UNIVERSITI PUTRA MALAYSIA

COGNITIVE ABILITY OF THE LABORATORY RAT (*Sprague dawley*) UNDER VARIOUS LIGHTING ENVIRONMENTS

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A project submitted to the

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In partial fulfilment of the requirement for the

DEGREE BACHELOR OF AGRICULTURE (ANIMAL SCIENCE)

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CERTIFICATION

It is hereby that I have read this project paper entitled "**COGNITIVE ABILITY OF THE LABORATORY RAT (*Sprague dawley*) UNDER VARIOUS LIGHTING ENVIRONMENTS"** by Muhammad Farris Bin Shani and in my opinion, it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course SHW 4999A and B – Project.

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An abstract of the project paper presented to the Faculty of Agriculture in partial fulfillment of the course SHW 4999 – Project.

COGNITIVE ABILITY OF LABORATORY RATS (Sprague *dawley*) UNDER VARIOUS LIGHTING ENVIRONMENTS

Muhammad Farris Bin Shani

2015

Supervisor: Dr. Sumita Sugnaseelan

The study documents the cognitive ability of the laboratory rats (Sprague *dawley*) under various lighting environments. The group 1 rats were 7th weeks old at the starting of the experiment and the group 2 rats were 14th weeks old at the starting of the experiment were used in this experiment. Various types of light represent different light wavelength which is the fluorescent light that compose of all the wavelength of light, short wavelength light (435 nm), medium wavelength light (543 nm) and long wavelength light (611 nm). The Illuminance of 6, 12, 25, 50, 100, 200 lux was used in this study. From the experiment, the results obtained shows that the Group 1 rats were faster with the learning ability compared to the group 2 rats although not all the results shows significant difference (P>0.05). The wavelength light do show significant different (P<0.05) in the learning ability of the rats only under fluorescent light and medium wavelength light. The back-track frequency of the rat in the mazes also were recorded to indicates the memory of the rats and the results shows that the group 1 rats do more back-track frequency compare to the group 2 rats but the results is also not significantly difference. The group 2 rats learn faster as the vision of the group 2 rats was better causes the rats make the decision faster compare to the group 1 rats. The group 1 may have the degeneration process occur of their eyes vision due to the usage and the age factor. The memory of the group 1 rats was also not as good as the group 2 and the group 2 rat can remember the information longer compare to the group 1 rats. Although some of the previous experiments have indicated that there are no difference in the working memory between the older and the younger rats. In conclusion, the group 2 rats have a better learning ability and also better memory compare to the group 1. Under low wavelength light and under low light illuminance, the rat learning ability is better.

Keywords: Cognitive ability, laboratory rat, light wavelength, memory, illuminance, Sprague *dawley*, Multiple T-maze, learning ability.

ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Pertanian sebagai memenuhi sebahagian daripada keperluan kursus SHW 4999 – Projek.

