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Assessing the effect of sex on the performance related traits in inbred Swiss albino mice

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Abstract
The similarity among humans and other mammals makes mice as one of the most preferred experimental animals in laboratory research. Inbred strains of mice are genetically similar may reduce experimental variability and increase study reproducibility. In this study, performance related traits of 628 Swiss albino mice in F_6 and 557 Swiss albino mice in F_7 generation were estimated. In F_6 population, body weight at birth (BWB), body weight at weaning (BWW) and adult body weight (ABW) were 1.50±0.00 g, 16.38±0.12 g and 29.98±0.17 g, respectively. However, BWB, BWW and ABW were 1.51±0.00g, 18.71±0.18 g and 29.15±0.21 g, respectively in F_7 inbred mice population. There was significant increase (P<0.05) in mean body weight at weaning (BWW) and adult body weight (ABW) in males of F_6 and F_7 generation. These findings showed that less magnitude of inbreeding depression effect was seen in BWW and ABW of male sex as compare to that of female sex. In summary, increasing level of inbreeding resulted in the depression of performance of female inbred mice than male inbred mice.

Keywords: Inbreeding, Swiss albino mice, performance traits, F_6 and F_7 generation

1. Introduction
The laboratory mice are often used as an outstanding research model in various areas of biological research due to its small size, short generation interval, easy laboratory reproduction and low maintenance costs (Danneman *et al.*, 2012) [3]. The main advantage of using mice in scientific studies is the potential to control genetic and non-genetic variations more effectively (Arends *et al.*, 2018) [1]. Inbreeding has profound effects on the genetic composition of a population and in appropriate circumstances can lead to the formation of inbred strains in which all individuals are virtually genetically identical. An inbred strain provides more strength and requires fewer animals per experiment, thus limiting the noise caused by the separation of genetic variations (Danneman *et al.*, 2012) [3]. A strain is considered to be inbred if it is developed using brother × sister or parent × offspring mating of at least 20 consecutive generations (F_{20}) and can be identified in a single ancestral reproductive pair in generation 20 or later. On an average, at 20th generations, at least 98.6% of each loci of mouse are homozygous (Beck *et al.*, 2000) [2].
Selective breeding of like with like will increase or decrease or stabilize the mean, depending upon the direction of selection, and will also ultimately decrease the genetic variance, but not necessarily eliminate it. If the chosen mates are deliberately as unlike as possible, the genetic variance are going to be kept large. Combinations of inbreeding and selection systems give geneticists a good sort of methods for controlling the inherited characteristics of research animals. Researchers realized that genetic factors created variation among animals making it difficult to check hypotheses. Early geneticists overcame this challenge by fixing or stabilizing the genetic makeup of mice through inbreeding, creating virtually genetically identical mouse populations, called inbred strains.
Inbreeding of animals will sometimes cause unwanted genetic drift. The continual overlaying of like genetics exposes gene patterns that always cause changes in reproduction performance, fitness, and skill to survive which is liable for inbreeding depression. The response to inbreeding depression varies between traits wherein traits that involve fitness like litter size or lactation in mammals are those critically affected. Hence, within the current study our main focus and outcome are going to be the phenotypic characterization of F_6 and F_7 inbred mice. The F_5 inbred Swiss albino mice will be used as base inbred population and the inbreeding effect on different performance traits in F_6 and F_7 inbred Swiss albino mice will be analyzed. Despite widespread utilization in research in the region, only very limited genetic studies has been performed on Swiss albino mice.

Therefore, considering the importance of inbred strain of mice, the present study was undertaken with the objective of evaluating the phenotypic performance and the impact of sex of on performance traits in F_6 and F_7 inbred Swiss albino mice.

Materials and methods

Experimental animals and mating plan

Swiss albino mice maintained at Laboratory Animal Research (LAR) Section, Animal Genetics Division, ICAR- Indian Veterinary Research Institute, Izatnagar, India were used for the present study. These 122 mating pairs (122 pairs of each male and female) from the F_5 inbred Swiss albino mice were selected. Selected mice were apparently healthy and full sib (brother × sister) mating was practiced to produce F_6 inbred mice. From these mating, 628 numbers of progenies (pups) were produced. Further, 100 mating pairs from above progenies (F_6 inbred) were selected and used again for full sib mating of these progenies to produce F7 inbred. From these mating, 557 numbers of progenies (pups) were produced. The selection criterion for choosing of F_5 full sib breeding pairs were the body weight of the adult (≥ 30.0 g), apparently healthy and litter size at birth (≥ 8.0 g). The selected mice were provided with an *ad libitum* food and water. These mice were reared under similar feeding and management conditions throughout the experimental period. Sexing of mice was done at weaning age of 28 days. Subsequently, until further mating, males and females were housed separately. The recording of performance of F_6 and F_7 generation inbred mice was done by recording the performance traits i.e. body weight at birth (BWB), body weight at weaning (BWW) and adult body weight (ABW).

Statistical analysis

The data regarding effect of sex on performance related traits like BWW and ABW was analysed by using Analysis Variance Model of Statistical Analysis System software.

