Determining Autolysis and Decomposition Rate of Mouse Carcasses

Maryam Heshmati, Kathleen Keene, and Jason S. Villano
Undergraduate Research Opportunity Program, University of Michigan, College of Veterinary Medicine, University of Illinois Urban Champaign, Unit for Laboratory Animal Medicine,
University of Michigan Medical School, Ann Arbor, Michigan

Despite the widespread use of mice in biomedical research, there is currently a lack of information on carcass decomposition and autolysis rate. While it is not uncommon to find dead mice in cages, researchers and veterinarians often harvest tissues for experiments and/or histopathology for health surveillance and disease diagnosis. Thus, it is important to have quality tissues for histological evaluation. The overall goal of this study is to investigate autolysis and decomposition rates of mouse carcasses in different microenvironments and time period's post-mortem. We evaluated factors that could affect these rates: body core temperature, body weight, body fat composition, and microenvironmental variables. Mice (n=19), implanted with microchips to measure body core temperature, were anesthetized for dual energy X-ray absorptiometry (DEXA) scan to determine body fat composition. Mice were euthanized by carbon dioxide inhalation and necropsy was performed immediately after euthanasia or 2 hours after carcass placement (PE2) in either static microisolator caging (SM) or cold room; where carbon dioxide (CO_2), ammonia, humidity, and temperature were measured. Tissues were fixed in formalin and trimmed for histological scoring. Our data shows CO_2 levels decreased significantly from 0 hours ($\bar{X}$=3800ppm ± 160.52) to PE2 ($\bar{X}$=7533.3 ± 117.908); whereas, changes in humidity and ammonia levels, and temperature changes were insignificant. Interestingly, body weight loss was noted in cold room PE2 while mice in the SM gained weight. Histopathological results are pending for future consultation with microenvironment. Future studies will include longer time points and different cage systems.

Determining Autolysis and Decomposition Rate of Mouse Carcass

Maryam Heshmati, [1] Kathleen Keene, [2] Jason S. Villano[3]
Undergraduate Research Opportunity Program, University of Michigan;[1]College of Veterinary Medicine, University of Illinois-Urbana Champaign;[2]
Unit for Laboratory Animal Medicine, University of Michigan Medical School[3]

Abstract

Despite the widespread use of mice in biomedical research, there is currently a lack of information on carcass decomposition and autolysis rate. While it is not uncommon to find dead mice in cages, researchers and veterinarians often harvest tissues for experiments and/or histopathology for health surveillance and disease diagnosis. Thus, it is important to have quality tissues for histological evaluation. The overall goal of this study is to investigate autolysis and decomposition rates of mouse carcasses in different microenvironments and time period's post-mortem. We evaluated factors that could affect these rates: body core temperature, body weight, body fat composition, and microenvironmental variables. Mice (n=19), implanted with microchips to measure body core temperature, were anesthetized for dual energy X-ray absorptiometry (DEXA) scan to determine body fat composition. Mice were euthanized by carbon dioxide inhalation and necropsy was performed immediately after euthanasia or 2 hours after carcass placement (PE2) in either static microisolator caging (SM) or cold room; where carbon dioxide (CO_2), ammonia, humidity, and temperature were measured. Tissues were fixed in formalin and trimmed for histological scoring. Our data shows CO_2 levels decreased significantly from 0 hours ($\bar{X}$=3800ppm ± 160.52) to PE2 ($\bar{X}$=753.33 ± 117.908); whereas, changes in humidity, ammonia, and temperature changes were insignificant. Interestingly, carcass body weight loss was noted in cold room PE2 while carcasses in the SM gained weight. Histological results are pending for correlation with microenvironmental results. Future studies will include longer time points and different cage systems.

Materials and Methods

- Gas detector probe was inserted into ~5mm holes in SM cages or placed inside cold room for oxygen, ammonia, and carbon dioxide measurement.
- Data logger was placed inside cold room and SM to measure humidity and temperature.
- Mice were weighed and implanted with microchips to measure body temperature.
- Body fat composition was analyzed by dual energy X-ray absorptiometry (DEXA) scan.

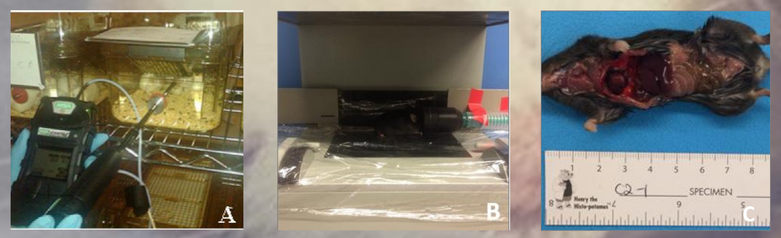
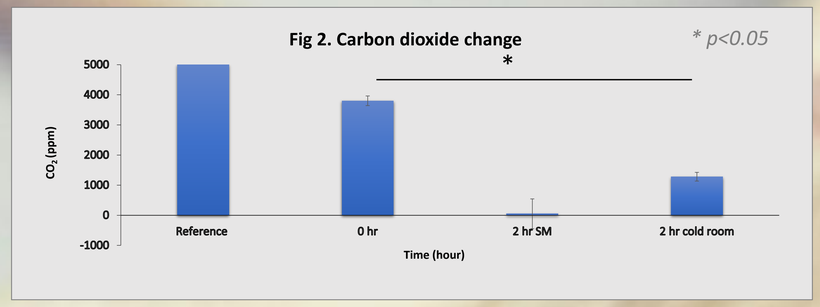
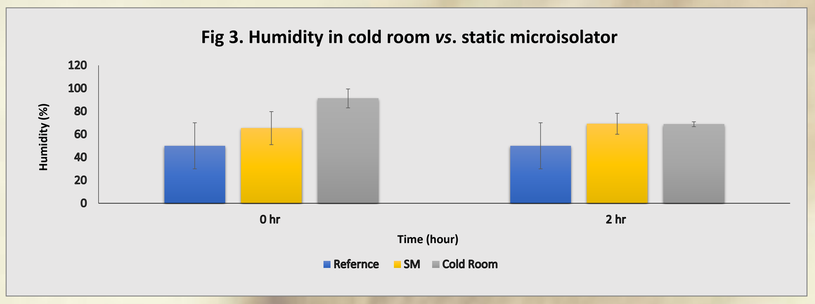