KEBOLEHAN KOGNITIF TIKUS MAKMAL (Sprague *dawley*) DI BAWAH PENGCAHAYAAN PERSEKITARAN YANG PELBAGAI

Muhammad Farris Bin Shani

2015

Penyelia: Dr. Sumita Sugnaseelan

Kajian ini mendokumenkan keupayaan kognitif tikus makmal (Sprague Dawley) di bawah pelbagai persekitaran pengcahayaan. Kumpulan 1 tikus adalah berumur 7 minggu di permulaan eksperimen dan kumpulan 2 tikus adalah berumur 14 minggu di permulaan kajian telah digunakan dalam eksperimen ini. Pelbagai jenis pangcahayaan mewakili panjang gelombang cahaya yang berbeza iaitu cahaya neon yang merangkumi semua panjang gelombang cahaya, cahaya gelombang pendek(435 nm), cahaya gelombang sederhana (543 nm) dan cahaya gelombang panjang (611 nm). Keamatan cahaya 6, 12, 25, 50, 100, 200 lux telah digunakan dalam kajian ini. Dari keputusan eksperimen, keputusan yang diperolehi menunjukkan bahawa Kumpulan 1 tikus adalah lebih cepat dalam keupayaan pembelajaran berbanding dengan kumpulan 2 tikus walaupun tidak semua keputusan menunjukkan perbezaan yang signifikan($P>0.05$). Panjang gelombang cahaya yang menunjukkan perbezaan yang signifikan ($P<0.05$) dalam keupayaan pembelajaran tikus hanya di bawah lampu neon dan cahaya bergelombang sederhana. Kekerapan berpatah balik tikus dalam maze diperhatikan untuk menunjukkan ingatan tikus dan keputusan menunjukkan bahawa kumpulan 1 tikus melakukan lebih banyak kekerapan berpatah balik berbanding dengan kumpulan 2 tikus tetapi keputusan yang ada tidak ketara. Kumpulan 2 tikus belajar dengan lebih cepat kerana penglihatan kumpulan 2 tikus adalah lebih baik menyebabkan tikus membuat keputusan yang lebih cepat berbanding dengan kumpulan 1 tikus. Kumpulan 1 boleh mempunyai proses degenerasi berlaku penglihatan mata mereka kerana faktor penggunaan dan faktor umur. Memori tikus kumpulan 1 juga tidak sebaik kumpulan 2 dan tikus kumpulan 2 boleh ingat maklumat yang lebih lama berbanding dengan kumpulan 1 tikus. Walaupun beberapa eksperimen sebelumnya telah menyatakan bahawa tiadaada perbezaan di dalam memori kerja antara tikus yang lebih tua dan tikus muda. Kesimpulannya, tikus kumpulan 2 mempunyai keupayaan pembelajaran yang lebih baik dan juga memori yang lebih baik berbanding dengan kumpulan 1. Di bawah panjang gelombang cahaya pendek, dan di bawah keamatan cahaya yang rendah membolehkan tikus belajar lebih baik.

Kata kunci: Kebolehan kognitif, tikus makmal, panjang gelombang cahaya, memori, keamatan cahaya, Sprague *dawley*, T-maze pelbagai, kebolehan belajar

1 INTRODUCTION

Cognition of the animal is how the animal receives information via its sensory receptors, processes and retains the information, and then to deciding the action to be taken(Shettleworth, 2001). Much of the work on animal cognition is more appropriately described by the term comparative cognition, because the processes and capacities underlying behaviour are compared between species (Shettleworth, 2001). Cognitive processes such as perception, learning, memory and decision making plays an important role in mate choice, foraging and other behaviours (Shettleworth, 2001). The concept of adaptation refers not only of evolutionary adaptation, but, also changes in behaviour during one's lifetime through the processes of learning (Shettleworth, 2001). Therefore, learning process is crucial during adaptation phase.

Farm animals are frequently confronted with major changes in their environment as they go through different phases of the production system. Examples include introduction to a new housing system, provision of a new type of feed, mixing with unfamiliar conspecifics or being exposed to new human handlers (Wechsler and Lea, 2007). Learning processes through previous experience may be able to reduce uncertainty in such situations, and are likely to be very important for the animal's welfare as well as its performance (Wechsler and Lea, 2007).

The greatest challenge when studying animal cognition is to devise a pure behavioural criteria for reasoning specific mental processes (Wechsler and Lea, 2007). Learning and memory are considered to require higher brain functions and are not merely the acquisition of a series of elicited responses (Kirsch *et al.*, 2004). The cognitive test on animals can provide the potential treatments for cognitive disorders (Sarter, 2004). The learning process of some animal are difference from others as they have different motor ability, thus, there is no unbiased comparison of the learning ability possible (Sarter, 2004).

Environmental light intensity also play role on the exploratory behaviour of the rats as reported by (Garcia *et al.*, 2005). They reported that the exploratory behaviour of the Male Wistar-derived rat occurring in the open arms was more intense under the lower light intensity (0 and 1 lux) compare to the higher light intensity (3,10,30,100 and 300 lux) (Garcia *et al.*, 2005). (Cardenas *et al.*, 2001) also reported that Vibrissal sense is not the main sensory modality in rat exploratory behaviour but light intensity also is one of the causal of rat exploratory behaviour. Results from the experiments shows that rats with whole vibrissae under the low illumination light tended to explore more frequently and at the longer time than under high illumination of light. It is also same when whole of the vibrissae are removed where the exploratory behaviour of the rat are more frequently and longer than under high illumination. The increases in length of open arm entries are maybe due to need more time to obtain information about the environment since lower presence of light and vibrissae were removed (Cardenas *et al.*, 2001).

More study need to be done on the learning ability of the rat in order to gain more information and therefore, the objectives of this experiment are:

- to investigate learning ability of the laboratory rat when placed in a multiple T-maze
- to investigate learning ability of the laboratory rat in different lighting and illuminance.

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