Bhartiya Krishi Anusandhan Patrika, 36(4): 344-346 DOI: 10.18805/BKAP371

# A Study on Morphological Growth and Development of Swiss Albino Mice, Wistar Rat and Dunkin Hartley Guinea Pigs

**K. Abhijeet[1], Y.B. Rajeshwari[2], Vivek M. Patil[2], R.Y. Ranjith[3], S.M. Ali[3], G.S. Shaswath[3], S.K. Bhandekar[4], Akash Katiyar[5], K.D. Masood[3], Prabha Karan[6]**

Central Poultry Development Organization and Training Institute,
Hessarghatta, Bangalore-560 088, Karnataka, India.

Received: September 2021 Accepted: December 2021

## ABSTRACT

**Background:** Baseline information on the morphological development of laboratory animals is very scanty. Hence the present study was undertaken to understand the morphological development of experimental animals.

**Methods:** An experiment was conducted at Biogen animal facility, Bangalore in the year 2018 to study the morphological changes with regard to growth and developmental parameters in Swiss albino mice and Wistar rats and body weight in guinea pigs. Ten Swiss albino mice and Wistar rats in advanced pregnancy of similar age groups and comparable litter sizes in the previous kindlings were selected for the experiment, where as five guinea pigs males and females each were selected with same age group. During the study period, litter weight and size at birth and at weaning, time of initiation and completion (full growth of hair) of hair growth, time of opening of eyes and ears recorded in Swiss albino mice and Wistar rats whereas body weight at birth, 3rd day, 6th day, 9th day, 12th day and 15th were recorded in Dunkin Hartley guinea pigs.

**Result:** The results of Swiss albino mice indicated that the average litter weight (grams) and litter size at birth ranged from 1.39 and 7.50 respectively. The average time taken from initiation and full growth of hair covering on body was 7.50 to 15.30 days. Eyes and ears opened at 7.90 and 8.20 days respectively. Average weight of male and female recorded at weaning (25 days) 19.38 and 15.12 respectively and the litter size at the weaning was 9.70 whereas, livability percent was recorded 87.81 at the end of the trial. The results of Wistar rats indicated that the average litter weight (grams) and litter size at birth ranged from 5.07 and 11 respectively. The average time taken from initiation to full growth of hair covering on body was 9 to 16.20 days. Eyes and ears opened at 12.20 days, average weight (grams) of male and female recorded at weaning (25 days) 78.03 and 63.09 respectively. The litter size at the weaning was 9.70. The livability percent was recorded 88.02 at the end of the trial. The results of Dunkin Hartley guinea pigs indicated that the average body weight (grams) of female at birth, 3rd day, 6th day, 9th day, 12th day, 15th (Weaning period) ranged from 94.88, 109.34, 123.94, 139.74, 152.14 and 166.66, respectively. On the other hand, average body weight (grams) of male at birth, 3rd day, 6th day, 9th day, 12th day, 15th (Weaning period) ranged from 145.38, 155.42, 170.50, 185.54, 200.64 and 215.7, respectively.

**Key words:** Dunkin hartley guinea pig, Growth pattern, Litter size, Swiss albino mice, Wistar rat.

## INTRODUCTION

Laboratory mice, rats and guinea pigs are the animals which are very extensively used in many of research area especially in the field of transplantation and cancer studies. Baseline information on the morphological development of Swiss albino mice, Wistar rats and Dunken Hartley guinea pigs maintained in India are very scanty. Hau and Van Hoosier (2005) reported that Swiss albino mice are an out bred strain with good breeding ability and strong maternal instinct. Swiss albino mice mainly used in the research area like oncology, pharmacology, immunology and ageing. Wistar rat strain was selected by Donaldson in 1906 at the Wistar Institute (USA), from a batch belonging to Chicago University (Lindsay, 1979; Russel *et al.,* 1981). The Wistar rat is an out bred stock, used in all fields of medical and biological research. Its longevity and high rate of spontaneous tumors make it an ideal choice for ageing studies. It is an albino strain, easy-to-handle, it is however slower learner than Long Evans rat. Swiss Albino mice are usually used in toxicology studies. It is not often used in R&D studies. Swiss mice being an out bred animal is suitable for toxicology as it has genetic variability between animals

