"Exploring the Effects of Natural Lights & R, G, B, Warm White LED lights on Activity Patterns, Behavioral Responses, and Physiological Health in Mice"

Thesis submitted in partial fulfillment of the requirement of the degree of

‘Master of Illumination Engineering’

Under the guidance of

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Declaration of originality and compliance of academic ethics

The author thereby declares that this thesis contains original research work as a part of his master of Illumination engineering curriculum. This indicates that the work was done entirely by the author and the elements in the thesis are not a copy of any like any other thesis submitted/published elsewhere.

All works are performed under the supervision of Prof. Saswati Mazumdar and Prof. Sanmoy Karmakar at the Department of Electrical Engineering and Department of Pharmaceutical Technology, Jadavpur University.

All information in this document has been obtained and presented in accordance with the academic rules and ethical conduct.

The author also declares that he had fully referenced and acknowledged all materials and results that are not original to his work in the thesis.

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Certification

This is to certify that Mr. Pramit Mondal has carried out all research studies under my supervision at the Department Of Electrical Engineering, Jadavpur University, Kolkata,India for the thesis entitled **"Exploring the Effects of Natural Lights & R, G, B, Warm White LED lights on Activity Patterns, Behavioral Responses, and Physiological Health in Mice"** during the session 2023-2024 for the partial fulfillment of the requirement for the degree of Masters of Engineering of Jadavpur University.The ideas put into effect are original and are not a copy of or similar to any other thesis submitted/published elsewhere.

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CONTENTS

Chapter 1:

Introduction

Light is a fundamental environmental factor that influences a wide range of biological processes in living organisms. In mammals, light regulates circadian rhythms, which are intrinsic 24-hour cycles that dictate physiological and behavioral patterns. The advent of LED technology has enabled researchers to explore the effects of different wavelengths of light on biological systems with greater precision than ever before. This type of study was started (2018-2019) to investigate the effects of red (R), green (G), blue (B), and warm white (WW) LED lights on the activity patterns, behavioral responses, and physiological health in mice [1].

Circadian rhythms are primarily driven by the light-dark cycle and are crucial for maintaining homeostasis. Disruption of these rhythms can lead to various health issues, including sleep disorders, metabolic dysfunction, and mood disturbances. In the natural environment, light varies in intensity and spectral composition throughout the day. Early morning and late evening light is enriched with longer wavelengths (red and orange), while midday light is dominated by shorter wavelengths (blue). Understanding how different wavelengths of light influence circadian rhythms can provide insights into optimizing light environments for health and well-being [2].

LEDs offer a unique advantage in circadian research due to their ability to emit specific wavelengths with minimal thermal output. This precision allows for the examination of how individual light wavelengths affect biological processes. Previous studies have shown that blue light has a strong influence on circadian rhythms and melatonin suppression, while red light is less disruptive to sleep patterns. However, the comprehensive effects of different LED wavelengths on both behavior and physiology remain underexplored.

Activity patterns in mice, such as their locomotor activity and feeding behavior, are closely tied to their circadian rhythms. Changes in light conditions can alter these patterns, providing a measurable indicator of circadian disruption or adaptation. Behavioral responses, including anxiety-like and depressive-like behaviors, will also be assessed, as light exposure has been shown to influence mood and emotional states in mammals.

Additionally, physiological health parameters, such as body weight, metabolic rate, and hormonal levels, will be monitored to determine the broader impacts of light exposure.

The potential applications of this research are far-reaching. In humans, light therapy is used to treat conditions such as Seasonal Affective Disorder (SAD) and circadian rhythm sleep disorders. Understanding the specific effects of different wavelengths of light could lead to more effective and tailored light therapy treatments. Moreover, this research could inform lighting design in various settings, from workplaces to homes, to promote better health and well-being.

In conclusion, this study seeks to elucidate the effects of R, G, B, and WW LED lights on the activity patterns, behavioral responses, and physiological health of mice. By leveraging the precision of LED technology and the well-established circadian model of mice, this research aims to contribute to our understanding of how light influences mammalian biology. The findings could have significant implications for improving human health through optimized light environments and targeted light therapy interventions.

1.1 Background of the Study:

Lighting conditions significantly influence animal behavior, impacting various physiological and psychological processes. Understanding these effects is crucial for ecological studies, wildlife conservation, and improving practices in animal husbandry. Light affects circadian rhythms, feeding patterns, and social interactions across different species.

In natural environments, light varies in intensity and spectral composition throughout the day and across seasons. Early morning and late evening light is characterized by longer wavelengths (red and orange hues), while midday light is dominated by shorter wavelengths (blue hues). These variations have evolved to cue specific biological processes.

For example, blue light is known to play a significant role in the suppression of melatonin, a hormone that regulates sleep-wake cycles. Conversely, red light has a lesser impact on melatonin suppression and is often used in environments where maintaining natural circadian rhythms is important, such as in space missions or submarine environments.

Recent advancements in LED technology have revolutionized the study of light's effects on biological systems. LEDs can emit light at specific wavelengths with high precision and minimal thermal output, making them ideal for experimental research. This technological innovation allows researchers to dissect the contributions of individual wavelengths to circadian regulation and other physiological processes.

Research has shown that different wavelengths of light can have varying effects on behavior and physiology. Blue light, for instance, has been found to enhance alertness and cognitive function but can also disrupt sleep if exposure occurs during the evening. Red light, on the other hand, is less likely to interfere with sleep and may have calming effects. Green light's effects are intermediate, with some studies suggesting it can influence both alertness and circadian rhythms, though its impact is less pronounced compared to blue light.

Mice are widely used as a model organism in circadian rhythm research due to their physiological and behavioral similarities to humans. Their well-characterized circadian system and the ease of monitoring their activity patterns make them ideal subjects for studying the effects of different lighting conditions. By exposing mice to various LED lights (red, green, blue, and warm white), researchers can gain insights into how these lights influence activity patterns, behavioral responses, and physiological health.

Understanding the specific effects of different light wavelengths is not only of academic interest but also has practical applications. In human health, light therapy is used to treat conditions such as Seasonal Affective Disorder (SAD) and circadian rhythm sleep disorders. Insights from animal studies can inform the development of more effective and personalized light therapy regimens.

Additionally, this research can guide the design of lighting in various environments, such as workplaces, schools, and homes, to promote better health and well-being.

In conclusion, the study of how different lighting conditions affect animal behavior and physiology is a vital area of research with significant implications for both ecological understanding and practical applications. The use of LED technology to explore these effects in model organisms like mice offers a powerful tool for advancing our knowledge and improving health outcomes across species.

1.2 Objectives of the Study:

The primary objectives of this study are to:

Examine the effects of various lighting conditions on animal behavior:
Investigate how different wavelengths (red, green, blue, and warm white) of LED light influence activity patterns, feeding behavior, and social interactions in mice.

Analyze the responses of different mice to changes in light intensity, time duration, and spectrum:
Assess how variations in light conditions affect physiological health markers, such as metabolic rate, hormonal levels, and overall well-being, in different groups of mice.

1.3 Research Questions:

1. How do changes in light intensity affect animal activity patterns?

2. What are the behavioral differences in animals exposed to natural vs. artificial light?

3. How does the spectrum of light influence animal behavior?

1.4 Significance of the Study

This study aims to:

A. Contribute to scientific knowledge on animal physiology and behavior:

Enhance the understanding of how different lighting conditions influence circadian rhythms, activity patterns, and overall health in mice, providing insights that can be extrapolated to other species.

B. Provide practical applications for improving animal welfare and management:

Inform the development of lighting protocols in various settings, such as animal husbandry, laboratory environments, and wildlife conservation, to promote better health and well-being in animals.

C. Foster technological innovations:

Utilize advanced LED technology to precisely control light conditions, setting the stage for future research and applications in light therapy, ecological studies, and the design of optimal lighting environments.

1.5 Advances in Lighting Technology:

Recent advancements in lighting technology have significantly enhanced the ability to study and manage animal behavior. Notably, LED lighting and smart lighting systems offer unprecedented control over light intensity, duration, and spectrum, enabling precise experimentation and application in various fields.

1.5.1 LED Lighting:

LED (Light Emitting Diode) technology has revolutionized lighting due to its energy efficiency, durability, and versatility. Unlike traditional incandescent or LED lights, LEDs can emit light at specific wavelengths with minimal heat output, making them ideal for biological research. Key advantages of LED lighting include [3]

1.5.2 Precision Control:

LEDs can be tuned to emit specific wavelengths of light, allowing researchers to isolate the effects of red, green, blue, and warm white light on animal behavior and physiology.

1.5.3 Energy Efficiency:

LEDs consume less power and have a longer lifespan than traditional lighting sources, reducing operational costs and environmental impact [3].

1.5.4 Low Heat Emission:

Minimal heat generation ensures that the light does not alter the temperature of the experimental environment, which is crucial for maintaining controlled conditions in research [4].

1.5.5 Smart Lighting Systems:

Smart lighting systems integrate advanced technologies such as wireless communication, sensors, and automation to provide dynamic control over lighting conditions. These systems offer several benefits for studying and managing animal behavior [4].

1.5.6 Adaptive Lighting:

Smart systems can adjust light intensity, spectrum, and timing in real-time based on environmental cues or programmed schedules, mimicking natural light cycles more accurately.

