet_vegetables	Between Groups	.006	1	.006	.007	.936
	Within Groups	20.206	24	.842		
	Total	20.212	25			
Weight_pellet	Between Groups	.002	1	.002	.003	.959
	Within Groups	17.840	24	.743		
	Total	17.842	25			
Weight_Vegetables	Between Groups	.007	1	.007	.015	.902
	Within Groups	11.059	24	.461		
	Total	11.066	25			

For the weight of rabbits in T¹ which was given the feed of timothy-based pellet and vegetables such as carrots and cabbages and labeled as Weight_pellet_vegetables, the value of significance level $F(p<0.05) = 0.007$ compared to the weight of rabbits in T² which is labeled as Weight_pellet and the weight of rabbits in T³ which is labeled as Weight_Vegetables.

For the weight of rabbits in T² which was given the feed of timothy-based pellet only and labeled as Weight_pellet, the value of significance level $F(p<0.05) = 0.003$ compared to the weight of rabbits in T¹ which is labeled as Weight_pellet_vegetables and the weight of rabbits in T³ which is labeled as Weight_Vegetables.

For the weights of rabbits in T³ which was given the feed of vegetables such as carrots and cabbages only and labeled as Weight_Vegetables, the value of significance level $F(p<0.05) = 0.015$ compared to the weight of rabbits in T¹ which is labeled as Weight_pellet_vegetables and weight of rabbits in T² which is labeled as Weight_pellet.

4.2 Growth Rate of Rabbits in T¹, T² and T³

The data that was taken than was analyzed to get the growth rate measurement of the rabbits in T¹, T² and T³. To get the growth rate measurements, the data on weight recorded need to be analyzed and calculated using formula of:

$$\text{Growth Rate} = \frac{BW_2 - BW_1}{\text{Period of experiment}}$$

$$\begin{aligned} \text{Growth rate of rabbits in T}^1 &= \left[\left(\frac{5.8-3.0}{90} \right) + \left(\frac{5.9-3.0}{90} \right) \right] / 2 \\ &= 0.0317 \end{aligned}$$

$$\begin{aligned} \text{Growth rate of rabbits in T}^2 &= \left[\left(\frac{5.6-3.0}{90} \right) + \left(\frac{5.68-3.0}{90} \right) \right] / 2 \\ &= 0.0293 \end{aligned}$$

$$\text{Growth rate of rabbits in T}^3 = \left[\left(\frac{5.0-3.0}{90} \right) + \left(\frac{5.2-3.0}{90} \right) \right] / 2$$

$$= 0.0222$$

Based on the table 4.2 above, the growth rate of T¹ in which the rabbits was fed with timothy pellet and vegetables, the growth rate of the rabbit is 0.0317 which is the highest compared to T² and T³. This is because the rabbits in T¹ get the most suffice and best nutrition from its feeding scheme where it gets both crude protein source from the timothy pellet and supplement such as vitamins from the vegetables such as carrots and cabbages. The variety of feed given to the rabbits also increase their appetite causing to consume more food than rabbits in T² and T³ thus having the highest growth. The growth rate of T² is which was fed with timothy pellets only is the second highest among the three of the experiments where the value of the growth rate is 0.0293. This is caused by the rabbits in T² has enough crude protein, crude fiber and crude fat source from the timothy pellet but it does not get any supplement of vitamin from any vegetables that act as supplemental food thus causing their growth rate to a bit lower than T¹. The growth rate of T³ which was fed only with vegetables such as carrots and cabbages in this table was shown as the lowest value among the value of the three experiments T¹, T² and T³ with the value of the growth rate is only 0.0222.. This is obviously caused by the lack of nutrition such as protein source and fat source that act as energy supplier for the rabbits to grow. The rabbits in T³ was only fed with vegetables only such as carrots and cabbages which provide vitamin as supplement only to the rabbits causing them to not grow as fast as the others. Besides, lack of variation of food also caused the rabbit to lose appetite in consuming the same feed over and over thus making it to less consume the food. While reduction in consuming food will cause the rabbits to achieve minimum amount of growth rate.