*Corresponding author's E-mail: dr.abhikumar0501@gmail.com
[1]Central Poultry Development Organization and Training Institute, Bangalore-560 088, Karnataka, India.
[2]Department of Livestock Production Management, Veterinary College Hebbal, Bangalore-560 024, Karnataka, India.
[3]Veterinary College, Hebbal, Bangalore-560 024, Karnataka, India.
[4]Central Cattle Breeding Farm, Hessarghatta, Bangalore-560 088, Karnataka, India.
[5]Central Poultry Development Organization, Nayapalli, Bhubaneswar-751 012, Odisha, India.
[6]First Class Veterinary Hospital, Girihinda Chowk-811 105, Govt of Bihar, India.

whereas inbred mice such as BALB/c, C57BL/6, *etc,* they are very similar and there is not so much variations between animals. Almost 80% of the experimental animals are rodents, among the rodents; rats are the mostly used animals for experimental purposes (accounting for approximately 20% of the total number of mammals used for scientific studies) but no information is available on Wistar rat reared in our condition especially on the development pattern. Hence the present study was undertaken to study the morphological changes with regard to growth and developmental parameters in Swiss albino mice, Wistar rats and Dunkin Hartley guinea pigs.

## MATERIALS AND METHODS

Ten each Swiss albino mice and Wistar rats in advanced pregnancy of similar age groups and comparable litter sizes in the previous kindlings were selected for the experiment, where as five guinea pigs males and females each were selected with same age group. The mice and rats were kept in individual polypropylene cages whereas, guinea pigs kept in deep litter floor with 300 $cm^2$ area per animal. The animals were provided with clean, safe *ad libitum* reverse-osmosis–purified drinking water and balanced breeder specified pellet feed for laboratory animals (NRC, 1996). The room was maintained on a 14:10 light: dark cycle at 23 ± 3°C. During the study period, litter weight and size at birth and at weaning, time of initiation and completion (full growth of hair) of hair growth, time of opening of eyes and ears recorded in Swiss albino mice and Wistar rats whereas body weight at birth, 3rd day, 6th day, 9th day, 12th day and 15th were recorded in Dunkin Hartley guinea pigs.

## RESULTS AND DISCUSSION

Morphological growth and development of Swiss albino mice and Wistar rat are given in Table 1, whereas, growth of Dunkin Hartley guinea pigs related to the body weight are given in Table 2. The results of Swiss albino mice indicated that the average litter weight (grams) and litter size at birth ranged from 1.39±0.02 and 7.50±0.28 respectively. The average time taken from initiation and full growth of hair covering on body was 7.50±0.28 to 15.30±0.35 days. Eyes and ears opened at 7.90±0.53 and 8.20±0.37 days respectively. Average weight of male and female recorded at weaning (25 days) 19.38±0.45 and 15.12±0.48 respectively and the litter size at the weaning was 9.70±0.38 whereas, livability percent was recorded 87.81±1.34 at the end of the trial. The results of mice are in agreement with Zivkovic *et al*., (2006) who reported that the average litter size of Swiss albino mice ranges 6-8, weight of litter at birth ranges 0.9-1.5 grams, average weight of male and female recorded at weaning (25 days) was 19 and 14 grams respectively. Lynch, (1969) reported that eyes and ear opens at 7th day and hair coat fully grown on second weeks of Swiss albino mice. He also reported 90% livability at the time of weaning. The results of Wistar rats indicated that the average litter weight (grams) and litter size at birth ranged from 5.07±0.17 and 11±0.27 respectively. The average time taken from initiation to full growth of hair covering on body was 9±0.22 to 16.20±0.43 days. Eyes and ears opened at 12.20±0.21 days, Average weight (grams) of male and female recorded at weaning (25 days) 78.03±0.44 and 63.09±0.58 respectively and the litter size at the weaning was 9.70±0.38. The finding of the study are in agreement with (Bacon and McClintock 1994; Parshad 1997) where they find average litter size is approximately 10. On contrary to these findings, (Anonymous, 2015) reported that the rats maintained in JANVIR labs having average litter size 12 where as Ward, (2008) and Koolhass, (2010) reported that the average litter size of Wistar rat is 11. The litter size variability in these animals are due to their out bred nature and different rearing environment (Clause, 1993; Festing, 1993; Chia *et al.,* 2005). The disadvantage of outbred strains is that each breeding colony may be different due to genetic drift. Hence, a Wistar rat from one breeder may be genotypically and phenotypically different from those obtained from a different source (Rex *et al.,* 2007). Ward, (2008) reported that eyes and ear opens at 14th day and hair coat fully grown in two weeks of Wistar rats. The average weight of male and female at the time of weaning in the present study are in agreement with Pelis and Pelis, (1998). Schapiro and Everitt, (2006) reported that average litter weight at birth of Wistar rat is 5.5 grams. Anonymous, (2006) also published 5-6 grams of weight of litter at birth. Koolhass,