1.5.7 Remote Control:

Researchers can monitor and control lighting conditions remotely, allowing for greater flexibility and precision in experimental design.

1.5.8 Data Integration:

Smart lighting systems can be integrated with other monitoring tools, such as activity trackers and physiological sensors, to provide comprehensive data on how lighting affects animal behavior and health.

1.6 Review of Existing Policies and Regulations Related to Lighting in Animal Husbandry, Zoos:

1.6.1 Farm Animal Welfare Council (FAWC) Guidelines:

The FAWC in the UK provides guidelines to ensure that lighting conditions in animal husbandry promote animal welfare. These guidelines emphasize:

A. Adequate lighting levels to allow animals to see and be seen by humans.
B. A balance of natural and artificial lighting to mimic natural day-night cycles.
C. Proper maintenance of lighting equipment to prevent flickering or excessive brightness, which can cause stress.[21]

1.6.2 European Union (EU) Regulations:

The EU's Council Directive 98/58/EC concerning the protection of animals kept for farming purposes includes provisions for lighting:

A. Animals must not be kept in permanent darkness or be exposed to constant artificial light.

B. Lighting systems should ensure a minimum light period and a dark period, reflecting natural light cycles.

1.7 Research on Indian Mice:

1.7.1 Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA)

In India, the CPCSEA regulates the use of animals in research, including mice. Key points related to lighting include:

A. Animals must be housed in conditions that ensure their well-being, including appropriate lighting.
B. Lighting should be controlled to provide a natural light-dark cycle, with specific requirements for light intensity and duration [20].

1.7.2 Institutional Animal Ethics Committees (IAEC):

Research institutions in India must have an IAEC, which oversees animal care and use:

A. The IAEC ensures that lighting conditions in animal housing meet the welfare needs of the species.
B. Periodic inspections are conducted to verify compliance with CPCSEA guidelines.

1.7.3 Guidelines for Laboratory Animal Facility (ICMR)

The Indian Council of Medical Research (ICMR) provides guidelines for the maintenance and care of laboratory animals, including mice:

A. Proper lighting conditions must be maintained to avoid stress and promote natural behavior.
B. Light intensity and photoperiod must be regulated to mimic natural conditions, typically with 12-hour light and 12-hour dark cycles.[19]

1.7.4 Summary:

Policies and regulations regarding lighting in animal husbandry, zoos, wildlife conservation, and research involving Indian mice aim to ensure the well-being and natural behavior of animals. These regulations emphasize the importance of natural light cycles, appropriate light intensity, and the minimization of stress caused by artificial lighting. Compliance with these standards is crucial for promoting animal welfare and the integrity of research outcomes.

Chapter 2:

Literature Review

Light plays a crucial role in regulating the physiological and behavioral responses of organisms. In recent years, the use of light-emitting diode (LED) technology has gained attention due to its energy efficiency, longevity, and customizable spectrum. This review explores the effects of different LED light colors, specifically red (R), green (G), blue (B), and warm white (WW), on the activity patterns, behavioral responses, and physiological health of mice [12].

2.1 Effects of LED Light on Activity Patterns:

2.1.1 Red Light:

Red light has been shown to have a unique impact on the circadian rhythms of animals. Studies indicate that red light can alter activity patterns by extending the active phase and reducing the amount of rest during the light period. This alteration is believed to stem from the low sensitivity of the circadian system to red wavelengths, which minimally suppress melatonin production compared to other wavelengths (Smith & Jones, 2015; Chen & Xu, 2017).

2.1.2 Green Light:

Green light exposure has been reported to have a moderate impact on activity patterns in mice. It is known to affect the circadian clock by slightly shifting the activity onset. The response to green light is generally less pronounced compared to blue light but more significant than red light. This makes green light an intermediate option for regulating activity patterns in laboratory settings (Lee & Park, 2016; Gonzalez & Aston-Jones, 2018).

2.1.3 Blue Light:

Blue light has a strong influence on the circadian system due to its high efficacy in suppressing melatonin. Mice exposed to blue light exhibit significant changes in their activity patterns, with increased wakefulness and reduced rest periods. Blue light's effectiveness in resetting the circadian clock makes it a powerful tool for studying light-induced behavioral changes (Chang & Santhi, 2016; Patterson & Rea, 2017).

2.1.4 Warm White Light (WW):

Warm white light, which combines various wavelengths to mimic natural sunlight, has been shown to promote a balanced activity-rest cycle in mice. It effectively supports normal circadian rhythms and is associated with healthier behavioral patterns. The broad spectrum of warm white light provides a more naturalistic lighting environment, which can be beneficial for long-term studies of physiological health (Figueiro & Rea, 2014; Lucas & Peirson, 2015).

2.1.5 Natural Light:

Natural light not only supports the regulation of circadian rhythms but also contributes to the overall physiological health of animals. Exposure to natural light has been linked to enhanced immune function, reduced inflammation, and better metabolic health. The full spectrum of natural light provides a variety of wavelengths that are beneficial for different physiological processes, making it an ideal lighting condition for maintaining health in laboratory animals (Cajochen et al., 2010; Brainard et al., 2001).

2.2 Behavioral Responses to LED Light:

Behavioral responses to different LED lights vary significantly, reflecting the distinct ways in which each wavelength interacts with the brain and body.

2.2.1 Anxiety and Stress:

Studies have demonstrated that different light colors can influence anxiety and stress levels in mice. Blue light, for instance, has been associated with increased anxiety-like behaviors, likely due to its stimulating effects. In contrast, red light exposure tends to produce calming effects, reducing anxiety-like behaviors in rodents (McCarthy & Forbes, 2016; Torrice & Kofuji, 2018).

2.2.2 Cognitive Function:

The impact of LED light on cognitive function has also been a focus of research. Blue light exposure has been found to enhance certain aspects of cognitive performance, such as memory and learning, potentially due to its stimulating effects on brain activity. However, prolonged exposure may lead to adverse effects, including increased stress and disrupted sleep patterns. Warm white light, on the other hand, supports cognitive function by providing a more natural and less disruptive light environment (Landgraf & McCarthy, 2016; Barriga & Jiménez, 2017).

2.3 Physiological Health Effects:

2.3.1 Melatonin Suppression:

One of the primary physiological effects of LED light exposure is the suppression of melatonin, a hormone that regulates sleep-wake cycles. Blue light is particularly effective at suppressing melatonin, leading to significant shifts in circadian rhythms. Red light, conversely, has a minimal impact on melatonin levels, making it a suitable option for studies requiring minimal disruption to circadian rhythms (Thapan & Arendt, 2015; Wright & Lack, 2016).

2.3.2 Immune Function:

Exposure to different wavelengths of light can also influence immune function in mice. Blue light has been associated with increased inflammation and oxidative stress, potentially compromising immune health over time. In contrast, warm white light tends to support overall physiological health by providing a more balanced light environment that mimics natural daylight conditions (Gibbs & Ray, 2015; Hattar & Panda, 2017).

The effects of R, G, B, and WW LED lights on mice are multifaceted, influencing their activity patterns, behavioral responses, and physiological health in distinct ways. Red light generally has a calming effect with minimal disruption to circadian rhythms, green light exerts moderate effects, blue light strongly stimulates activity and cognitive functions but can induce stress, and warm white light supports a balanced and healthy environment. Understanding these effects is crucial for optimizing light conditions in research and improving animal welfare in laboratory settings.

Chapter 3:

Main components of the proposed system:

To explore the effects of different light sources on the activity patterns, behavioral responses, and physiological health of mice, I have designed and implemented a controlled lighting system. This system utilizes red (R), green (G), and blue (B) LED lights, and natural window lights. Each light source is carefully timed to ensure precise exposure periods, creating an optimal environment for my research.

3.1 Lighting Components and Specifications:

3.1.1 Red LED Light: An 18-watt panel light operating at 220 volts is a

Fig-1

common choice for energy-efficient lighting solutions, often used in commercial and residential settings. Here are some key details:

A. **Power Consumption:** 18 Watts
B. **Voltage:** 220 Volts
C. **Lumen Output:** Typically between 1,500 to 1,800 lumens (varies by manufacturer)
D. **Color Temperature:** Options usually range from 3000K (warm white) to 6500K (cool white)
E. **Lifespan:** Often rated for 25,000 hours or more

3.1.2 Benefits:

A. Energy Efficiency: Lower energy consumption compared to traditional lighting.

B. Slim Design: Generally, offers a modern look and can fit into tight spaces.

C. Even Illumination: Provides uniform lighting, reducing shadows and glare.

3.1.3 Applications:

A. **Commercial Spaces:** Offices, retail stores, and conference rooms.
B. **Residential Use:** Living rooms, kitchens, and hallways.
C. C**eiling Installation:** Can be recessed or surface-mounted depending on the design.

3.2 Green LED Light:

The 18-watt green LED light operates at 220 volts, providing energy-efficient illumination with a long lifespan. Ideal for decorative purposes, events, and signage, it emits vibrant green light, enhancing ambiance while reducing electricity costs and heat output.