Table 4.2: Growth rate of T¹, T² and T³

	T ¹	T ²	T ³
	(Timothy pellet and vegetables)	(Timothy pellet)	(Vegetables; Carrot and Cabbages)
Growth Rate	0.0317	0.0293	0.0222

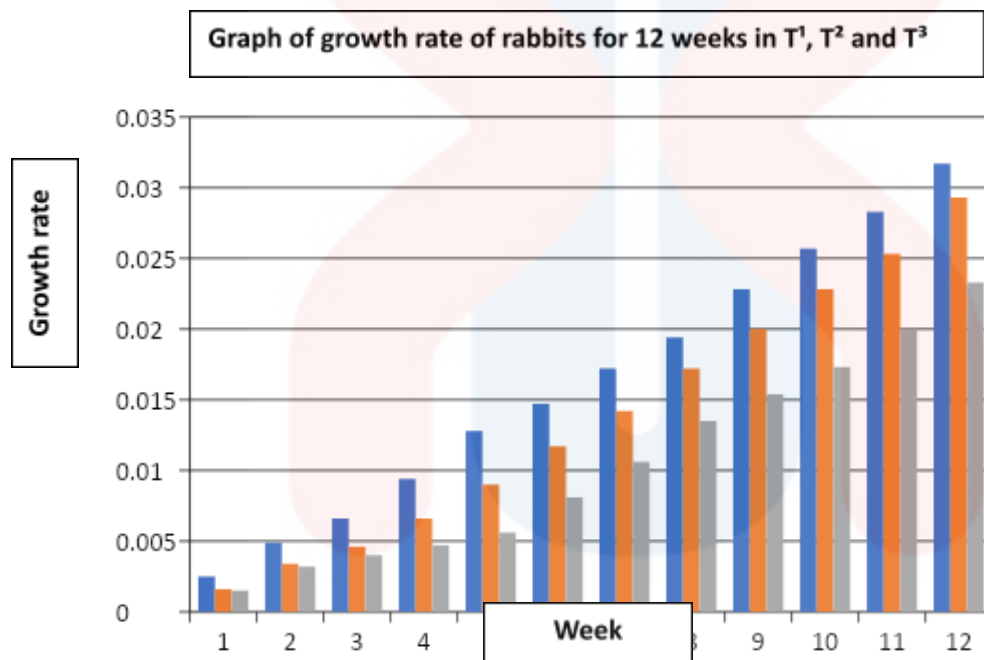


Figure 4.2: Graph of growth rate of T¹, T² and T³

Series 1= T¹

Series 2= T²

Series 3= T³

4.3 Feed Conversion Ratio (FCR) of Rabbits in T¹, T² and T³

After the observation and recording of data of the rabbits in T¹, T² and T³, the data also has been analyzed by measuring the feed conversion ratio (FCR) of the rabbits. The Feed Conversion Ratio (FCR) has been calculated using the equation of:

$$FCR = \frac{\text{Total feed consumed}}{BW_2 - BW_1}$$

$$\begin{aligned} \text{Feed Conversion Ratio (FCR) of rabbits in T}^1 &= \frac{\left(\frac{6930}{1000}\right)}{2.85} \\ &= 2.432 \end{aligned}$$

$$\begin{aligned} \text{Feed Conversion Ratio (FCR) of rabbits in T}^2 &= \frac{\left(\frac{6130}{1000}\right)}{2.64} \\ &= 2.322 \end{aligned}$$

$$\begin{aligned} \text{Feed Conversion Ratio (FCR) of rabbits in T}^3 &= \frac{\left(\frac{4960}{1000}\right)}{2.2} \\ &= 2.255 \end{aligned}$$

Table 4.3.1: Feed consumed (g) by rabbits in T¹, T² and T³ for 12 weeks

Weeks	T ¹ (g)	T ² (g)	T ³ (g)
1	560	500	400
2	600	520	420
3	580	500	400
4	540	460	400
5	600	460	420
6	560	480	430

7	580	500	400
8	600	510	410
9	560	560	420
10	590	540	400
11	600	580	420
12	560	560	430

Table 4.3.2: The feed conversion ratio (FCR) of rabbits in T¹, T² and T³

	T ¹ (Timothy pellet and vegetables)	T ² (Timothy pellet)	T ³ (vegetables)
Feed Conversion Ratio (FCR)	2.432	2.322	2.255

Table 4.3.2 shows that the measurement of the feed conversion ratio (FCR) of rabbits in T¹, T² and T³. From the table, we can see that the rabbits in T¹ which was given timothy pellet and vegetables have the highest feed conversion ratio (FCR) value which is 2.432. This shows that the rabbits consumed the most food daily compared to the rabbits in T² and T³. This also shows the ability of rabbits in T¹ to convert the daily food consumed into the weight is the most efficient as rabbits in T¹ also have the highest weight among the three of them. Also from the table, it is shown that the rabbits in T² which was give timothy pellet only has the second highest value of food conversion ratio (FCR) which is 2.322. This is a bit lower that T¹ but higher than T³.

