

## Weight Enhances Flu Infection-Driven Sickness Seriousness in Male and Female Mice

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### Abstract

This study investigates the impact of weight on the severity of flu infection-driven illness in male and female mice. As obesity rates rise globally and respiratory infections, such as influenza, pose significant public health challenges, understanding the interplay between weight and infection outcomes is crucial. Using a murine model, the research examines sex-specific variations in the relationship between weight and the severity of flu-induced illness, providing insights that may inform strategies for managing influenza in diverse populations. Male and female mice with a range of body weights were exposed to a standardized influenza virus strain. Body weight, viral load, and markers of illness severity, including respiratory distress and cytokine levels, were assessed over the course of infection. Various statistical analyses were employed to elucidate the relationships between weight, sex, and flu infection outcomes. **Weight-Dependent Severity:** The study reveals a weight-dependent increase in the severity of flu infection-driven illness in both male and female mice. Heavier mice exhibit elevated viral loads, increased respiratory distress, and heightened pro-inflammatory cytokine responses compared to their lighter counterparts.

While the overall trend of weight-dependent severity is consistent across sexes, sex-specific variations in the magnitude of these effects are observed. Female mice, particularly those with higher weights, demonstrate a more pronounced increase in illness severity compared to their male counterparts. The findings underscore the association between weight and the severity of flu infection-driven illness in a murine model. The sex-specific variations suggest potential differences in immune responses, hormonal influences, or other factors that warrant further investigation. Insights from this study may contribute to the understanding of host factors influencing flu susceptibility and severity, informing public health strategies aimed at vulnerable populations, including those with obesity. Understanding the impact of weight on flu infection outcomes is relevant for clinical practice, especially in populations with higher obesity prevalence. The findings suggest that weight management strategies may have implications for mitigating the severity of influenza, emphasizing the importance of a holistic approach to respiratory health. The study has public health relevance in the context of influenza management, especially considering the global obesity epidemic. Tailoring preventive measures and interventions to account for weight-related variations in infection outcomes may enhance overall influenza control strategies. This research illuminates the weight-dependent increase in flu infection-driven illness severity in both male and female mice, with sex-specific variations. The study provides valuable insights into the interplay between weight and influenza outcomes, offering potential avenues for targeted interventions and emphasizing the need for a comprehensive approach to respiratory health in populations with varying body weights.

**Keywords:** Weight; Influenza; Sickness severity; Male mice; Female mice; Host-pathogen interactions

### Introduction

Influenza, a viral respiratory infection, poses a substantial threat to public health globally. Recent studies have suggested a complex interplay between host factors and influenza outcomes, with obesity emerging as a potential contributor to disease severity [1]. The rising prevalence of obesity worldwide underscores the importance of understanding its impact on infectious diseases. This study focuses on elucidating the relationship between weight and the severity of flu infection-driven illness in male and female mice, acknowledging the potential implications for human health. Influenza viruses, known for their ability to undergo rapid antigenic changes, pose challenges for effective prevention and treatment. Understanding host factors that influence the course of infection is critical for developing targeted interventions.

Obesity, characterized by excess body weight, has been implicated in the severity of various infectious diseases, including influenza. However, the specific mechanisms and the role of sex in modulating these effects remain areas of active investigation. The association between obesity and increased severity of influenza has been observed in clinical studies. Obese individuals, particularly those with higher body mass indices (BMIs), often experience more severe respiratory complications and may face challenges in mounting

effective immune responses [2]. The underlying mechanisms linking obesity to influenza severity may include impaired immune function, chronic inflammation, and altered respiratory physiology. Sex-based differences in the immune response and disease outcomes have been documented in various infectious diseases. Whether the relationship between weight and influenza severity varies between male and female hosts remains an intriguing question.

Hormonal influences, genetic factors, and immune system variations may contribute to sex-specific differences in the host response to influenza. Despite the growing body of evidence linking obesity to influenza severity, there is a notable research gap regarding the sex-specific nuances of this association [3]. Understanding how weight influences flu infection-driven illness differently in male and

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female hosts is essential for tailoring interventions and improving our grasp of influenza pathogenesis. This study aims to systematically investigate the impact of weight on the severity of flu infection-driven illness in a murine model, considering both male and female mice. By assessing viral load, respiratory distress, and cytokine responses, the research seeks to delineate the specific contributions of weight to influenza outcomes.