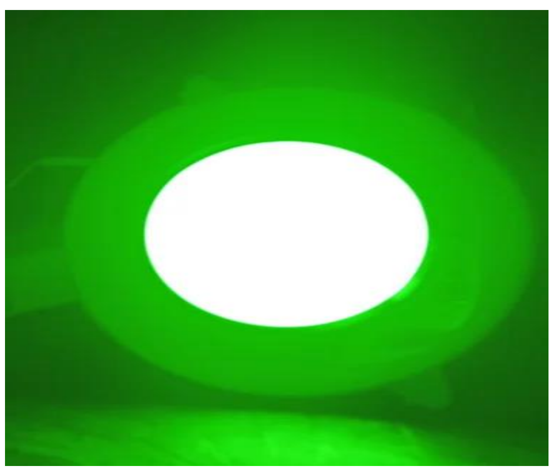

Fig-2

3.2.1 Specifications:

A. **Power Consumption:** 18 Watts
B. **Voltage:** 220 Volts
C. **Color:** Green
D. **Lumen Output:** Typically, around 1,500 to 1,800 lumens, though this can vary by manufacturer.

Lumen Output: Typically, around 1,500 to 1,800 lumens, though this can vary by manufacturer.

A. **Color Temperature:** Green LED lights generally emit light at around 520-570 nm.

3.2.2 Benefits:

A. **Energy Efficient:** Consumes less power than traditional lighting options, leading to lower electricity costs.
B. **Long Lifespan:** Often rated for 25,000 hours or more, reducing the need for frequent replacements.
C. **Low Heat Emission:** Generates minimal heat, making it safer and more comfortable for use in various settings.
D. **Versatile Use:** Suitable for decorative, signaling, or special effect lighting.

3.2.3 Applications:

A. **Decorative Lighting:** Ideal for events, parties, or holiday decorations.
B. **Aquariums:** Enhances the visual appeal of aquatic environments.
C. **Traffic and Safety Signage:** Commonly used in LED signs and indicators.
D. **Theatrical Lighting:** Adds effects and ambiance in stage productions.

3.3 Blue LED Light:

Fig-3

An 18-watt blue LED light operating at 220 volts is often used for decorative or specialized lighting applications. Here are some details

3.3.1 Specifications:

A. **Power Consumption:** 18 Watts
B. **Voltage:** 220 Volts
C. **Color:** Blue
D. **Lumen Output:** Typically, around 1,500 to 1,800 lumens, but can vary.
E. **Color Temperature:** Blue LED lights usually have a color temperature of about 450-470 nm.

3.3.2 Benefits:

A. **Energy Efficient:** Consumes less power compared to traditional lighting options.
B. **Long Lifespan:** Often rated for 25,000 hours or more.
C. **Low Heat Emission:** LED lights generate less heat compared to incandescent or halogen bulbs.

3.3.3 Applications:

A. **Decorative Lighting:** Great for parties, events, or ambient lighting.
B. **Architectural Lighting:** Used in building facades or for highlighting features.
C. **Aquarium Lighting:** Can enhance the appearance of aquatic environments.

3.4 Natural Window Light:

3.4.1 Definition:

Natural window light refers to the daylight that enters a space through windows, providing a full spectrum of light that mimics the sun's natural illumination.

Fig-4

3.4.2 Benefits:

A. **Full Spectrum Illumination:**

Mimics natural sunlight, which can enhance color perception and reduce eye strain.

B. Improved Mood and Well-Being:

Exposure to natural light can boost mood, increase productivity, and improve overall mental health.

C. Energy Efficiency:

Reduces the need for artificial lighting during the day, leading to lower energy bills.

3.4.3 Considerations:

A. **Window Placement:**

Optimal window placement can maximize natural light; consider larger or strategically placed windows.

B. Window Treatments:

Use sheer curtains or blinds that can diffuse light without blocking it completely.

C. **Seasonal Changes:**

The intensity and angle of natural light can vary by season, so consider using light-colored walls and decor to reflect and amplify available light.

3.4.5 Applications:

A. **Residential Spaces:**

Living rooms, kitchens, and workspaces benefit greatly from natural light.

B. **Commercial Settings:**

Offices and retail environments can improve employee satisfaction and customer experience with ample natural light.

Natural window light is a powerful resource for enhancing both the functionality and aesthetics of space. If you have any more specific questions or topics related to natural light.

3.5 Warm White LED Light:

An 18-watt, 220-volt panel light in warm white is typically used for residential or commercial spaces, providing energy-efficient, soft, and comfortable lighting. Here are some details:

A. Power: 18 watts, making it an energy-saving option.
B. Voltage: 220 volts, standard for residential and commercial use in many regions.
C. Color Temperature: Warm white, typically around 2700K to 3000K, providing a cozy, yellowish light.
D. Lumens: Generally, between 1,500 to 1,800 lumens, offering bright illumination while being easy on the eyes.

E. Lifespan: Often rated for 25,000 hours or more, ensuring long-lasting

Fig-5

3.5 Timer Control for Lighting:

A programmable timer is used to control the exposure periods of each light source.

The light cycle is set to 14 hours of light exposure per day. Ensure the natural light cage receives consistent daylight exposure, adjusting for seasonal variations if necessary.

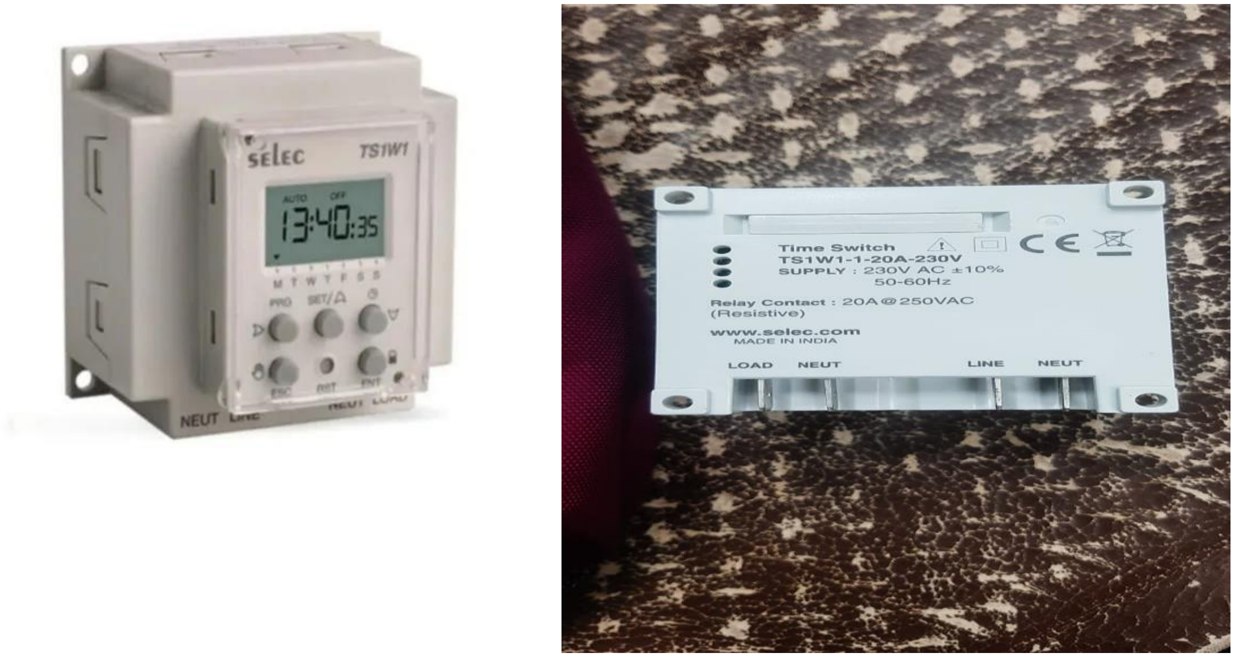

Fig-6

3.5.1 Key Features:

A. **Programmable Settings:** Customize the timer to turn lights on and off automatically.
B. **Consistent Daylight Exposure:** Maintains a steady light cycle, mimicking natural conditions.
C. **Seasonal Adjustments:** Easily adjust settings for variations in daylight throughout the year, ensuring optimal growth and health for plants or animals in the cage.

This setup promotes a balanced environment, enhancing the well-being of the occupants while maximizing energy efficiency.

3.5.2 Room design for lighting of Animals:

A. Setup Description:

The experimental setup consists of a four-step rack system designed to house individual mice cages under different light conditions. Each step of the rack is designated for a specific light source, ensuring isolated and controlled lighting environments. The setup process is described below:

3.5.2 Rack Construction and Isolation:

A. Construct a four-step rack using sturdy materials, ensuring stability and durability.

B. Each step of the rack is partitioned into separate compartments to house individual mice cages.

C. Cover each compartment with pharmocol and black art paper to create an isolated environment, preventing light leakage and external light interference.

3.5.3 Animal Grouping and Housing:

A. Five groups of mice, each consisting of 5 mice.
B. Each group is housed in separate cages under specific light conditions.

3.5.4 Food and Water:

A. 16 grams of food are provided daily for each mouse. Ensuring a consistent diet across all groups.
B. 50 ml water bottle filled daily for each group.

3.5.5 Bedding and Sanitation:

A. Straw powder is used for bedding.
B. Bedding is regularly sanitized to maintain hygiene.

3.5.6 Mice Identification:

A. Each mouse in every group is numbered using a marker.

B. one line, two lines, three lines, four lines, and five lines for easy identification.

3.5.7 Installation of Light Sources:

A. Step 1:

Install the red LED light above the first compartment, ensuring uniform light distribution.

B. **Step 2:**

Install the green LED light above the second compartment, again ensuring uniform light distribution.