This is because the rabbits in T² consumed quite a lot of feed which is the pellet but not as much as in T¹. It also can be caused by the ability of the rabbit to convert the feed consumed into weight is quite high but not as efficient as rabbits in T¹. The table also show that the rabbits in T³ which is given vegetables only such as carrots and cabbages has the lowest value of food conversion ratio (FCR) which is only 2.255. This value is the lowest compared to the value of food conversion ratio (FCR) for the rabbits in T¹ and T². This is caused by the type of feed given to the rabbits in T³ is only vegetables such as carrots and cabbages causing the rabbits to lose appetite eventually after eating the same food daily and does not get crucial nutrition such as crude protein, crude fiber and crude fat thus causing it to lose energy. The loss of energy cause the rabbits ability in converting food into weight become inefficient thus causing low level of feed conversion ratio (FCR).

4.4 Behavior of Rabbits in T¹, T² and T³

After making observations for 90 days, the data on the behavior of the rabbits in T¹, T² and T³ have been recorded and list out. The data on behavior was taken based on the act of active-head, ambulate, consumption, gnawing, grooming and also inactive. The act of ambulate is taken when the rabbits start moving around the cage without any purpose. It also includes the act of circling and running around the cages. The data on act of consumption is taken when the rabbits start to eat the feed given in which the rabbits in T¹ start to eat the timothy pellets and vegetables while rabbits in T² start to eat the timothy pellets and the rabbits in T³ start to eat the vegetables such as carrots and cabbages given. The act of consumption also includes drinking the water. The act of gnawing is observed and the data is recorded when the rabbits in T¹, T² and T³ start to gnaw, bite or nibble the wooden block or the feed box and the steel cage until

wear down. The act of grooming is recorded when the rabbits in T¹, T² and T³ start to scratch, bite and nibble themselves. Data on inactive state is also recorded when the rabbits in T¹, T² and T³ start to lay down, sleeping or just resting in the cages. For the last behavior, the active head, it is taken when the rabbits in T¹, T² and T³ start to smell their surrounding by only moving their head around or their forelimb around and their hind limb just stay put at the same place. All the data was recorded for 4 hours from 2 p.m. till 6 p.m. on every day for 12 weeks and listed out.

Table 4.4.1: Total of action of behavior of rabbits from 4 p.m. to 6 p.m. of T¹, T² and T³

Action of behavior	T ¹	T ²	T ³
Ambulate	469	406	367
Active-head	533	486	434
Consumption	882	870	661
Grooming	561	546	502
Gnawing	308	379	468
Inactive	539	471	532

The table 4.4.1 above shows that the rabbits in T¹ ambulate more than rabbits in T² and T³ in which rabbits in T¹ ambulate about 469 times while rabbits in T² ambulate around 406

times and rabbits in T³ ambulate for 367 times. This is because T¹ were given timothy pellet and vegetables such as carrots and cabbages thus getting enough nutrition and supplements causing the rabbits to have more energy to behave energetic and ambulate. For T² and T³, the amount of ambulation is 406 and 367 respectively in which rabbits in T³ ambulate the least because of not getting much energy from feed given. An animal is designated 'restless' when it does not complete ongoing activities and this is a behavioral sign of increased stress in the animal (Lehmann,1987; Hughes and Duncan, 1988). Because of that, we can say that rabbits in T³ is quite "restless" because it ambulate the least and continue not to do their activities. The table also shows that the behavior of active head is quite active for the rabbits in T¹ where they do the active-head 533 times compared to rabbits in T² where the rabbits behave a bit less active compared to T¹ in which they do the active head around 486 times and the rabbits in T³ are the least active where it only does the active-head around 434 times. This is because as the rabbits are well fed such as in T¹ and T², it become more territorial and energetic thus they want to investigate the environments more often while the rabbits in T³ don't have much energy to be curious and sniffing around. Besides investigating the environments, rabbits also do active-head as for searching actively for a route or plan on escaping. For the behavior of consumption, based on the table, rabbits in T¹ consume much more than rabbits in T² and T³ where the act of consumption recorded for the rabbits in T¹ are around 882 times and rabbits in T² are around 870 times while rabbits in T³ are 661 times which is the least of all. This is because rabbits in T¹ were given the feed of timothy pellet and vegetables such as carrots and cabbages. The variety of food make the rabbits have more appetite plus there is no restriction of time and amount of feed to be eaten for the rabbits thus increasing the consumption amount of the rabbits while the rabbits in T³ were only given cabbages causing it to lose appetite over the time eating the same food routinely thus decreasing the consumption. For grooming, the rabbits in T¹, also have the

