

Effects of Non-Nutritive Sweeteners on Growth Performance and Diarrhea of Weaned Pigs



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Mariah Jansen¹, Veronica Polniak¹, Andrea Luttman², Riley Barber¹, Delani Stull¹, Dale Rozeboom¹, Kwangwook Kim¹
¹Department of Animal Science, ²Genetics & Genomic Sciences, Michigan State University, East Lansing, United States

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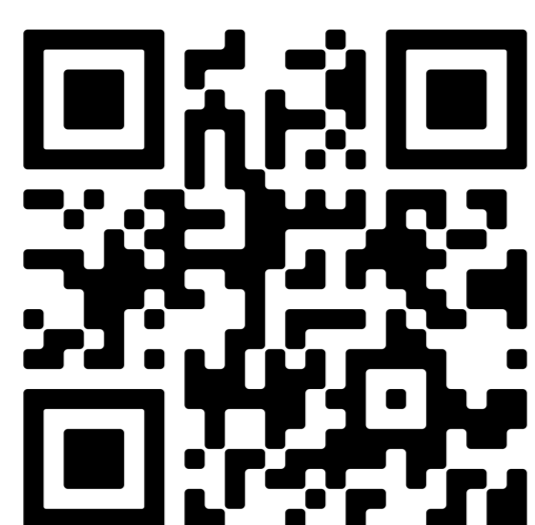
Introduction & Objective

Materials & Methods

Results

Results & Conclusion

Animal Nutrition, Health,
and Physiology Laboratory
Michigan State University



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Abstract

The objective of this experiment was to investigate the dietary supplementation of non-nutritive sweeteners on the growth performance and diarrhea of weaned pigs, in comparison with in-feed antibiotics. Two hundred and eighty-eight pigs (6.21 ± 0.45 kg body weight (BW); PIC 800 x Yorkshire) were weaned at 21 ± 1 and allotted to 4 dietary treatments with 6 pigs/pen based on a randomized complete block design using BW and sex as blocks. four dietary treatments were: (1) Control (CON): Basal nursery diet; (2) Sucralose (SCL): control diet supplemented with 150 mg/kg of sucralose; (3) Neotame (NEO): control diet supplemented with 30 mg/kg of neotame; and (4) Antibiotic (CBX): control diet supplemented with 50 mg/kg carbadox. A two-phase feeding program was utilized with varied dietary treatment supplementations for phase 1 (day 0 to 14) and phase 2 (day 15 to 28). BW and feed disappearance were measured at the end of each interval (day 7, 14, 21, and 28) after weaning to calculate average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (G:F). Diarrhea was recorded twice daily throughout the experiment with the score ranging from 1 to 5 (1 = normal to 5 = watery diarrhea). The frequency of diarrhea based on the score was calculated as the percentage of the pen days with a diarrhea score 3 or greater (incidence of diarrhea). All data were analyzed by ANOVA using the PROC MIXED of SAS, with a pen as the experimental unit. The frequency of diarrhea was analyzed by a Chi-square test. Pigs supplemented with NEO tended to increase ($P < 0.10$) BW on day 7 and 14 and had greater ($P < 0.05$) ADG during day 0 to 7, compared to the CON group. Supplementation of CBX resulted in greater ($P < 0.05$) BW on d 7 and 14 and improved ($P < 0.05$) ADG during day 0 to 7 and phase 1, in comparison with CON group. ADFI improved ($P < 0.05$) during phase 1 and phase 2, when pigs were fed non-nutritive sweeteners compared to the CON. Supplementation of NEO reduced ($P < 0.05$) frequency of diarrhea during phase 1 (33.97% vs. 45.51) and throughout the experiment (18.52% vs. 25.93%), compared to pigs fed the CON diet, respectively. In conclusion, dietary supplementation of non-nutritive sweeteners either improved body weight during the first week after weaning, improved feed intake or alleviated the severity incidence of post-weaning diarrhea. Further studies are warranted to explore the effects on intestinal development, physiological changes, and the mechanisms underlying these observed changes.

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Introduction

- Weaning is a critical event that negatively impacts the biological functions of pigs such as growth performance and gut integrity (Campbell et al., 2013).
- Antibiotic alternatives are needed due to an increase in drug-resistant bacteria, consumer preference, and the banning of growth-promoting use of antibiotics in pigs (He et al., 2022).
- Non-nutritive sweeteners have been used to potentially increase feed palatability and initiate voluntary feed intake in pig feeds (Chen et al., 2020).

Objective

Investigate the effect of non-nutritive sweeteners on the growth performance and incidence of diarrhea in pigs during the early weaning period.