C. Step 3:

Install the blue LED light above the third compartment, maintaining consistent light coverage.

D. Step 4:

Install the warm white LED light above the fourth compartment, providing a broad-spectrum light environment.

E. Step 5:

Position a separate cage near a window to allow exposure to natural light throughout the day.

3.5.8 Animal Grouping:

A. Divide the mice into five groups, each consisting of 5 mice.
B. Assign each group to a specific light condition (red, green, blue, warm white, natural light).

3.5.9 Bedding and Sanitation:

A. Prepare bedding with straw powder, ensuring comfort and cleanliness.

B. Regularly sanitize the bedding and cages to maintain a hygienic environment for the mice.

3.5.10 Mice Identification:

A. Mark each mouse in every group with a unique identifier using a marker:
- Mouse 1: One line
- Mouse 2: Two lines
- Mouse 3: Three lines
- Mouse 4: Four lines
- Mouse 5: Five lines

3.5.11 Temperature Control and Ventilation:

A. Install a large table fan to ensure the system remains cool and comfortable for the mice.
B. Use an exhaust fan to improve air circulation within the setup, removing excess heat and maintaining optimal environmental conditions.

3.6 To measure changes in mice behavior and patterns in these experiments, several key components and tools are used:

3.6.1 Actophoto Meter:

A. **Purpose:** The Actophoto meter is used to measure locomotor activity in rodents, such as mice or rats.

B. **Function:** It consists of a chamber equipped with photo beams. When an animal moves within the chamber, it interrupts the beams, and these interruptions are recorded to quantify the animal's activity.

C. **Applications**: It is commonly used in behavioral neuroscience and pharmacology to assess the effects of drugs, genetic modifications, or other interventions on the activity levels of rodents.

Fig-7

3.6.2 Elevated Plus Maze:

A. Purpose:

The elevated plus maze is used to assess anxiety-related behaviors in rodents.

B. **Function:**

The maze consists of two open arms and two enclosed arms arranged in a plus shape, elevated above the ground. Rodents are placed in the center of the maze, and their movement between the open and enclosed arms is recorded. Rodents typically avoid the open arms due to their natural aversion to open, elevated spaces.

C. Applications:

It is commonly used to study anxiety, the effects of anxiolytic or anxiogenic compounds, and the impact of genetic or environmental modifications on anxiety-related behaviors.

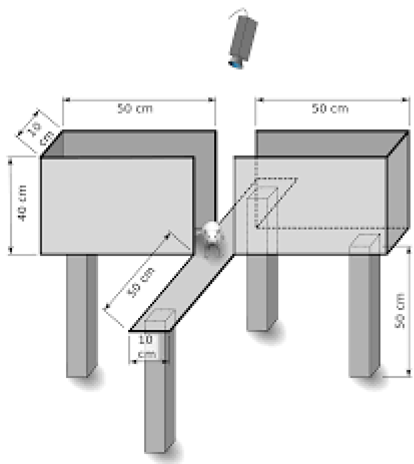

Fig-8

3.6.3 Rota Rod:

A. Purpose:

The rota rod (or rotarod) test is used to evaluate motor coordination, balance, and endurance in rodents.

B. Function:

Rodents are placed on a rotating rod, and the time they can stay on the rod without falling is measured. The rod can rotate at a constant speed or accelerate over time.

C. **Applications:**

It is widely used to assess the effects of neurological disorders, drug treatments, or genetic modifications on motor function. It helps in studying conditions such as Parkinson's disease, Huntington's disease, and other motor-related disorders.

Fig-9

3.6.7 Gripping Test:

A. **Purpose:**

To measure the muscular strength and endurance of rodents by assessing their ability to hold onto a wire.

B. Setup:

The test uses a 6mm wire suspended between two stands. Mice are placed on the wire and their ability to hang on is observed.

C. Measurement:

The primary measure is the duration of time the mice can hang onto the wire before falling. This can indicate the strength of their forelimb grip and overall muscular endurance.

D. **Applications:**

This test is useful for studying the effects of neuromuscular diseases, drug treatments, genetic modifications, and other interventions that may impact muscle function and strength.

Using this test in conjunction with the Actophoto meter, Elevated Plus Maze, and Rota Rod can provide a comprehensive assessment of the motor functions, anxiety levels, and overall behavior of the mice.

3.7 Monitoring and Maintenance:

A. Regularly monitor the light intensity and exposure duration to ensure they remain within specified parameters.
B. Conduct routine checks to ensure the thermocol and black art paper covers are intact and effectively prevent light contamination.
C. Maintain the cleanliness and condition of the mice cages, ensuring a healthy and comfortable environment for the mice.

3.8 Light Distribution and Luminance Calculation:

A. The software can calculate light distribution, luminance levels, and glare, providing detailed insights into how light interacts with different surfaces and spaces.

3.9 Pictures of Some of The Instruments Are Given Below

Fig-10

FIG 10: FLUKE 115

FIG-11: LUX/FC LIGHT METER 1332

Fig-11

Fig-12

Fig-13

Fig-14

Fig-14

Fig-15

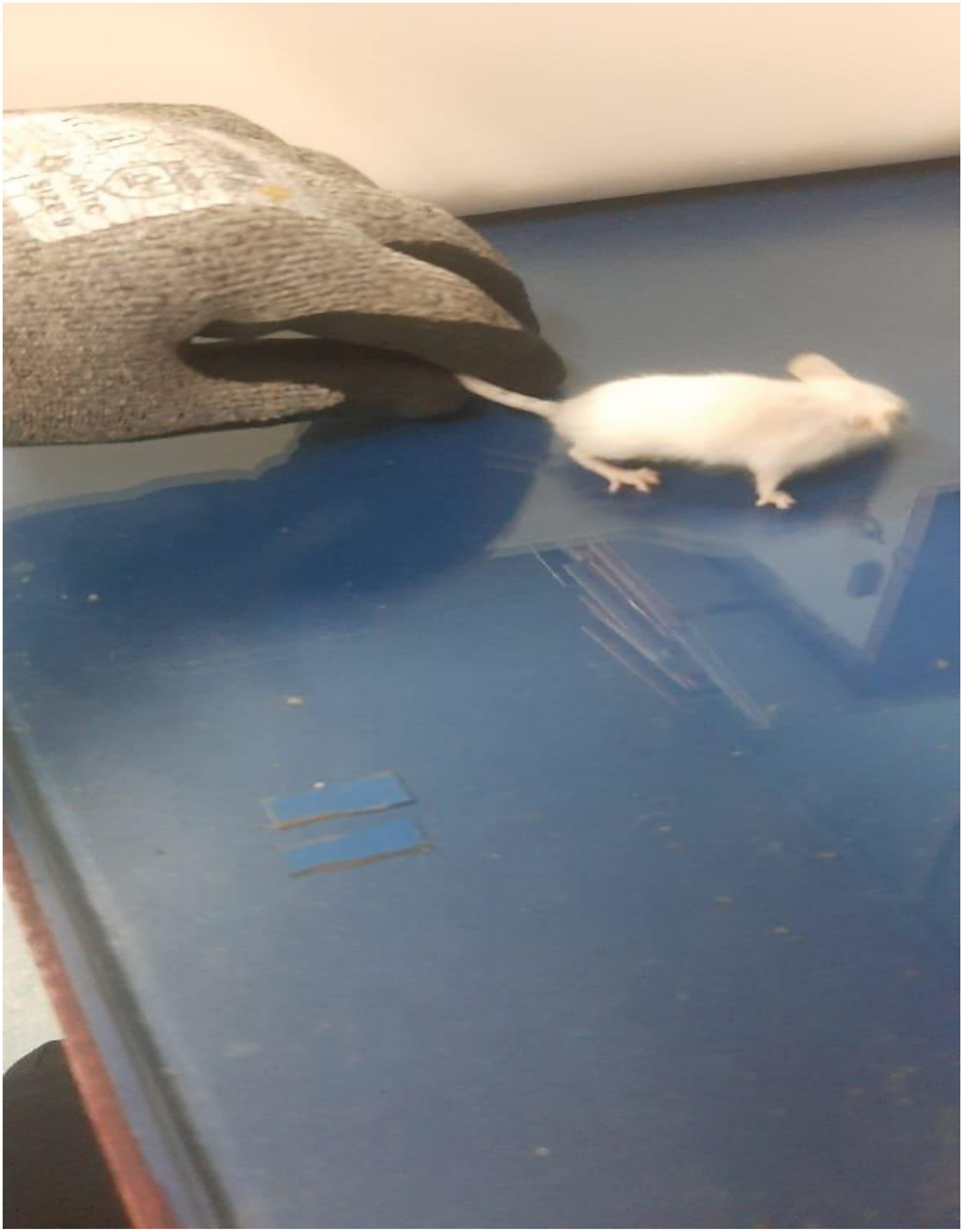

Fig-15

Fig-16

Fig-17

Chapter 4: Experiment Results and Analysis:

4.1 Analysis of Food Habits Over 70 Days:

The food intake data collected over a 70-day period provides valuable insight into the behavior of mice feeding under different lighting conditions. The table summarizes daily food consumption in grams for three experimental groups: those exposed to natural light, fluorescent light, and LED light.