highest amount of grooming compared to rabbits in T² and T³ in which rabbits in T¹ groom about 561 times and rabbits in T² and T³ groom about 546 and 502 times respectively. Although it is the least action of grooming done by rabbits in T³, but the grooming has been done excessively while it has been stated that grooming excessively can indicate an under stimulation from the environment or social deprivation as stated. (Morton et al., 1993; Gunn and Morton, 1995). For gnawing rabbits in T³ gnaw more than rabbits in T¹ and T² in which the amount for gnawing in T³ is 468 times while T¹ and T² is 308 and 379 times respectively. The higher amount of gnawing indicates higher stress level in rabbits thus rabbits in T³ have the highest stress level because of the feed given to them and less consumption. It also indicates that the rabbits have more difficulties in coping with the environment where it is characterized as abnormal behavior. (Morton, 1993; Lidfors, 1997). For inactive behavior, the rabbits in T¹ and T³ have high value of inactive compared to T² where the values are 539 and 532 times respectively while T² is 471 time. Though the data on being inactive for the rabbits in all T¹, T² and T³ are quite high but it is normal for rabbits that were kept in cages as there was no sign of apathy in any of the cage systems as found in many other experiments stated by (Huls et al., 1991; Morton et al., 1993; Gunn and Morton, 1995) while being inactive.

Chapter 5

Conclusion

5.1: Conclusion

Each feed types have its own uniqueness and advantages to complete the nutritional requirements for every consumer. Each different type of feed plays their own role in providing

their own nutritional value to the consumer thus with the lack of each type of feed, it will cause the lack on nutrition thus effect the consumers in many ways especially the growth rate of the consumers and behaviors. Through this experiment, it is obviously that by giving both feed type which are timothy pellet and vegetables, it completes the required diets for the rabbits thus maintain the rate of growth of the rabbits in perfect condition where the growth rate is high and also maintain the behavior of the rabbits which restrict the rabbits to change its behavior into abnormal. The rabbits which were given only timothy pellets also has quite high growth rate but not complete as there is no supplement such as vegetables thus it slows down the growth rate for a bit and the behavior become quite slow but not that obvious in changes. For the rabbits which were provide with vegetables only, the growth rate is quite worse as it does not get the main nutrition needed for the growth rate to be maximized as well as the rabbits become stressed out thus changing its behavior. Because of that, it can be concluded that the rabbits obviously need the perfect feed in which pellet with supplemental feed such as vegetables are enough to complete the minimum diets but with only vegetables, the rabbits cannot survive perfectly. With the data, it can be said that rabbit with timothy pellet feed type is better than the rabbit which were given vegetables feed type such as carrots and cabbages. Because of that, timothy-based pellet is better than vegetables only.

5.2: Recommendation

For the recommendation, I recommend that to rear rabbits, perfect diet is crucial to them while rearing them in cages need more attention and better feeding routine as rabbits are unique and fussy creatures. Because of that, choosing a feeding scheme that perfect the needs and requirement of these creatures is the best in which rabbits are easy to change behavior and

the growth rate are easy to be affected by their diet. Behavior of rabbits also must be watched and observed daily as their behavior is the first sign to indicate any problems whether it's a disease related problem or rearing related problems. Change in behavior will always indicate problems in the rabbits reared.

REFERENCES

Atti, N., Rouissi, H., & Mahouachi, M. (2004). The effect of dietary crude protein level on growth, carcass and meat composition of male goat kids in Tunisia, *54*, 89–97.

