Zootechnical Data Analysis in a Breeding Animal Facility: Tracing the Patterns of Mouse Production

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ABSTRACT

This paper discusses the main findings of the work published by Ferreira and collaborators in the journal Laboratory Animal Research in January 2021. Due to the promulgation of Law Arouca 11794/2008, then regulated by Decree 6899/2009, an important movement for the implementation of changes in the scenario of animal experimentation in Brazil, mainly in the need for improvements in management. With the purpose of dealing the management of the animal facility colony of the Carlos Chagas Institute (ICC), the BioterC software was developed and implemented in 2014. After 5 years of using this system, the information in the database was analyzed using Exploratory Data Analysis (AED) techniques in Python programming language. Was obtained satisfactory results and identification of production patterns, such as number of animals produced (15,106 mice). Median births for different groups of strains (6-10 mice). Period between mating at birth (35 days) to the period of sexing (19 days). Most requested lineages between internal and external users (C57BL/6, Balb/c and Swiss). The main reason for animal disposal was the Zootechnical disposal. Based on our results, it was possible to compare the patterns of mouse colony creation and to contribute for the discussion in rational use of animals in experimentation.

Keywords: BioterC, Exploratory Data Analysis (AED), Laboratory Animals, Python

INTRODUCTION

The use of animals in scientific research has been common practice since the 17th century [1,2]. With the advent of the enactment of Law 11794/2008 (Arouca Law), later regulated by Decree 6899/2009, an important movement for the implementation of changes in the scenario of animal experimentation in Brazil, with emphasis on the need for improvements in management [3]. In order to improve the capacity of the management process of the Laboratory of Animal Creation and Experimentation (LACEA) of the Carlos Chagas Institute (ICC), the BioterC software was developed and implemented in 2014. After 5 years of uninterrupted use of this system, the present study sought to compile and analyze the information in the database through exploratory data analysis (AED) techniques. The objective of these analyses was to answer questions regarding the management of the colony and the animal facility, identifying patterns of creation and production of mice.

MATERIALS AND METHODS

The analyses were performed using a data mining technique, an area of knowledge that is part of Data Science with the objective of analyzing the set of data obtained in the BioterC software from 2014 to 2019. The Python programming language was used to develop exploratory data analysis (EDA) tools. Different modules were used as analysis tools and high- performance data structures, such as Pandas, Numpy, Matplotlib and Seaborn.

RESULTS AND DISCUSSION

The results showed that from Sep/2014 to June 2019, 15,107 animals were produced (1,808 records). Of these, the strains C57BL/6 (3,553 births), Balb/c (3,452 births) and Swiss (3,025 births) were the most produced in the animal facility. Unfortunately, it was not possible to make a comparison from this data with another animal facility that presents production of mice closely related was evaluated, since these data are not available for comparison of animal production, limiting our investigations.

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The production of mating births for isogenic strains presents an average of 6-7 pups and for heterogenic strains the average of 10 puppies per birth. Our findings agree with Benavides [4] who states that, mice usually generate 4-8 puppies in isogenic strains, and in the case of groups of heterogenic mice, the number of puppies can range from 10-14, with a record of 32 pups for a female of the Swiss mouse group (Swiss).

The mating period of these animals has an average of 35 days. Santos [5] demonstrated that the mating period between mice is 19 to 21 days. Guénet [6] also state that the period between mating and birth is 19 to 22 days, varying according to the lineage or stock.

Sexing records (from birth to weaning) averaged 18.97 days and median was 19 days. Sexing is performed after weaning of the puppies that usually occurs at 19 days of birth, and in isogenic strains weaning can occur at 28 days [5]. Guénet [6] describe that breastfeeding lasts between 19 and 21 days, where mice would be ready to feed solids and prepared to be sexed and separated. Although the data are within the described period, the mean and median of 19 days found in the records indicate the early ness of sexing. Kikusi [7] presented that the behavior of puppies and mothers separated prematurely can be altered, with higher activity of mice and less rest during the post-sexage period, causing anxiety in the puppies of the colony.

Among the records of supply of mice, 393 entries of animal requests were recorded between internal and external laboratories. Among the data analyzed, 90% of the requests are from external research institutions [8].

The main reason for the requests is due to the high availability of animals, in addition to genetic and sanitary quality. It was observed that more than half of the animals produced to meet the demand for requests were discarded. The most frequent reason for disposal in LACEA was zootechnical, that is, mice being discarded by fights, animals that no longer reproduce and especially animals that were not used for experiments or overbred. Cardoso (2002) states that considering the conditions of the animal facility, which aims at high productivity at the lowest possible cost, the disposal of undesirable animals is a necessary measure [9]. Of the 15,107 animals, 38% were destined for animal experimentation, 58% were discarded and 4% were not found in the animal destination data.

CONCLUSION

The present work allowed a complete view of the capacities of retrieval of the information contained in the BioterC, allowing a unique knowledge of animal husbandry by the animal facility. In addition to bringing management and quality gains to animal facility that use this solution.

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