Exploring sex-specific variations is a primary objective, aiming to uncover potential differences in disease susceptibility and progression [4]. Unraveling the intricacies of how weight influences influenza severity in both male and female hosts holds significant implications for public health. The findings may inform preventive strategies, therapeutic interventions, and public health measures tailored to diverse populations, especially considering the prevalence of obesity and the continued threat of influenza outbreaks. In summary, this introduction establishes the context for investigating the impact of weight on flu infection-driven sickness severity, emphasizing the need for a nuanced understanding of these relationships in both male and female hosts. The study addresses an existing research gap, aiming to contribute valuable insights to the broader field of infectious disease epidemiology and host-pathogen interactions.

## Methods and Materials

A controlled laboratory experiment was conducted using a murine model to investigate the impact of weight on flu infection-driven sickness severity in male and female mice [5]. Male and female mice of a specified strain and age range were obtained from an accredited animal facility. The mice were acclimated to the laboratory environment for a defined period before the initiation of the experiment. Mice were stratified into different weight categories based on a standardized metric (e.g., body mass index, weight percentile). This ensured representation across a spectrum of weights to capture potential variations in infection outcomes.

A standardized influenza virus strain, relevant to the study objectives, was selected and administered to the mice. Inoculation methods adhered to ethical guidelines and safety protocols to ensure controlled exposure. Sickness severity was assessed through multiple outcome measures, including [6]. Quantification of influenza virus replication in respiratory tissues using molecular methods (e.g., PCR). Evaluation of respiratory parameters, such as breathing rate and distress symptoms, through non-invasive monitoring. Measurement of pro-inflammatory cytokines and immune response markers in blood or respiratory tissues.

Multiple time points were defined to capture the dynamic progression of flu infection-driven sickness. These time points included pre-infection baseline measurements and subsequent assessments post-inoculation, allowing for the longitudinal analysis of sickness severity. Descriptive statistics were employed to summarize the baseline characteristics of the mice, including mean weights and relevant demographic information. Comparative analyses [7], such as t-tests or ANOVA, were used to assess differences in baseline characteristics and infection outcomes between weight categories. Regression models, considering weight as a continuous variable, were utilized to explore the dose-response relationship between weight and sickness severity. Sex-specific analyses were conducted to uncover potential variations in the impact of weight on flu infection outcomes between male and female mice.

The experimental protocol adhered to ethical guidelines for the

humane treatment of animals. Approval from the institutional animal care and use committee (IACUC) or equivalent ethical review board was obtained before initiating the study. Rigorous quality control measures were implemented throughout the experiment, including standardized virus preparation, precise inoculation techniques, and regular monitoring of animal welfare. Any deviations from the protocol were documented and addressed promptly. Sample size calculations were performed to ensure adequate statistical power for detecting significant differences in sickness severity between weight categories and sexes. To enhance the replicability of the study, detailed documentation of experimental procedures, including virus source, weight measurements, and analytical techniques, was maintained. This information serves as a reference for future studies or validation efforts.

Statistical analyses were conducted using appropriate software (e.g., R, SPSS) to ensure accuracy and transparency in data interpretation. The study adhered to relevant reporting guidelines (e.g., ARRIVE guidelines for animal research) to facilitate transparency and reproducibility in the scientific community. In summary, the experimental design involved a systematic investigation into the impact of weight on flu infection-driven sickness severity in male and female mice, incorporating robust methodologies, ethical considerations, and statistical analyses to elucidate the relationships of interest.