Berthelsen, H., & Hansen, L. T. (1999). The Effect Of Hay On The Behaviour Of Caged Rabbits (*Oryctolagus Cuniculus*), 149–157.

Bolet, G., Carneiro, M., Afonso, S., Geraldès, A., Queney, G., Nachman, M. W., ... Boucher, S.

(2011). The Genetic Structure of Domestic Rabbits, 28(6), 1801–1816.

Brown, S., D, S. M. S. P., & Smith, E. (n.d.). Articles by : Compiled by :Care, R. (n.d.). Top 10 Things to Know about Your New Rabbit, 14–17.

Baumans V. 2005. Environmental enrichment for laboratory rodents and rabbits: requirements of rodents, rabbits, and research. ILAR J., 46: 162-170.

Chu, L., Garner, J. P., & Mench, J. A. (2004). A behavioral comparison of New Zealand White rabbits (*Oryctolagus cuniculus*) housed individually or in pairs in conventional laboratory cages, 85, 121–139. <https://doi.org/10.1016/j.applanim.2003.09.011>

Csiro, M., This, I., Whites, N. Z., Hares, W., Territory, A. C., Occurrence, R., & It, C. (1964). Further Observations On The Territorial Function And Histology Of The Submandibular Cutaneous (Chin) Glands In The Rabbit , *Oryctolagus Cuniculus* (L .).

Demello, M. (2010). Becoming Rabbit: Living with and Knowing Rabbits, 237–252. Drescher, B., Schlender-Bobbis, L., 1996. Etude pathologique de la pododermatite chez les lapins reproducteurs de souche lourde sur grillage. World Rabbit Sci. 4, 143–148

Gidenne, T., Lebas, F., & Fortun-lamothe, L. (2010). Feeding behaviour in rabbits, 233–252. Gyovai, M. (n.d.). Effect of Different Rearing Methods on the Weight of Rabbits, 68(4), 261–264.

Hansen, L. T., & Berthelsen, H. (2000). The effect of environmental enrichment on the behaviour of caged rabbits ž *Oryctolagus cuniculus* /, 163–178.

Huls W.L., Brooks D.L., Bean-Knudsen D. 1991. Response of adult New Zealand White rabbits to enrichment objects and paired housing. Lab. Anim. Sci., 41: 609-612.

Harris L.D., Lewis B., Burge J.R., Ruble G.R. 2001. Evaluation of objects and food for

environmental enrichment of NZW rabbits. *Contemp. Top. Lab. Anim.*, 40: 27-30.

Lb, S., M, P., Flint, A., Martens, M., & Raben, A. (2003). Effect of sensory perception of foods on appetite and food intake : a review of studies on humans, 1152–1166.

Lo"liger, H.C., 1992. Consideration of animal protection and welfare in domestic rabbit housing and management. *J. Appl. Rabbit Res.* 15, 684–691.

Lidfors L. 1997. Behavioural effects of environmental enrichment for individually caged rabbits. *Appl. Anim. Behav. Sci.*, 52: 157-169.

Lehmann M 1987 Interference of a restricted environment - as found in battery cages - with normal behaviour of young fattening rabbits. In: Auxilia T (ed) *Rabbit Production Systems Including Welfare*

Love J.A. 1994. Group-housing: meeting the physical and social needs of the laboratory rabbit. *Lab. Anim. Sci.* 44: 5-11.

Moore, L. C. (2010). *Rabbit*.

Morisse, J. P., Boilletot, E., & Martrenchar, A. (1999). Preference testing in intensively kept meat production rabbits for straw on wire grid floor.

Morisse, J.P., Maurice, R., 1994. Welfare and the intensive production of rabbits. *Rev. Sci. Tech. Off. Int. Epizoot.* 13, 143–152.

Morisse, J.P., Maurice, R., 1997. Influence of stocking density or group size on behaviour of fattening rabbits kept under intensive conditions. *Appl. Anim. Behav. Sci.* 54, 351–357

Marcato, P.S., Rosmini, R., 1996. Ulcerative pododermatitis. In: Esculapio Ed., *Pathology of the*

Rabbit and Hare. Bologna, Italy, p. 11.