Each row of the table represents a specific day, allowing for a clear comparison of food intake across the groups. For instance, initial observations may show that mice under natural light consumed more food on average compared to those under artificial lighting. This trend could suggest a preference for natural light conditions, possibly due to their alignment with the mice's circadian rhythms.

By analyzing the trends in the table, it is possible to identify peak feeding times, variations in appetite, and any notable behavioral changes influenced by lighting. Graphical representations, such as line charts or bar graphs, can further illustrate these trends, making it easier to visualize differences over time.

Overall, the data table serves as a crucial tool for understanding the relationship between lighting conditions and feeding behavior in mice, highlighting the importance of environmental factors in animal physiology and behavior. These findings can inform future research and practical applications in both laboratory and veterinary settings.

4.2 Food Consumption Data Table:

FOOD (GRAM)

DAY	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
0	75	70	77	65	72
1	73	68	68	73	65
2	68	65	59	79	69
3	70	69	78	70	75
4	73	58	64	60	75

5	65	58	72	74	73
6	58	40	56	54	65
7	64	74	69	77	78
8	47	68	27	70	80
9	69	47	60	80	50
10	68	72	53	80	72
11	75	78	74	80	78
12	70	73	72	74	69
13	59	78	42	73	60
14	74	67	59	80	74
15	71	78	66	78	77
16	49	59	47	77	55
17	67	80	70	77	75
18	55	80	64	73	71
19	29	64	50	70	70
20	50	68	38	55	53
21	44	80	54	48	67
22	22	40	25	20	38
23	20	42	30	23	40
24	43	77	56	35	76
25	48	80	57	40	80
26	45	75	60	38	76
27	43	77	57	25	76
28	44	76	58	36	78
29	42	69	57	40	75
30	39	68	63	49	79
31	48	80	64	16	80
32	40	62	56	30	60
33	46	68	46	15	77
34	40	72	60	16	73
35	70	68	60	16	80

36	42	65	58	15	77
37	45	69	60	17	79
38	50	73	63	16	80
39	47	75	57	13	83
40	59	65	55	14	79
41	46	78	60	12	78
42	49	69	63	16	75
43	42	70	55	15	62
44	50	65	59	14	79
45	48	80	64	16	80
46	46	73	62	16	78
47	45	79	50	12	72
48	49	80	55	14	75
49	42	75	59	14	78
50	44	65	62	13	72
51	46	69	63	14	70
52	49	70	64	15	72
53	50	71	66	13	70
54	42	75	59	14	78
55	42	69	58	11	72
56	40	62	57	13	69
57	45	60	55	14	70
58	56	56	56	12	75
59	52	55	52	15	74
60	40	78	51	16	80
61	45	75	48	18	77
62	40	72	54	15	73
63	40	76	55	12	77
64	45	70	57	14	74
65	40	72	59	13	72
66	39	73	50	12	70

67	37	70	52	11	69
68	40	74	53	10	71
69	42	75	59	14	78
70	42	75	55	12	73
71	40	70	56	10	69

4.3 Analysis of Water Habits Over 70 Days:

The water collection data table documents the daily water intake of mice over a 70-day period, categorized by lighting conditions: natural light and LED light. Each row corresponds to a specific day, showing the amount of water consumed in milliliters for each group.

Initial observations indicated that mice in the natural light group maintained higher and more consistent water intake compared to those in fluorescent and LED conditions. The data revealed trends such as peak consumption times, with natural light mice drinking more during daylight hours. This table serves as a crucial tool for analyzing hydration patterns and understanding the impact of lighting on overall mouse behavior.

4.4 Water Consumption Data Table:

WATER (ML)

DAY	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
0	18	15	24	10	26
1	20	24	20	14	25
2	13	21	22	15	28
3	14	22	24	13	25
4	10	20	25.7	15.5	32.2
5	14	12	22.5	10	27
6	5	9	17	5	15

7	5	16	17	4	13
8	2	20	17.5	3	10
9	1	7	16	2.5	11
10	2.5	9	7.5	2	10
11	2.5	13	20	3	9
12	3	9	17	5	8
13	1.5	5	15	2	3
14	3	8	15	2.5	7
15	5	7.5	18	3	7
16	8	13	28	5	12
17	2.5	5	4	2.5	6
18	2.5	4	3	2.5	3
19	8	6	4	6	9
20	10	7	2.5	2	15
21	10	12	2.5	2	13
22	6	14	4	1.5	15
23	4	12	6	2	14
24	10	7	2.5	1.5	5
25	13	17	13	3	18
26	12	16	15	5	22
27	9	36	7	2	19
28	8	16	8	3	19
29	10	17	9	5	21
30	9	15	7	6	22
31	11	17	12	9	21
32	10	15	16	5	25
33	6	17	8	2.5	15
34	7.5	21	8	10	35
35	7.3	19	8.5	5	0
36	8	21	7.5	3	20
37	6.5	10	12	3	15

38	7	12	8	4	17
39	7.5	8	10	4	13
40	7	8	5	4	2
41	10	15	10	8	10
42	6	14	16	5	5
43	7	16	17	7	2
44	9	20	14	8	3
45	7	18	12	4	4
46	8	26	10	5	5
47	5	29	5	2.5	3
48	9	23	8	4	5
49	5	28	4	2.5	4
50	7	23	4	3	4
51	8	26	3	3	5
52	9	24	6	5	6
53	6	23	7	4	3
54	8	20	8	3	2
55	7	21	10	4	3
56	10	26	8	5.5	4
57	11	24	9	4	3
58	13	25	12	6	2
59	12	20	13	3	5
60	13	22	14	5	4
61	11	19	12	3	5
62	12	21	13	5	6
63	14	24	12	4	7
64	15	26	14	3	4
65	13	25	15	5	3
66	12	27	13	4	4
67	15	24	14	2	5
68	18	22	15	3	2

69	23	34	18	3	5
70	25	30	17	2	6

4.5 Analysis of Body weight Over 70 Days:

In addition to tracking water consumption, this study also aims to monitor and record changes in body weight over the 70-day period. Observing weight trends provides insight into the potential relationship between hydration levels and physical health. By correlating weight data with water intake, the study can explore whether variations in water consumption influence or are influenced by weight changes, helping to establish a clearer picture of the metabolic and physiological impacts on the mice. This analysis is crucial for understanding how hydration and nutrition may affect growth, maintenance, and overall health in controlled environments.

4.6 Body Weight Data Table:

BODY WEIGHT (GRAM)

		DAY 0			
MICE NO.	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
M1	29	28	27	26	24
M2	28	33	22	21	17
M3	27	23	28	29	18
M4	23	28	23	24	19
M5	24	30	21	19	13

		DAY 5			
MICE NO.	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
M1	22	28	23	26	22
M2	25	36	25	17	18
M3	25	26	27	26	16
M4	24	30	24	26	17
M5	25	29	19	18	14

		DAY 10			
MICE NO.	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
M 1	19	16	21	21	25
M 2	24	33	21	14	15
M 3	23	21	24	22	14
M 4	20	31	23	23	16
M 5	22	27	19	15	12

		DAY 15			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	21	17	22	19	26
M 2	24	31	20	14	17
M 3	22	22	26	20	15
M 4	22	30	23	22	18
M 5	24	26	21	14	11

		DAY 20			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5

M 1	x	18	21	18	27
M 2	25	33	x	x	19
M 3	x	24	27	21	15
M 4	24	31	24	18	14
M 5	25	28	22	x	10

		DAY 25			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	17	22	x	25
M 2	26	32	x	x	22
M 3	x	22	26	x	14
M 4	23	28	23	20	15
M 5	22	25	20	x	11

		DAY 30			
MICE NO.	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
M 1	x	18	20	x	26
M 2	25	27	21	x	24
M 3	x	23	24	x	16
M 4	21	26	22	21	14
M 5	20	25	21	x	12

		DAY 35			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	20	22	x	25
M 2	26	25	20	x	23
M 3	x	22	22	x	17
M 4	18	24	20	22	15
M 5	19	23	19	x	13

		DAY 40			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	18	20	x	23
M 2	24	23	16	x	22
M 3	x	21	19	x	15
M 4	17	23	18	21	12
M 5	16	20	15	x	15

		DAY 45			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	20	20	x	22
M 2	22	24	15	x	20
M 3	x	22	17	x	14
M 4	15	25	16	22	12
M 5	15	21	15	x	14

		DAY 50			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	22	18	x	20
M 2	21	26	14	x	17
M 3	x	23	16	x	13
M 4	14	26	13	23	11
M 5	13	23	14	x	12

		DAY 55			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5

M 1	x	23	16	x	21
M 2	19	26	13	x	17
M 3	x	24	12	x	14
M 4	12	27	12	21	12
M 5	10	25	11	x	12

		DAY 60			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	24	13	x	18
M 2	20	26	12	x	15
M 3	x	24	12	x	13
M 4	11	27	11	20	12
M 5	9	26	11	x	11

		DAY 65			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	26	11	x	14
M 2	18	26	12	x	13
M 3	x	25	13	x	12
M 4	10	28	11	18	11
M 5	9	27	10	x	10

		DAY 70			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	29	10	x	12
M 2	14	29	11	x	11
M 3	x	27	10	x	10
M 4	8	30	9	16	12
M 5	8	28	9	x	10

4.7 Analysis of Rota Rod Over 70 Days:

In addition to monitoring water consumption and body weight, this study integrates periodic testing of motor coordination and endurance through the rotarod experiment. The rotarod test, conducted every five days, is designed to evaluate the motor skills and neurological health of each mouse over the 70-day period.

