

**Effect of Different Room Temperatures on Breeding Performance of icr Strain Mice**

*Sandar Lin<sup>1\*</sup>, Aye Win Oo<sup>2</sup>, Htay Yee<sup>1</sup>, Kyaw Kyaw Wai<sup>1</sup>,  
Nyunt Nyunt<sup>1</sup>, Than Tint<sup>1</sup>, Aye Aye Shwe<sup>1</sup>, Thida<sup>2</sup> & Win Aung<sup>2</sup>*

<sup>1</sup>Laboratory Animal Services Division  
Department of Medical Research (POLB)  
<sup>2</sup>Department of Medical Research (HQ)

Temperature is one of the environmental factors and the laboratory mice may have physiological changes because of the environmental temperature. Food and temperature availability have a strong interaction that influences the reproductive performance of female mice throughout the reproductive cycle. This study aimed to analyze the effect of different room temperatures in the housing room on breeding performance of icr mice. In this study, healthy 15 males and 45 females with 1:3 mating ratio of icr strain mice, weighing 25-30 gm, were used for breeding performance under different room temperatures; 18-22°C, 23-25°C and 26-32°C conditions. The monitoring and evaluation were done during 21 days, from birth to weaning for each group. Fertility rate, delivery rate, litter size, birth weight, weaning rate, weaning weight and mortality rate were monitored at the first, the second and the third consecutive gestations. It was found that fertility rate 100%, delivery rate 100%, litter size 9, weaning rate 99.75% and mortality rate 0.24% in group one condition; fertility rate 100%, delivery rate 100%, litter size 7.67%, weaning rate 98.67% and mortality rate 1.32% in group two condition; fertility rate 71.11%, delivery rate 71.11%, litter size 5.33, weaning rate 80.63% and mortality rate 19.37% in group three condition; were found in the first, the second and the third gestations in this study. Birth weight 1.5±0.1 gm and weaning weight 9.5±0.1 gm were found in every room condition. The findings showed that high temperature has effect to lower growth rate and impaired fertility. It was found that the high temperature (26-32°C) is not suitable for breeding performance and well-being of the animals.

*Key words:* Temperature, Reproductive performance, Mice

**INTRODUCTION**

Temperature is one of the environmental factors for reproductive performance in mouse. The laboratory mice may have physiological changes by the temperature variation. The environment of breeding room is an important factor for the productivity. Animals are very sensitive to environmental changes such as sharp fluctuations in temperature, humidity, light, sound and ventilation. A constant room temperature is essential because variation in room temperature causes change in food and water intake.

The temperature also affects fertility and lactation.<sup>1</sup> In animals, alteration in the environmental temperature can produce subtle changes in respiration, cardiac rate and behavior in order to maintain a constant body temperature. Body temperature is regulated by a balance between heat production and heat loss. Behavioral adaptation include alterations of body position to change the ratio of surface area to mass, hair raising, huddling together of animal in cold and grooming in heat.<sup>2</sup>

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\*To whom correspondence should be addressed.  
Tel: +95-976682751  
E-mail: sandadmr@gmail.com

Extreme temperatures usually lead to lower growth rate and impaired fertility. At 32°C, productivity declines as a result of intra-uterine fetal death.<sup>3</sup> Food and temperature availability have a strong interaction that influences the reproductive performance of female mice throughout the reproductive cycles.<sup>4</sup> The aim of this study was to find out effect of different room temperature conditions on breeding performance of icr strain mouse (*Mus musculus*) by determining the delivery rate, fertility rate (pregnancy rate), number of suckling (litter size), birth weight, weaning weight, weaning rate and mortality rate and to compare those parameters of icr mice under different room temperatures.<sup>5,6</sup>

## MATERIALS AND METHODS

This study was a laboratory-based, experimental study. Mice male (n=15) and female (n=45) (*Mus musculus*) of icr strain were obtained from Laboratory Animal Services Division, Department of Medical Research (Pyin Oo Lwin Branch). Cleaned polypropylene cages (24 cm x 18 cm x 13 cm), covers, water bottles were provided throughout the study. Body weight of animals was measured by balance Scout Pro SPS402F (USA). Breeding room temperatures were measured by standard thermometer (UK).

Three different room temperatures were adjusted and stabilized at 18°C to 22°C, 23°C to 25°C and 26°C to 32°C before starting the experiment and experiment were kept in well-ventilated rooms with exhaust fan. Standardization of thermometer was carried out. Thermometers were placed in each experimental room. Conventional pellet diet and water were provided *ad libitum* for experimental animals. The bedding materials were changed twice a week. These conditions as above were maintained throughout the whole experiment. For acclimatization of mice, 15 male mice were kept in one cage and 45 female mice were kept in another cages for one week before experiment.

In next week, the animals were divided into three groups for three different room temperatures (18°C to 22°C, 23°C to 25°C and 26°C to 32°C) with the mating ratio of 1:3 (5 males and 15 females) for each room temperature. A total of five cages were prepared for three different rooms, in each cage, one male and three females were kept together for mating purpose. When pregnancy occurred, the female was transferred into a separated cage until weaning. After that, the female mice were mated again with their male mice partners. The experiment was continued with the same procedure until 3<sup>rd</sup> litter.