**Table 1:** Morphological and developmental parameters of Swiss albino mice and Wistar rat (n=10).

| Parameters | Swiss albino mice | Wistar rat |
|---|---|---|
| Litter size (Average weight grams) | 1.39±0.02 | 5.07±0.17 |
| Litter size | 7.50±0.024 | 11.00±0.27 |
| Hair started growing age (days) | 7.50±0.28 | 9.00±0.22 |
| Opening of eyes age (days) | 7.90±0.53 | 13.7±0.47 |
| Opening of ears age (days) | 8.20±0.37 | 12.20±0.21 |
| Hair full grown age (days) | 15.30±0.31 | 16.2±0.43 |
| **Weight at weaning (in grams)** | | |
| Male | 19.38±0.45 | 78.03±0.44 |
| Female | 15.12±0.48 | 63.09±0.58 |
| Litter size at weaning | 9.70±0.38 | 9.70±0.38 |
| Livability (%) | 87.81±1.34 | 88.02±2.23 |

**Table 2:** Mean body weight of Dunkin Hartley male female guinea pigs at birth, 3rd day, 6th day, 9th day, 12th day and 15th day (Weaning period) interval of the experiment (n=5).

| Parameters | Dunken hartley guinea pig body weight (grams) | |
|---|---|---|
| | Male | Female |
| At birth | 145.38±1.11 | 94.87±1.26 |
| 3rd day | 155.42±0.99 | 109.34±1.81 |
| 6th day | 170.5±1.09 | 123.94±1.49 |
| 9th day | 185.54±1.15 | 139.74±1.38 |
| 12th day | 200.64±1.01 | 152.14±1.65 |
| 15th day | 215.7±1.10 | 166.66±1.69 |

(2010) also reported the same birth weight 5.7 grams. The livability percent was recorded 88.02±2.23 at the end of the trial. The livability (%) recorded for Wistar rat maintained at Janvir labs is around 94. Krinke *et al.*, (2000) concluded that the livability (%) will be varied based on the rearing environment and reported 85-94. The results of Dunkin Hartley guinea pigs indicated that the average body weight (grams) of female at birth, 3rd day, 6th day, 9th day, 12th day, 15th (Weaning period) ranged from 94.88±1.26, 109.34±1.81, 123.94±1.49, 139.74±1.38, 152.14±1.65 and 166.66±1.69 respectively. On the other hand, average body weight (grams) of male at birth, 3rd day, 6th day, 9th day, 12th day, 15th (Weaning period) ranged from 145.38±1.11, 155.42±0.99, 170.5±1.09, 185.54±1.15, 200.64±1.01 and 215.7±1.10 respectively. The manual for Laboratory Animal John Hopkins University published the male and female weight (grams) at birth is 145-150 and 95-101 respectively. Anonymous, (2015 published similar findings about the growth of guinea pigs (Dunkin Hartley) maintained at Charles river laboratories and Janvir labs.

## CONCLUSION

The findings of the present study based on the morphological, growth and development parameters of Swiss Albino mice, Wistar rat and Dunken Hartley guinea pigs are similar to the studies conducted by other research workers.