Hypothesis

Non-nutritive sweeteners may reduce the incidence of diarrhea in pigs by promoting growth and health during the early weaning period.

Abstract

Introduction &
Objective

Materials &
Methods

Results

Results &
Conclusions

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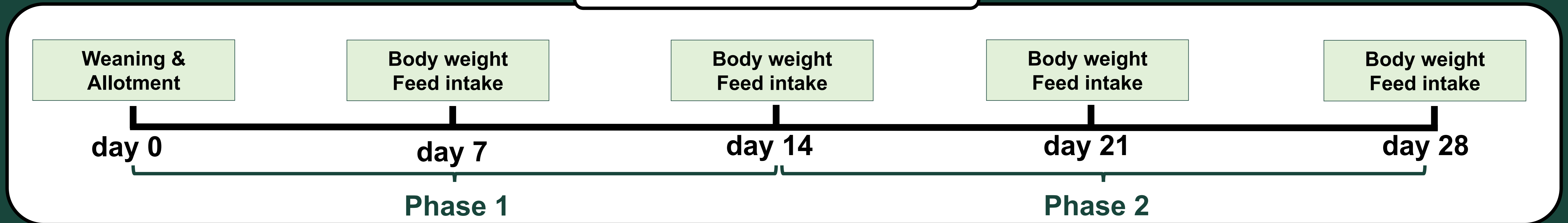


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Materials & Methods



➤ Experimental Design:

- **Randomized Complete Block Design**
(Blocks: Body weight & Sex)
- **288 weanling pigs** (6 pigs/pen, 4 treatments)
 - ✓ Average body weight: 6.21 ± 0.45 kg
 - ✓ Weaning age: 21 ± 1 day old
- **2-phase feeding program**
 - ✓ Phase 1: 14 days
 - ✓ Phase 2: 14 days

➤ Dietary treatment:

- Nursery basal diet as control (CON)
- CON + 150 mg/kg of Sucralose (SCL)
- CON + 30 mg/kg of Neotame (NEO)
- CON + 50 mg/kg of Carbadox (CBX)

➤ Growth Performance

- Body weight
- Average daily gain
- Average daily feed intake
- Frequency of Diarrhea
 - Percentage of the pen days with a diarrhea score ≥ 3
- Statistical analysis
 - Growth performance: ANOVA using PROC MIXED of SAS
 - Frequency of diarrhea: Chi-square test
 - $P < 0.05$: Considered statistically significance
 - $0.05 < P < 0.10$: Considered tendency