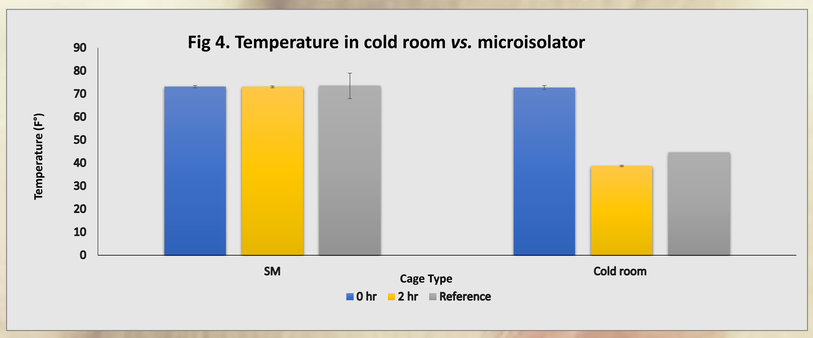
Fig 1. (A) Measuring microenvironmental factors (oxygen, ammonia, and carbon dioxide); (B) DEXA scan; (C) performing necropsy.

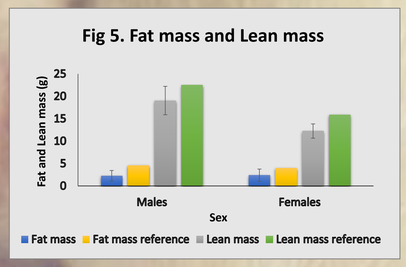
- Mice were euthanized by CO_2 overdose (10-30%).
- Necropsy was performed immediately after euthanasia or PE2 after going through rigor mortis in SM or cold room.
- Tissues were fixed in formalin, trimmed and placed into labeled cassettes submerged into ethanol.

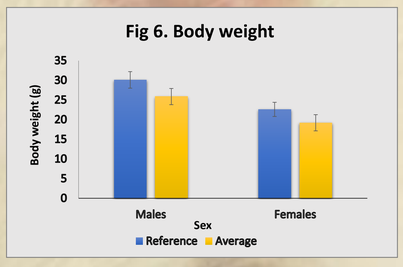
Results

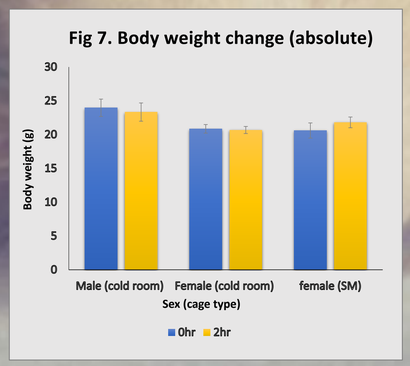












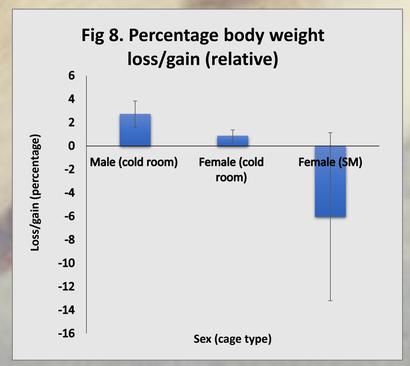


Fig 9. Spleen and gastrointestinal tract of mice at 0 and 2 hour time point for cold room and static microsiolator; spleen and gastrointestinal tract increased in size at static microisolator while they were reduced in size at cold room.

Discussion

- CO_2 levels decreased PE2 because of the absence of animal respiration. CO_2 changes in cold room was considerably less because it is a larger microenvironment.
- All other microenviromental changes were insignificant since microenvironment was affected by the controlled macroenvironment (animal holding room) and one or two days prior euthanasia cage change out.
- Body weight, lean and fat mass between male and female mice were also insignificant.

Limitations

- A small number of mice were used.
- Carcasses were left in only two types of microenvironment (SM and cold room); individually ventilated cages need to be used.
- Time points were 0 and 2 hours post euthanasia; further experiments are up to 24 hours to simulate husbandry health check.

Conclusions

- There is no difference in microenviromental variables except CO_2.
- Pending histopathological results; we are anticipating there is no difference in 0 and 2 hours for autolysis and decomposition rate.
- Our sample population was small and further studies are warranted.

Acknowledgment

- We would like to recognize the members and husbandry personnel of Unit of Laboratory Animal Medicine for taking care of the mice.
- Special thanks to UROP for making this research opportunity possible.

Selected References

1. Committee for the Update of the Guide for the Care and Use of Laboratory Animals; Institute for Laboratory Animal Research; Division on Earth and Life Studies; National Research Council. 1996. *Guide for the Care and Use of Laboratory Animals. 8th: 142.*
2. The Jackson Laboratory http://jaxmice.jax.org/support/weight/000664.html
3. The Jackson Laboratory http://jaxmice.jax.org/support/phenotyping/B6data000664.pdf