The 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> litters mean that total number of offspring per a female in the first, second and third deliveries. Weaning weight means body weight at weaning period. Fertility and delivery rate were measured and recorded as the data of reproductive performance of icr strain mouse. The reproductive performance of icr mouse was calculated under different room temperatures as follow:

$$\text{Litter size} = \frac{\text{Total no. of offspring per female mouse (at birth)}}{\text{Total no. of mated females}}$$

$$\text{Fertility rate} = \frac{\text{Total no. of pregnant female}}{\text{Total no. of mated females}} \times 100$$

$$\text{Delivery rate} = \frac{\text{Total no. of delivery}}{\text{Total no. of pregnant}} \times 100$$

$$\text{Weaning rate} = \frac{\text{Total no. of weaned}}{\text{Total no. of offspring}} \times 100$$

$$\text{Mortality rate} = \frac{\text{Total no. of deaths}}{\text{Total no. of offsprings}} \times 100$$

Birth weight and weaning weight were measured individually.

### Data analysis

The findings were described by mean and standard deviation. Analysis of variance (ANOVA) was used to determine the significant difference among three tested groups. The statistical comparison of the data was performed by analysis of variance followed by Bonferroni test. 'p' value less than 0.05 (p<0.05) was considered significant.

## RESULTS AND DISCUSSIONS

According to the study, the significant differences in fertility, delivery rate, litter size, birth weight, weaning weight, weaning rate and mortality rate were found among three tested groups.

Table 1. Comparison of fertility and delivery rate among three tested groups

Group	Room temperature (°C)	1 <sup>st</sup> litter (%)	2 <sup>nd</sup> litter (%)	3 <sup>rd</sup> litter (%)	Mean±SD (%)
I	18-22	100	100	100	100±0.00
II	23-25°	100	100	100	100±0.00
III	26-32°	93.33	66.67	53.33	71.11±20.37

Table 1 shows comparison of fertility and delivery rate. Fertility and delivery rate were 100±0.00% in group one and group two. Fertility and delivery rate were observed 71.11±20.37% in group three. The significant difference in fertility and delivery rate was not found between group one and group two. The significant difference in fertility and delivery rate was found between group one and group three and between group two and group three (p<0.05).

Table 2. Comparison of litter size and birth weight among three tested groups

Group	Room temperature (°C)	Litter size	Birth weight
		Mean±SD (gm)	Mean±SD (gm)
I	18-22	9.0 ±1.00	1.6±0.00
II	23-25	7.6±1.53	1.5 ±0.087
III	26-32	5.33±1.53	1.43±0.058

Table 2 shows comparison of litter size and birth weight. Litter size was recorded at birth of icr strain mouse. Litter size was 9.0±1 gm in group one, 7.6±1.53 gm in group two and 5.33±1.53 gm in group three. Litter size of group one was greater than those of the other two groups. The significant difference in litter size was found between group one and group three (p<0.05). Birth weight was measured for individual group in same manner. Birth weight was 1.6±0 gm in group one,

1.5±0.087 gm in group two and 1.43±0.058 gm in group three. Birth weight of group one was greater than those of the other two groups. The significant difference in birth weight was found between group one and group three (p<0.05).

Table 3. Comparison of weaning weight and weaning rate among three tested groups

Group	Room temperature (°C)	Weaning weight	Weaning rate
		Mean±SD (gm)	Mean±SD (%)
I	18-22	10±0.44	99.7±0.43
II	23-25	9.6±0.26	98.67±1.25
III	26-32	8.9±0.10	80.63±.61

Table 3 shows comparison of weaning weight and weaning rate. Weaning weight was measured for individual group in same manner. Weaning weights were 10±0.44 gm in group one, 9.6±0.26 gm in group two and 8.9±0.10 gm in group three. Weaning weight of group one was greater than those of the other two groups. The significant difference in weaning weight was found between group one and group three (p<0.05). Weaning rates were measured for having reproductive performance of icr strain mouse. Weaning rate of group one and two were 99.75% and 98.67%, respectively. In group three, weaning rate was observed as 80.63%. According to this study, group three had less weaning rate than group one and group two among three tested groups. The significant difference in weaning rate was found between group one and group three and between group two and group three (p<0.05).

Table 4. Comparison of mortality rate in three tested groups

Group	Room temperature (°C)	1 <sup>st</sup> litter	2 <sup>nd</sup> litter	3 <sup>rd</sup> litter	Mean±SD (%)
		(%)	(%)	(%)	(%)
I	18-22	0.00	0.00	0.74	0.24±0.43
II	23-25°	0.00	1.48	2.50	1.32±1.26
III	26-32°	14.29	15.71	28.12	19.37±7.61

Table 4 shows comparison of mortality rate. Mortality rate was also measured for different room temperatures in breeding of

icr strain mouse in this study. The mean mortality rates of all three litters was  $0.24 \pm 0.43\%$  in group one,  $1.32 \pm 1.26\%$  in group two and  $19.37 \pm 7.61\%$  in group three, respectively. Group three had the highest mortality rate among three tested groups.

The significant difference in mortality rate was found between group one and group three, between group two and group three ( $p < 0.5$ ). The mortality rate in 3<sup>rd</sup> litter was greater than those in 1<sup>st</sup> and 2<sup>nd</sup> litters.

#### *Conclusion*

The results showed that changes of the environmental temperature influence the evaluated parameters above significantly. Group three condition is not suitable for breeding of icr strains mice and the high temperature ( $26-32^{\circ}\text{C}$ ) should be avoided. As room temperature is one of the important factors for breeding performance of mice room temperature should be maintained at the condition of ( $18-22^{\circ}\text{C}$ ).

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