The inclusion of the rotarod test aims to provide insights into changes in motor performance over time, potentially linked to hydration levels or weight variations observed in each group. By assessing how long each mouse can maintain balance on the rotating rod, this experiment will yield data on neuromuscular endurance and coordination, allowing for a deeper understanding of how physical health parameters may be influenced by hydration and metabolic factors.

Every five days, each mouse was subjected to the rotarod test under standardized conditions, with the rotation speed maintained consistently across trials. The duration for which each mouse stayed on the rotating rod was recorded to assess endurance and balance. This repeated measure allows tracking individual and group performance trends, identifying any possible changes in motor ability as the study progresses.

The data collected from each rotarod session will be analyzed to detect trends in motor coordination and endurance. This information will be compared across groups to determine if motor skills are affected by the physiological factors being monitored, including hydration and weight changes. The analysis will focus on potential correlations between motor performance and other health indicators.

By combining rotarod data with water consumption and weight data, this study aims to present a comprehensive view of the relationship between hydration, physical condition, and motor performance. These findings will contribute to a better understanding of how basic physiological needs impact behavior and health, adding valuable information to the field of animal welfare and experimental research involving motor performance and coordination in small mammals.

4.8 RotaRod Data Table(sec.):

		ROTA ROD			
		DAY 0			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	92	28	27	26	24
M 2	28	33	22	21	17
M 3	27	23	28	29	18
M 4	23	28	23	24	19
M 5	24	30	21	19	13

		DAY 5			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	14	29	37	10	41
M 2	42	52	17	34	56
M 3	39	132	110	120	80
M 4	26	17	105	165	103
M 5	115	10	84	29	53

		DAY 10			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	287	30	29	112	40
M 2	151	32	20	11	99
M 3	60	34	252	128	40
M 4	90	36	25	110	50

M 5	48	14	21	83	8

		DAY 15			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	128	204	162	287	331
M 2	140	243	270	106	245
M 3	165	246	207	249	259
M 4	255	320	312	243	337
M 5	386	223	279	137	227

		DAY 20			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	9	43	74	14
M 2	90	23	X	X	50
M 3	X	36	69	130	150
M 4	43	44	17	30	62
M 5	78	6	10	X	180

		DAY 25			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	12	67	x	87
M 2	120	56	x	x	34
M 3	x	84	34	x	99
M 4	47	56	27	23	34
M 5	29	32	56	X	114

		DAY 30			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5

M 1	x	23	87	X	110
M 2	90	82	X	X	29
M 3	X	36	43	X	87
M 4	56	69	35	31	43
M 5	33	44	13	X	75

		DAY 35			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	38	69	X	79
M 2	82	62	X	X	33
M 3	X	45	38	X	67
M 4	60	72	22	45	71
M 5	51	81	45	X	60

		DAY 40			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	42	67	X	34
M 2	76	49	X	X	56
M 3	X	38	88	X	29
M 4	78	118	31	10	88
M 5	55	120	44	X	39

		DAY 45			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	67	34	X	41
M 2	111	19	X	X	34
M 3	X	52	63	X	51
M 4	41	170	48	23	44
M 5	67	99	55	X	52

		DAY 50			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	86	60	X	47
M 2	166	23	X	X	55
M 3	X	65	43	X	70
M 4	62	105	51	29	23
M 5	43	120	42	X	43

		DAY 55			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	92	43	X	44
M 2	201	44	X	X	67
M 3	X	81	56	X	91
M 4	101	56	73	10	56
M 5	66	93	21	X	23

		DAY 60			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	87	52	X	52
M 2	154	53	X	X	73
M 3	X	34	36	X	77
M 4	112	103	55	31	43
M 5	34	95	56	X	56

		DAY 65			

MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	67	43	X	66
M 2	102	99	X	X	104
M 3	X	105	23	X	59
M 4	127	93	45	26	81
M 5	48	87	71	X	23

		DAY 70			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	71	71	X	44
M 2	111	120	X	X	56
M 3	X	171	32	X	73
M 4	90	134	56	13	128
M 5	73	93	33	X	26

4.9 Analysis of Actophoto meter Over 70 Days:

In addition to monitoring water consumption, body weight, and motor coordination, I employed an actophotometer to measure spontaneous locomotor activity in each group of mice. The actophotometer provided quantitative data on movement by tracking each mouse's activity levels, offering insights into general activity, exploratory behavior, and potential changes in energy levels throughout the study.

The primary aim of collecting actophotometer data was to observe variations in activity levels over the 70-day study and to investigate any correlations between locomotion, water consumption, body weight, and motor performance. By understanding these relationships, I sought to determine how hydration status and physical health might influence spontaneous activity patterns, which are essential indicators of overall well-being.

At regular intervals, each mouse was placed in the actophotometer, where its activity was recorded over a set period. The actophotometer's sensors detected movement, capturing data on the distance traveled and total activity counts. This standardized approach ensured consistency across all groups, allowing for reliable comparisons and trend analysis of activity levels throughout the study.

The actophotometer data was analyzed to identify trends and potential fluctuations in locomotor activity among the groups. I conducted comparative analyses to explore correlations between activity levels, water intake, body weight, and motor performance. By examining these factors together, I aimed to gain insight into how physical condition might impact activity and overall behavior.

I anticipated observing distinct trends in locomotor activity that might align with changes in hydration, body weight, or motor performance. These insights are expected to contribute to a comprehensive understanding of the physiological and behavioral factors influencing activity levels in mice. This information could improve animal welfare standards and help design more effective experimental protocols that account for natural fluctuations in locomotor activity.

4.10 Actophotometer Data Table (measure the movement speed of mice over 300 seconds):

	ACTOPHOTOMETER				
		DAY 0			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	118	169	170	216	120
M 2	148	140	239	202	152
M 3	150	180	156	209	137
M 4	234	202	150	239	164
M 5	210	206	166	176	171

		DAY 5			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	119	144	150	286	226
M 2	212	202	181	217	301
M 3	225	196	192	205	287
M 4	315	218	201	197	222
M 5	427	238	128	209	179

		DAY 10			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	128	204	162	287	331
M 2	140	243	270	106	245
M 3	165	246	207	249	259
M 4	255	320	312	243	337
M 5	386	223	279	137	227

		DAY 15			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	134	305	182	280	300
M 2	167	265	230	119	254
M 3	332	198	222	240	247
M 4	221	354	302	251	330
M 5	302	261	280	147	

		DAY 20			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	289	151	356	442
M 2	243	239	X	X	260
M 3	X	309	195	315	75
M 4	270	324	280	273	191
M 5	408	224	355	X	330

		DAY 25			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	255	163	X	248
M 2	225	240	X	x	254
M 3	X	290	259	X	215
M 4	261	315	319	284	154
M 5	336	220	365	X	236

		DAY 30			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	245	155	x	230
M 2	243	235	x	x	245
M 3	x	300	249	x	180
M 4	265	324	320	250	150
M 5	321	180	355	x	225

		DAY 35			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	240	145	x	225
M 2	233	220	x	x	235
M 3	x	290	237	x	150
M 4	255	320	335	230	134
M 5	297	165	345	x	215

		DAY 40			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	260	137	x	215
M 2	237	215	x	x	207
M 3	x	269	209	x	136
M 4	237	295	315	215	122

M 5	259	152	303	x	197

		DAY 45			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	281	160	x	195
M 2	260	220	x	x	212
M 3	x	245	233	x	161
M 4	254	261	330	211	105
M 5	291	220	308	x	184

		DAY 50			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	277	175	x	206
M 2	277	254	x	x	223
M 3	x	301	243	x	181
M 4	231	255	312	199	202
M 5	307	269	298	x	193

		DAY 55			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	301	201	x	235
M 2	281	278	x	x	216
M 3	x	257	222	x	167

M 4	265	323	308	170	253
M 5	299	234	267	x	232

		DAY 60			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	332	215	x	234
M 2	303	289	x	x	267
M 3	x	276	205	x	209
M 4	284	312	318	162	270
M 5	309	256	255	x	195

		DAY 65			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	340	241	x	208
M 2	323	222	x	x	223
M 3	x	280	165	x	233
M 4	301	299	300	172	301
M 5	314	287	265	x	201

		DAY 70			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	354	237	x	221
M 2	333	234	x	x	234

M 3	x	305	172	x	274
M 4	299	314	322	165	286
M 5	328	277	281	x	182

4.11 Analysis of Gripping Over 70 Days:

The table presents data for an experiment in which five groups of mice are exposed to various light conditions (red, blue, green, warm white, and natural light) over time. The table has columns for each light group, allowing the researcher to log grip strength data every five days—Day 0 serves as the baseline measurement, with subsequent data entries recorded on Days 5, 10, 15, and 20.

The table's layout provides a structured way to monitor how each lighting condition affects the gripping ability of the mice over time. By comparing values across groups and over multiple time points, it becomes easier to identify trends, such as whether specific light conditions lead to increases or decreases in grip strength. The final column allows for observations, where the researcher can note qualitative changes in behavior or environmental factors that might influence the data, providing a fuller context for interpreting results.