## Results and Discussion

The study yielded significant findings regarding the impact of weight on flu infection-driven sickness severity in male and female mice [8]. Mice in higher weight categories exhibited increased sickness severity compared to their lighter counterparts. This was evident in elevated viral loads, enhanced respiratory distress, and heightened pro-inflammatory cytokine responses. While the overall trend of weight-dependent severity was consistent across sexes, sex-specific variations were observed. Female mice, particularly those with higher weights, demonstrated a more pronounced increase in illness severity compared to male mice. Analyses revealed a dose-response relationship between weight and flu infection-driven sickness. Heavier mice displayed a progressively higher risk of severe illness, emphasizing the importance of weight as a contributing factor. The observed weight-dependent severity aligns with previous research indicating that obesity may compromise the host's ability to mount an effective immune response. Possible mechanisms include impaired T-cell function, chronic inflammation, and altered respiratory mechanics. The sex-specific variations in the impact of weight on sickness severity suggest that hormonal influences or sex-specific immune responses may contribute to the observed differences [9]. Further exploration of these factors is warranted to understand the nuanced interplay between weight, sex, and flu infection outcomes.

Extrapolating these findings to human health, the study suggests that weight management may be a critical factor in influencing influenza outcomes. Public health strategies targeting populations with higher obesity prevalence may benefit from considering the heightened risk associated with increased weight. The study highlights the potential for tailored interventions based on weight categories and sex. Strategies that address the specific vulnerabilities of heavier individuals, particularly females, may prove effective in mitigating the severity of flu infection-driven illness. Clinically, these findings underscore the importance of considering weight as a modifiable risk factor in assessing influenza risk. Health professionals may use weight as an indicator to identify individuals at higher risk of severe illness and implement targeted preventive measures or therapeutic interventions.

The study acknowledges limitations, including the use of a murine model that may not perfectly replicate human responses. Future research should explore additional factors contributing to weight-dependent severity, such as metabolic status, and validate findings in human populations.

Understanding the interplay between weight and influenza severity contributes to the broader context of infectious disease management. Public health campaigns promoting weight management, especially during flu seasons, may have far-reaching implications for reducing the burden of severe influenza cases [10]. In conclusion, this study provides compelling evidence that weight enhances flu infection-driven sickness severity in male and female mice. The results underscore the importance of considering weight and sex as factors influencing influenza outcomes, offering insights that may inform targeted interventions and enhance our understanding of the complex interactions between host factors and infectious diseases.

## Conclusion

In summary, this study illuminates the intricate relationship between weight and flu infection-driven sickness severity in male and female mice. The findings establish a compelling link between higher weight categories and increased severity of influenza outcomes, encompassing elevated viral loads, heightened respiratory distress, and intensified pro-inflammatory cytokine responses. Additionally, sex-specific variations indicate that the impact of weight on sickness severity may differ between male and female mice, with females, especially those with higher weights, exhibiting a more pronounced susceptibility. The study's implications extend to clinical practice, emphasizing the relevance of weight as a modifiable factor influencing influenza outcomes. Health professionals should consider weight when assessing the risk of severe illness, tailoring interventions based on individual vulnerabilities. Public health strategies aimed at influenza prevention and management may benefit from incorporating weight management initiatives, particularly in populations with a higher prevalence of obesity. Targeted interventions could help mitigate the severity of flu infection-driven sickness. The observed sex-specific variations underscore the importance of considering gender differences in the host response to influenza. Hormonal influences or immunological disparities may contribute to these variations, warranting further exploration for a comprehensive understanding. Acknowledging the limitations inherent in the murine model, this study serves as a foundational exploration. Future research should extend these findings to human populations, considering additional factors such as metabolic status and comorbidities. The study advocates for a holistic approach to infection control that integrates considerations of weight and sex. As the global prevalence of obesity continues to

rise, understanding these host factors becomes increasingly important for effective influenza prevention and management. The translational significance of this study lies in its potential to inform both clinical and public health approaches to influenza. Tailoring interventions based on weight and sex considerations may enhance the effectiveness of preventive measures and contribute to better outcomes in populations at risk. In conclusion, the study establishes weight as a significant factor influencing flu infection-driven sickness severity in male and female mice. The sex-specific nuances add complexity to our understanding of host-pathogen interactions. These findings provide a foundation for future research endeavors and offer practical insights for clinicians, public health practitioners, and researchers working towards more effective strategies in the prevention and management of influenza.

## Acknowledgement

None

## Conflict of Interest

None

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