Results and discussion

Performance related traits of F_6 and F_7 generation inbred mice were estimated on 628 and 557 individual offspring, respectively. The BWB, BWW and ABW were recorded at the age of day 0, 28 and 70, respectively. The estimated performance parameters (BWB, BWW and ABW) were found to be in concurrence with the general mice vital statistics.

Estimation of phenotypic traits in F_6 and F_7 inbred mice population

The commonly estimated phenotypic traits in mice are growth trait like BWB, BWW and ABW. The phenotypic traits estimated in the mice population in both the F_6 as well as F_7 inbred mice generations, are depicted in Table 1.

Table 1: Mean ± SE of phenotypic traits estimated in F_6 and F_7 generation of inbred Swiss albino mice

Traits	Generation	
	F_6	F_7
BWB (g)	1.50±0.00	1.51±0.00
Male BWW (g)	16.60±0.17	19.22±0.27
Female BWW (g)	16.05±0.17	18.20±0.23
Overall BWW (g)	16.38±0.12	18.70±0.18
Male ABW(g)	30.68±0.25	29.81±0.33
Female ABW (g)	29.13±0.23	28.51±0.27
Overall ABW (g)	29.98±0.17	29.15±0.21

Effect of sex on performance traits in F_6 and F_7 inbred mice

The effect of sex (male and female) of offspring on performance traits was estimated in F_6 and F_7 inbred mice population using SAS 9.3 and is shown in tables 2 and 3, respectively. The mean value of BWW and ABW in F_6 inbred mice was higher in males than in females, respectively. Effect of sex on BWW was found to be statistically significant ($P<0.05$).

Table 2: Effect of sex on BWW and ABW in F_6 generation mice

Category Sex		BWW(g)		ABW(g)
	N	Mean± SE	N	Mean± SE
Male	341	16.60^{a}±0.17	341	30.68^{a}±0.17
Female	283	16.05^{b}±0.17	283	29.13^{b}±0.17

*Means with the different letter superscript are significantly different ($P<0.05$).

In F_7 generation mice the males had higher BWW than the females and the effect of sex on BWW was found to be statistically significant ($P<0.05$). The males had higher ABW (29.81) than the females (28.51) and the effect of sex on ABW was found to be statistically significant ($P<0.05$).

Table 3: Effect of sex on WW and ABW in F_7 generation mice

Category Sex		BWW(g)		ABW(g)
	N	Mean± SE	N	Mean± SE
Male	277	19.22^{a}±0.27	277	29.81^{a}±0.33
Female	280	18.20^{a}±0.23	280	28.51^{b}±0.27

*Means with the different letter superscript are significantly different ($P<0.05$).

The impact of sex of offspring on performance traits was revealed that mean estimates of BWW and ABW in F_6 and F_7 inbred mice was higher in males than in females. The similar pattern of mean estimates of BWW and ABW for male and female were also noticed by Tarang (2018) [6], Kaushal (2019) [4] and Saini (2021) [5]. Tarang, (2018) [6] found that the mean value of BWW and ABW were higher in males than in females in F_0 outbred mice. The mean value of BWW and ABW were higher in males (16.87 Vs and 34.52) than in females (16.04 Vs 29.66) in F_1 inbred mice. Kaushal, (2019) [4] also observed that the mean value of ABW was higher in males than in females in F_2 inbred mice. The mean value of BWW and ABW were higher in males than in females in F_3 inbred mice. Saini (2021) [5] also investigated that the mean value of BWW and ABW were higher in males than in females in F_4 inbred mice. The mean value of BWW and ABW were higher in males than in females in F_5 inbred mice. Consequently, the findings showed that, male mice had a comparatively higher body weight than female mice and also were in agreement with White (1972) [7].

Conclusion

Furthermore, BWW and ABW of males were higher than that of females in both the generations. These findings showed that less magnitude of inbreeding depression was observed in body weight at weaning and adult body weight of males as compare to that of female.

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References

1. Arends D, Hesse D, Brockmann GA. Invited review: Genetic and genomic mouse models for livestock research. Archives Animal Breeding 2018;61(1):87-98.
2. Beck JA, Lloyd S, Hafezparast M, Lennon-Pierce M, Eppig JT, Festing MF *et al*. Genealogies of mouse inbred strains. Nature Genetics 2000;24:23-25.
3. Danneman PJ, Suckow MA, Brayton C. The laboratory mouse. CRC Press, 2012.
4. Kaushal S. Genetic analysis of inbred Swiss albino Mice of different filial generations. Ph.D. Thesis submitted to ICAR-IVRI, Izatnagar (India), 2019.
5. Saini BL. Genetic characterization and transcriptome profiling of inbred Swiss albino mice. Ph.D. Thesis submitted to ICAR-IVRI, Izatnagar (India), 2021.
6. Tarang M. Phenotypic and genetic characterization of outbred and F1 inbred Swiss Albino strain of mice. M.V.Sc. Thesis submitted to ICAR-IVRI, Izatnagar (India) 2018.
7. White JM. Inbreeding effects upon growth and maternal ability in laboratory mice. Genetics 1972;70(2):307-317.