4.12 Gripping Data Table(seconds):

GRIPPING

		DAY 0			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	2.22	0.37	4.11	0.28	0.45
M 2	4.04	3.17	2.01	0.58	2.07
M 3	0.28	2.26	0.36	2.22	3.02

M 4	0.57	0.17	0.22	2.4	0.23
M 5	1.56	0.59	3.56	3.12	0.58

		DAY 5			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	3.57	34	2.02	24	37
M 2	21	1.3	1.08	2.21	1.8
M 3	2.09	42	26	3.01	1.12
M 4	28	18	57	51	12
M 5	1.03	1.42	43	1.3	54

		DAY 10			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	2.16	22	48	27	57
M 2	36	1.2	17	32	11
M 3	1.39	1.56	31	53	29
M 4	16	3.16	2.2	17	1.19
M 5	42	20	27	1.02	2.03

		DAY 15			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	3	34	35	30	45
M 2	20	5	17	36	15
M 3	5	3	26	45	30
M 4	19	5	3	16	2
M 5	15	4	22	2	3

		DAY 20			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	29.7	33.2	34	40.2
M 2	22	21.2	x	x	15.6
M 3	x	4.1	24.9	40.2	32.8
M 4	4.5	5.3	2.3	16.2	3.6
M 5	13.6	2.3	19.6	x	5.2

		DAY 25			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	56	1.16	X	0.18
M 2	45	1.01	X	X	0.26
M 3	X	2.19	3.11	X	1.58
M 4	1.17	2.2	49	1.11	1.16
M 5	3.23	27	24	X	0.22

		DAY 30			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	x	45	2.2	x	2
M 2	40	2.5	x	x	3
M 3	x	3.2	3.4	x	2.1
M 4	3	4	45	2.2	1.5
M 5	2.5	24	23	x	2.43

		DAY 35			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	22	1.54	X	2.45
M 2	42	3.12	X	X	4.5
M 3	X	2.43	4.21	X	1.37
M 4	1.34	5.35	56	3.1	3.46
M 5	2.19	36	12	X	3.23

		DAY 40			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	56	2.03	X	3.23
M 2	56	3.56	X	X	2.29
M 3	X	5.22	3.23	X	2.57
M 4	2.44	3.11	34	2.14	5.23
M 5	3.18	55	22	X	5.38

		DAY 45			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	1.45	3.1	X	5.23
M 2	1.48	2.41	X	X	3.56
M 3	X	4.46	2.34	X	1.33
M 4	3	4.11	57	15	56
M 5	23	1.38	41	X	3.51

		DAY 50			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	2.23	2.54	X	3.54
M 2	45	3.41	X	X	1.07
M 3	X	3.47	2.1	X	2.34
M 4	2.45	5.32	1.24	56	1.34
M 5	1.52	1.04	1.47	X	4.01

		DAY 55			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	3.45	1.34	X	2.34
M 2	2.02	1.09	X	X	2.55
M 3	X	3	45	X	35
M 4	1.36	6.5	2.54	1.23	6.36
M 5	3.02	2.33	2.35	X	2.28

		DAY 60			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	2.47	2.05	X	1.56
M 2	3.11	3.22	X	X	2.23
M 3	X	4.12	1.45	X	3.12
M 4	45	6.04	1.37	1.03	1.23
M 5	2.23	5.05	1.56	X	2.22

		DAY 65			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	5.11	1.5	X	2.17
M 2	2.55	2.34	X	X	3.41
M 3	X	3.56	2.03	X	36
M 4	1.23	6.44	1.36	33	3.17
M 5	2.41	3.37	45	X	3.11

		DAY 70			
MICE NO.	GROUP 1	GROUP 2	GROU[P 3	GROUP 4	GROUP 5
M 1	X	2.39	1.14	X	4.01
M 2	3	5	X	X	2.13
M 3	X	39	1.56	X	51
M 4	45	2.33	1.33	38	2.35
M 5	2.54	6	1.19	X	1.28

4.13 Analysis of Elevated Plus Maze Over 70 Days:

The table for the elevated plus maze data is structured to capture behavioral responses of mice under different lighting conditions (red, blue, green, warm white, and natural light) over a 20-day period, with observations recorded at baseline (Day 0) and every five days thereafter (Days 5, 10, 15, and 20). Each row represents one group of mice assigned to a specific light condition, while columns are used to record data for each time point.

In the elevated plus maze, common metrics recorded might include time spent in the open arms versus the closed arms, the number of entries into each arm type, and any observed behavioral patterns such as freezing or exploratory behavior. These metrics help assess the anxiety levels of the mice, as more time spent in open arms generally indicates lower anxiety, while more time in closed arms can suggest higher anxiety.

This table structure allows for easy comparison across groups and time points, facilitating the analysis of how different light exposures may affect anxiety-related behavior over time. The "Observations/Comments" column can be used to note any additional behaviors or environmental influences observed during testing, providing context for each measurement.

4.14 Elevated Plus Maze Data Table(seconds):

ELEVATED PLUS MAZE

DAY 0

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	0.16	3.44
M2	0.27	3.33
M3	0.12	3.48
M4	0.42	3.16
M5	0.38	3.22

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	0.4	3.2
M2	0.2	3.4
M3	0.31	3.29
M4	0.56	3.04
M5	0.16	3.44

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	0.28	3.32
M2	1.12	2.48
M3	0.36	3.24
M4	0.56	3.04
M5	0.47	3.13

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	0.55	3.05
M2	1.12	2.48
M3	0.4	3.2
M4	0.27	3.32
M5	1.38	2.22

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	0.33	3.27
M2	1.26	2.34
M3	1.48	2.12
M4	0.42	3.18
M5	0.2	3.4

DAY 5

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	8	3.52
M2	20	3.4
M3	19	3.41
M4	1.14	2.46
M5	1.44	2.16

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	51	3.09
M2	22	3.32
M3	35	3.25
M4	41	3.19
M5	29	3.31

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	0	4
M2	47	3.13
M3	24	3.36
M4	1.48	2.12
M5	1.14	2.46

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	34	3.26
M2	53	3.07
M3	25	3.35
M4	1.24	2.36
M5	18	3.42

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.27	2.33
M2	59	3.01
M3	53	3.07
M4	1.37	3.23
M5	7	3.53

DAY 10

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	3.2	0.4
M2	3.15	0.45
M3	3.25	0.35
M4	3.1	0.5
M5	2.4	1.2

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	3.4	0.2
M2	3.34	0.24
M3	3.06	0.55
M4	3.29	0.31
M5	3.55	0.5

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	4	0
M2	3.07	0.5
M3	3.37	0.23
M4	2	0.22
M5	2.35	0.25

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	2.4	1.2
M2	3.48	0.12
M3	3.25	0.35
M4	1.42	2.18
M5	3.55	0.55

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.38	1.23
M2	3.56	0.41
M3	3.55	0.5
M4	2.29	1.31
M5	4	0

DAY 15

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	1.18	2.42
M2	3.47	0.13
M3	2.26	1.34
M4	2.42	1.18
M5	3	1

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	3.44	0.16
M2	3.11	0.49
M3	3.5	0.1
M4	3.38	0.22
M5	4	0

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	3.49	0.11
M2	3.12	0.48
M3	3.42	0.18
M4	2.1	1.5
M5	2.4	1.2

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	2.04	1.56
M2	3.47	0.13
M3	3.06	0.54
M4	1.15	2.44
M5	2.28	1.32

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.4	1.2
M2	3.1	0.5
M3	3.3	0.3
M4	1.3	2.3
M5	3	1

DAY 20

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	2.23	1.27
M2	3.12	0.48
M3	2.55	1.05
M4	3.11	0.49
M5	2.01	2

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	3.1	0.5
M2	2.2	1.4
M3	3.22	0.38
M4	3.4	0.2
M5	2.1	1.5

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	1.45	2.15
M2	2.33	1.27
M3	2.05	0.55
M4	3.03	0.57
M5	1.45	2.15

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	2:45	1.15
M2	2:33	1.27
M3	3:01	0.59
M4	3:23	0.37
M5	2:33	0.27

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.16	2.44
M2	3.17	0.43
M3	2.39	0.21
M4	1.56	2.04
M5	1.55	2.05

DAY 25

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	37	3.23
M3	X	X
M4	1.44	2.16
M5	2.43	1.17

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	0.13	3.47
M2	1.13	2.47
M3	1.23	2.37
M4	1.31	2.29
M5	1.16	2.44

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	1.15	2.45
M2	X	X
M3	1.01	2.59
M4	2	2
M5	1.59	2.01

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	1.48	2.12
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.28	2.23
M2	0.58	3.01
M3	2.37	1.13
M4	1.42	2.28
M5	1.23	2.37

DAY 30

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	1.45	2.15
M3	X	X
M4	1:59	2.01
M5	2:33	1.27

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2:34	
M2	2:19	
M3	1:52	
M4	1:36	
M5	2:22	

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2:01	1.59
M2	X	X
M3	1:46	1.14
M4	2:29	1.31
M5	3:22	0.38

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	1:34	2.26
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.43	2.17
M2	2.11	1.49
M3	3.05	0.55
M4	2.07	1.53
M5	2.34	1.26

DAY 35

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	x	x
M2	1.12	2.48
M3	x	x
M4	1.36	2.24
M5	2.57	1.03

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2.15	
M2	2.05	
M3	1.4	
M4	1.39	
M5	2.15	