Maertens L., Buijs S., Davoust C. 2013. Gnawing blocks as cage enrichment and dietary supplement for does and fatteners: intake, performance and behavior

Metz J H M 1987 Behavioural problems of rabbits in cages. In: Auxilia T (ed) Rabbit Production Systems Including Welfare pp 257-268.

Nursing behaviour of domesticated and wild rabbit does under different keeping conditions. (2000), 8(july), 537–542.

Podberscek, A. L., Blackshaw, J. K., & Beattie, A. W. (1991). The behaviour of group penned and individually caged laboratory rabbits, 28, 353–363.

Princz Z., Orova Z., Nagy I., Jordan D., Stuhec I., Luzi F., Verga M., Szendrő Sz. 2007. Application of gnawing sticks in rabbit housing. World Rabbit Sci., 15: 29-36.

Princz Z., Dalle Zotte A., Radnai I., Biró-Németh E., Matics Sz., Gerencsér Zs., Nagy I., Szendrő Sz. 2008a. Behaviour of growing rabbits under various housing conditions. Appl. Anim. Behav. Sci., 111: 342-356.

Princz Z., Nagy I., Biró-Németh E., Matics Sz., Szendrő Sz. 2008b. Effect of gnawing sticks on the welfare of growing rabbits. In Proc.: 9th World Rabbit Congress, June 10-13, 2008, Verona, Italy. pp. 1221-1224

Poggiagliolmi S., Crowell-Davis S.L., Alworth L.C., Harvey S.B. 2011. Environmental enrichment of New Zealand White rabbits living in laboratory cages. J. Vet. Behav., 6: 343-350.

Rabbits, P. (n.d.). Common diseases and conditions of pet rabbits Common Diseases and

Conditions of.

Rommers, J. M., Bracke, M. B. M., Reuvekamp, B., Gunnink, H., & C, D. J. I. (2014). Cage enrichment : rabbit does prefer straw or a compressed wooden block, (January 2013), 301–309.

<https://doi.org/10.4995/wrs.2014.1353>

Rommers, J.M., Meijerhof, R., 1996. The effect of different floor types on foot pad injuries of rabbit does. In: Lebas, F. Ed., Proc. 6th World Rabbit Congress, Toulouse, France, 9–12r07r1996, pp. 431–436.

Rongeot, J., 1981. Origine et histoire du Lapin. Ethnozootecnie, 27 : 1--9.

Stauffacher M. 1992. Group-housing and enrichment cages for breeding, fattening and laboratory rabbits. Anim. Welfare 1: 105-125

The Bunny Lover ' s Complete Guide To House Rabbits. (2012).

Valley, M. (n.d.). Caring for Your Companion Rabbit, 94942(415).

Vastrade, F. O. M. (1986). (oryctolagus cuniculus, 16, 165–177.

Verga, M., 1992. Some characteristics of rabbit behaviour and their relationship with husbandry systems. J.Appl. Rabbit Res. 15, 55–63.

Welfare, R., Rights, A., Magazine, L., & Pet, P. P. (1943). So what are some of the animal welfare / animal rights issues facing rabbits ?

Zucca D, Marelli S.P., Redaelli V., Heinzl E., Cardile H., Ricci C., Verga M., Luzi F. 2012. Effect of environmental enrichment and group size on behaviour and live weight in growing rabbits. World Rabbit Sci., 20: 89-95



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Appendixes

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	M
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						Lower Bound	Upper Bound
Weight_Pellet_Vegetables	1.00	13	4.3423	.91693	.25431	3.7882	4.8964
	2.00	13	4.3715	.91820	.25466	3.8167	4.9264
	Total	26	4.3569	.89915	.17634	3.9937	4.7201
Weight_Pellet	1.00	13	4.1369	.85755	.23784	3.6187	4.6551
	2.00	13	4.1546	.86675	.24039	3.6308	4.6784
	Total	26	4.1458	.84479	.16568	3.8046	4.4870
Weight_Vegetables	1.00	13	3.8638	.66876	.18548	3.4597	4.2680
	2.00	13	3.8969	.68874	.19102	3.4807	4.3131
	Total	26	3.8804	.66532	.13048	3.6117	4.1491

A 1: Anova analysis on growth rate



A 2: The process of bathing the rabbits



A 3: Behavior of inactivity of rabbits



A 4: Behavior of gnawing on drinking tray



A 5: Feeding the timothy pellets and act of consumption





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