Abstract

Introduction &
Objective

Materials &
Methods

Results

Results &
Conclusions

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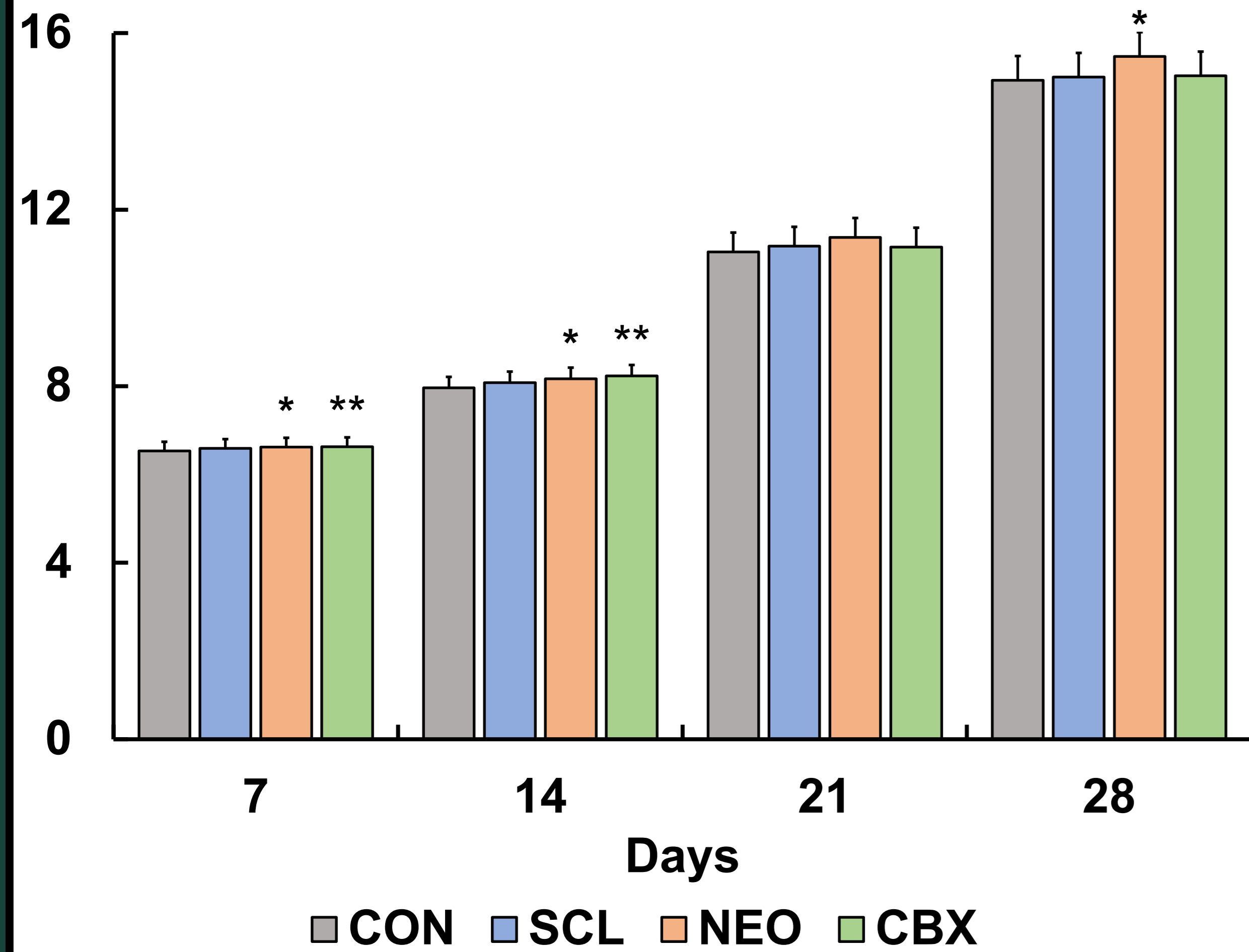
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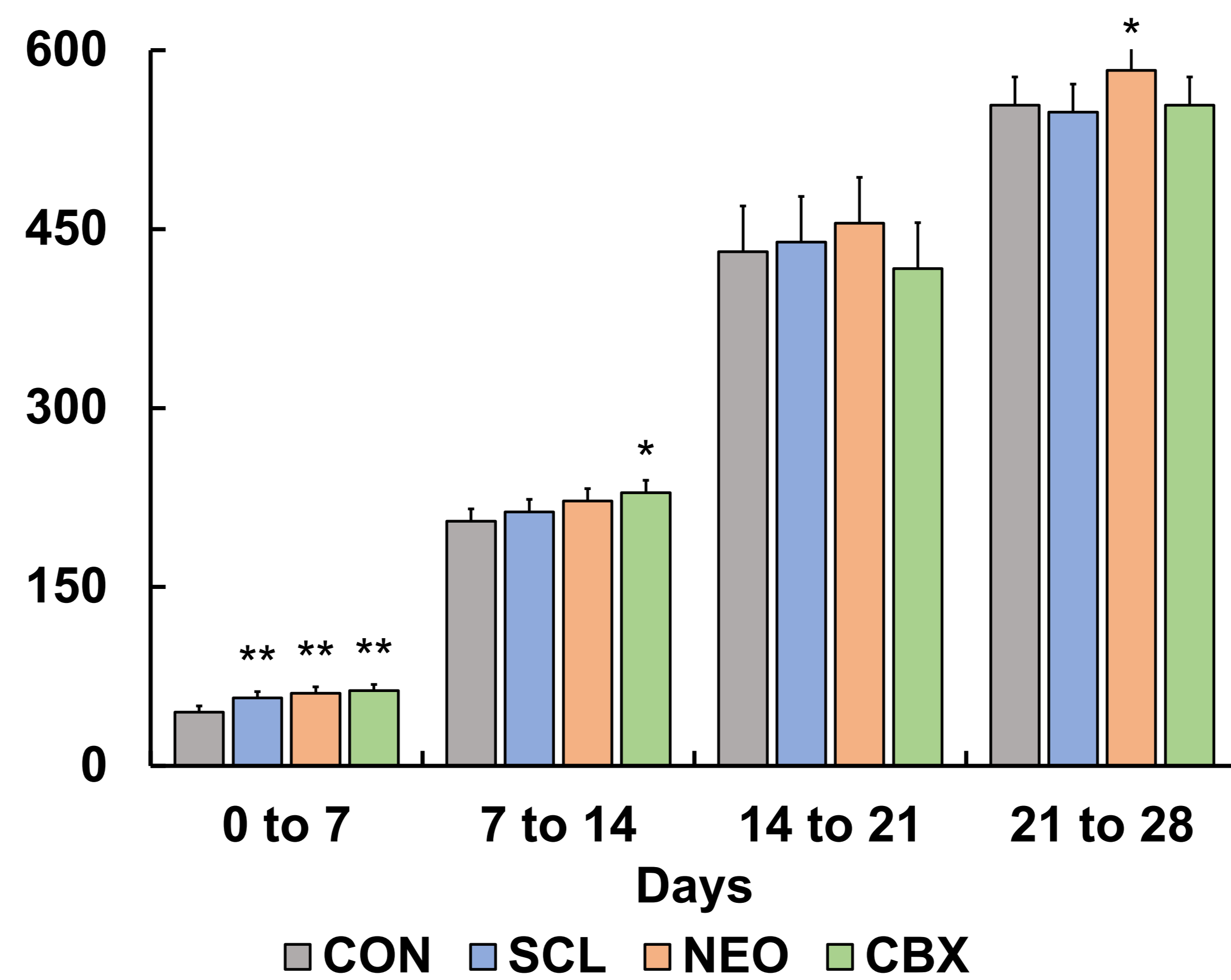
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Results