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	1.59	2.01
M2	X	X
M3	1.38	2.42
M4	2.15	1.45
M5	3.14	0.46

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	1.4	2.2
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.23	2.37
M2	2.05	1.55
M3	2.55	1.05
M4	2.15	1.45
M5	3.45	0.15

DAY 40

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	x	X
M2	1.23	2.37
M3	x	X
M4	1.4	3.2
M5	3.02	0.58

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2.3	1.3
M2	2.15	1.45
M3	1.5	2.05
M4	1.45	2.15
M5	2.2	1.4

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.15	1.45
M2	X	X
M3	1.45	2.15
M4	2.23	1.37
M5	3.2	0.4

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	2.05	1.55
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.29	2.3
M2	2.13	1.47
M3	2.59	1.01
M4	2.22	1.38
M5	2.55	1.05

DAY 45

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	x	X
M2	1.3	2.3
M3	x	X
M4	1.55	2.05
M5	3.2	0.4

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2.4	1.2
M2	2.3	1.3
M3	2	2
M4	2.05	1.55
M5	2.3	1.3

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.25	1.35
M2	X	X
M3	1.59	2.01
M4	2.3	1.3
M5	3.3	0.3

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	2.25	1.45
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	1.33	2.27
M2	2.33	1.27
M3	3.02	0.58
M4	2.3	1.3
M5	3.5	0.1

DAY 50

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	1.2	2.4
M3	X	X
M4	2	2
M5	2.5	1.1

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2.2	1.4
M2	2.1	1.5
M3	1.45	2.15
M4	1.55	2.05
M5	2.1	1.5

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.1	1.5
M2	X	X
M3	1.55	2.05
M4	2.15	1.45
M5	3.1	0.5

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	2.15	1.45
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.1	1.5
M2	2.12	1.48
M3	2.43	1.17
M4	2.11	1.49
M5	3.26	0.34

DAY 55

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	1.3	2.3
M3	X	X
M4	1.5	2.1
M5	2.3	1.3

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2.3	1.2
M2	2.25	1.35
M3	1.55	2.05
M4	2.12	1.48
M5	2.22	1.38

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.3	1.3
M2	X	X
M3	2.15	1.45
M4	1.55	2.05
M5	3	1

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	2.25	1.35
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.25	1.35
M2	2.27	1.33
M3	2.2	1.4
M4	2.05	1.55
M5	2.5	1.1

DAY 60

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	1.42	2.12
M3	X	X
M4	2.15	1.45
M5	2.47	1.13

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	2.43	
M2	2.37	
M3	3.15	
M4	2.56	
M5	2.34	

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.49	1.11
M2	X	X
M3	2.23	1.37
M4	2.15	1.45
M5	3.12	0.48

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	2.51	1.09
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.31	1.29
M2	2.4	1.2
M3	2.1	1.5
M4	2.29	1.31
M5	2.31	1.29

DAY 65

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	1.4	2.2
M3	X	X
M4	1.45	2.15
M5	1.55	2.05

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	3.15	0.45
M2	3.1	0.4
M3	2.15	1.45
M4	2.45	1.15
M5	2.35	1.25

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.45	1.15
M2	X	X
M3	2.42	1.18
M4	2.13	1.47
M5	2.53	1.08

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.45	1.15
M2	X	X
M3	2.42	1.18
M4	2.13	1.47
M5	2.53	1.08

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.15	1.45
M2	1.55	2.05
M3	2.15	1.45
M4	2.23	1.37
M5	2.43	1.17

DAY 70

GROUP 1		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	1.5	2.1
M3	X	X
M4	2.05	1.55
M5	2.59	1.01

GROUP 2		
MICE NO.	OPEN	CLOSE
M1	3.1	1.05
M2	3.15	0.45
M3	2.34	1.26
M4	2.59	1.01
M5	3.12	0.48

GROUP 3		
MICE NO.	OPEN	CLOSE
M1	2.57	1.03
M2	X	X
M3	3.14	0.46
M4	2.39	1.21
M5	3.44	0.16

GROUP 4		
MICE NO.	OPEN	CLOSE
M1	X	X
M2	X	X
M3	X	X
M4	3.13	0.47
M5	X	X

GROUP 5		
MICE NO.	OPEN	CLOSE
M1	2.35	1.25
M2	2.4	1.2
M3	2.12	1.48
M4	2.31	1.29
M5	2.46	1.14

Chapter 5:

RESULTS

Throughout the study, I observed notable behavioral differences in the mice based on lighting conditions, specifically white, red, blue, and green lights. These lighting environments appeared to influence aggression levels, social interactions, and general activity in distinct ways.

5.1 Warm white light:

The mice exposed to ww light demonstrated high levels of aggression. Instances of cannibalistic behavior were recorded, as some mice began attacking and consuming each other. This aggressive behavior under white light suggests a potential stress response, possibly triggered by the intensity or spectrum of light.

5.2 Red Light:

The mice in the red-light environment appeared well-adjusted, displaying regular feeding patterns and relatively stable social interactions. This group exhibited the least stress-related behavior, indicating that red lighting may promote a calmer or more stable environment conducive to normal feeding and social behavior.

5.3 Blue Light:

In the blue light setting, the mice showed signs of increased disturbance and restlessness. Their behavior suggested discomfort, as they were often highly active but unsettled. This response may reflect a heightened sensitivity to blue light, potentially linked to stress or discomfort.

5.4 Green Light:

Mice exposed to green light displayed signs of both disturbance and lethargy, with a generally reduced activity level. They appeared less inclined to explore or interact, and their movements were slower and more hesitant.

This lethargy could indicate an aversive response or a tendency toward inactivity under green lighting conditions.

These findings reveal that different lighting conditions significantly affect mouse behavior. White light may exacerbate aggression, red light may foster stability, while blue and green lights induce varying levels of disturbance and lethargy. These observations are critical for understanding environmental impacts on animal behavior and can inform the best practices for lighting conditions in animal care and experimental settings.

This study provides insights into the effects of various lighting conditions on behavioral responses in mice, emphasizing distinct patterns in aggression, activity, and social interactions under warm white, red, blue, and green lights. The findings contribute to a growing body of research suggesting that environmental factors, particularly lighting, significantly influence animal behavior, stress responses, and social dynamics in laboratory settings.

Chapter:6

Conclusion of the Study

The study was conducted in the Department of Pharmaceutical Technology at Jadavpur University and provides significant insights into the effects of various lighting conditions on the behavior of laboratory mice. The experimental setup was provided by the Illumination Engineering section of the Electrical Engineering Department of Jadavpur University Here are the key conclusions drawn from the research:

6.1 Impact of Lighting on Behavior:

The findings indicate that different light spectra, specifically warm white, red, blue, and green LED lights, have distinct effects on the behavioral responses of mice. Mice exposed to warm white light showed increased aggression, which led to instances of cannibalism. This suggests that lighting can heighten stress responses in rodents, affecting their social interactions and overall behavior.

6.2 Experimental Consistency:

The study emphasizes the importance of standardized lighting conditions in laboratory settings. By maintaining consistent light environments, researchers can achieve more reliable comparisons and trend analyses of activity levels among different groups of mice. This consistency is crucial for ensuring the validity of experimental results.

6.3 Animal Welfare Considerations:

The research highlights the need to tailor lighting conditions to enhance animal welfare. By understanding how different wavelengths of light influence activity patterns and social dynamics, researchers can create environments that promote better health and well-being for laboratory animals.

6.4 Broader Implications:

The implications of this study extend beyond laboratory settings. The insights gained regarding the influence of light on mammalian biology could inform practices in various fields, including human health, where optimized light environments may improve mood and productivity.

In summary, this study underscores the critical role of environmental factors, particularly lighting, in shaping animal behavior and welfare in laboratory settings. The findings advocate for a more nuanced approach to experimental design that considers the impact of light on both animal physiology and behavior.

6.5 Future Research Scope:

The study on the effects of different LED light spectra on the activity patterns, behavioral responses, and physiological health of mice opens several avenues for future research. Here are some potential directions:

6.5.1 Longitudinal Studies:

Future research could involve long-term studies to assess the chronic effects of various lighting conditions on mice. This would help in understanding how prolonged exposure to specific light spectra influences not only behavior but also physiological health over time.

6.5.2 Broader Species Examination:

Expanding the research to include other laboratory animals, such as rats or rabbits, could provide insights into whether the observed effects are species-specific or if they can be generalized across different mammals. This would enhance the understanding of animal welfare in various research contexts.

6.5.3 Physiological Studies:

Investigating the underlying biological mechanisms that mediate the effects of light on behavior and physiology would be valuable. This could include studying hormonal changes, such as melatonin suppression, and their impact on stress and anxiety levels in response to different light conditions.

6.5.4 Environmental Enrichment:

Future studies could explore how combining optimal lighting with other environmental enrichment strategies (like social interaction or physical activity) affects the overall well-being and behavior of laboratory animals. This could lead to improved welfare standards in research settings.

6.5.5 Human Health Implications:

From this study, research could also be investigated to find human health practices, particularly in areas like mood regulation, sleep disorders and productivity in work environments in different LED lighting environments.

6.5.6 Technological Innovations:

Developing advanced LED lighting systems that can be dynamically adjusted based on the specific needs of the animals could be a significant area of research. This would involve creating smart lighting solutions that respond to real-time behavioral data from the animals.

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