## ACKNOWLEDGEMENT

Authors are thankful to the Mr. Francis, Managing Director of BIOGEN Laboratory Animal House, Attibele, Bangalore and Dr. Y.B Rajeshwari, Retd. Professor and Head, Department of LPM, Veterinary College, Bangalore for providing facilities to conduct the research trail.

## REFERENCES

Anonymous, (2006). Manual of aboratory animals - John Hopkins University. Accessed at https://web.jhu.edu/animalcare/procedures/rat.html#general.

Anonymous (2015). Dunkin Hartley Detailed specifications - Janvier-Labs. Accessed at https://www.janvier-labs.com/en/fiche_produit/dunkin hartley/pdf/.

Anonymous, (2015). WISTAR Rat Detailed specifications - Janvier-Labs. Accessed at https://www.janvier-labs.com/en/fiche_produit/swiss_mouse/pdf/.

Bacon, S.J. and McClintock, M.K. (1994). Multiple factors determine the sex ratio of postpartum - conceived Norway rat litters. Physiol. Behav. 56(1): 359-366.

Baker, J.R., Lindsey, S.H., Weisbroth, (1979). (eds.). Academic Press, New York NY: 2-36.

Chia, R., Achilli, F., Festing, M.F. and Fisher, E.M. (2005). The origins and uses of mouse outbred stocks. Nat. Genet. 37(11): 1181-1186.

Clause, B.T. (1993). The Wistar rat as a right choice: Establishing mammalian standards and the ideal of a standardized mammal. J. History. Biol. 26(2): 329-349.

Festing, M.F.W. (1993). International Index of Laboratory Animals, 6th edn. Festing, Leicester.

Hau, J. and Van Hoosier, G.L. (2005). Handbook of Laboratory Animal Science: Animal Models, Volume III. Handbook of Laboratory Animal Science: Animal Models, Volume III., (Ed. 2).

Koolhaas, J.M. (2010). The Laboratory Rat. The UFAW Handbook on the Care and Management of Laboratory and other Research Animals. 8(1): 311-26.

Krinke, G., Bunton, T. and Bullock, G. (Eds) (2000). The Laboratory Rat. Academic Press, New York.

Lindsay, J.R. (1979). Historical Foundations. In: The Laboratory Rat, Vol. I, Biol. and Dis. (H.J. Lynch CJ: The so-called Swiss mouse. Lab Anim Care 1969, 19(1): 214-220.

National Research Council (1996). Guide for the Care and use of Laboratory Animals. National Academies Press, Washington, DC.

Parshad, R.K. (1997). Effect of restricted feeding of prepubertal and adult male rats on fertility and sex ratio. Indian J. Exp. Biol. 31(1): 991-992.

Pellis, S.M. and Pellis, V.C. (1998). Play fighting of rats in comparative perspective: A schema for neurobehavioral analyses. Neuroscience and Biobehavioral Reviews. 23(1): 87-101.

Rex, A., Kolbasenko, A., Bert, B. (2007). Choosing the right wild type: Behavioral and neurochemical differences between 2 populations of rats from the same source but maintained at different sites. J. Am. Assoc. Lab. Anim. Sci. 46(2): 13-20.

Russell, R.J., Johnson, D.K. and Stunkard, J.A. (1981). A Guide to Diagnosis. Treatment and Husbandry of Pet Rabbits and Rodents. Veterinary Medicine Publishing Co., Edwardsville KY.

Schapiro, S.J. and Everitt, J.I. (2006). Preparation of animals for use in the laboratory: Issues and challenges for the Institutional Animal Care and Use Committee (IACUC). ILAR Journal. 47(4): 370-375.

Ward, J.D. (2008). A Manual for Laboratory Animal Management World Scientific Publishing Company. (Vol. 5).

Živkoviće, I., Rajnpreht, I., Minić, R., Mitić, K., Aleksić, I., Kadrić, J. and Petrušić, V. (2016). Characterization of Intor: Swiss albino mice adopted in the Institute of virology, vaccines and sera: Torlak, Belgrade in the early twentieth century. Acta Veterinaria-Beograd. 66(3): 279-293.