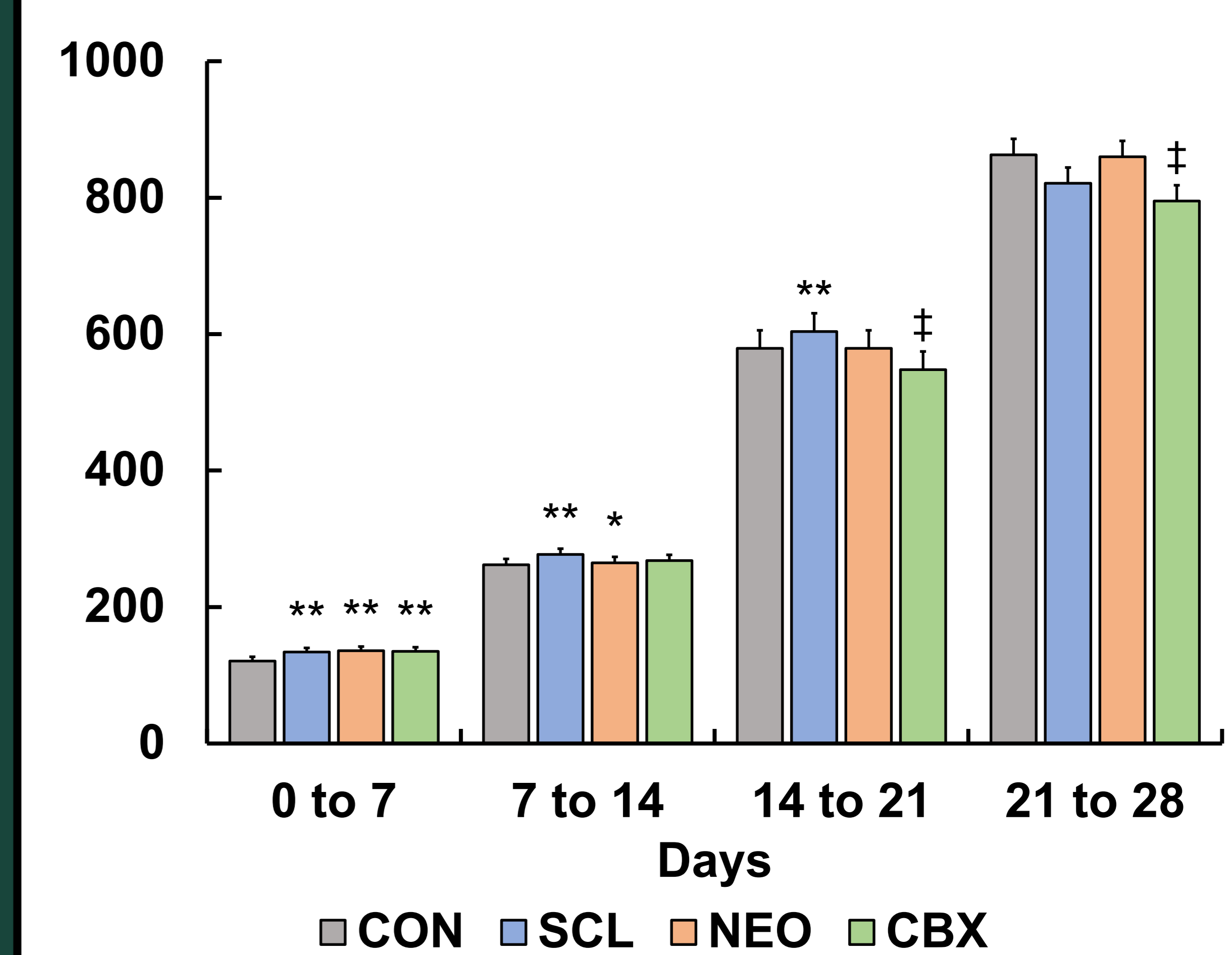
Body Weight, kg



Average Daily Gain, g/d



Average Daily Feed Intake, g/d



* 0.05 < P < 0.10: Tended to increase vs. CON
 ** P < 0.05: Significant increase vs. CON
 ‡ P < 0.05: Significant decrease vs. CON

CON = Nursery basal diet
 SCL = CON + 150 mg/kg of Sucralose
 NEO = CON + 30 mg/kg of Neotame
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Abstract

Introduction & Objective

Materials & Methods

Results

Results & Conclusions

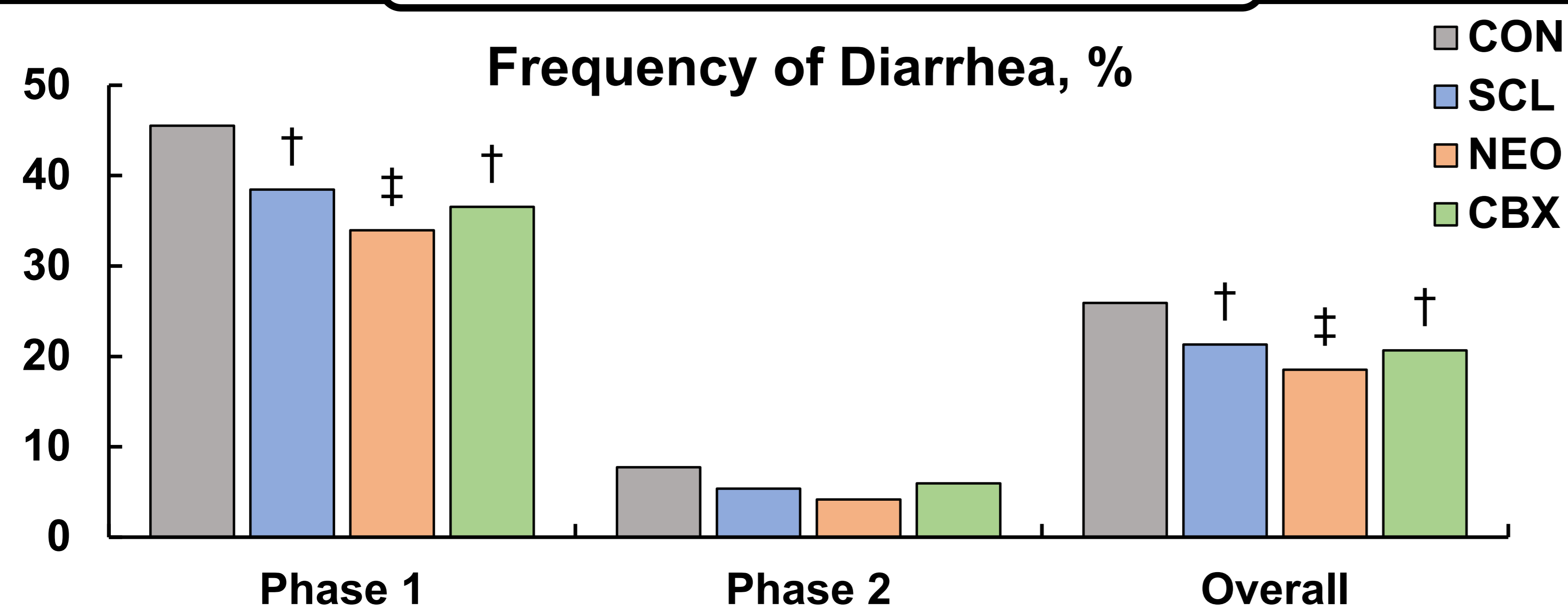
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Results



† 0.05 < P < 0.10: Tended to decrease vs. CON
‡ P < 0.05: Significant decrease vs. CON

Conclusions

- **Supplementation of Sucralose**
 - Tended to increase average daily gain in **Week 1**
 - Increase average daily feed intake in **Phase 1** and **Week 3**
 - Tended to reduce the frequency of diarrhea in **Phase 1**, and throughout the experiment
- **Supplementation of Neotame**
 - Tended to increase bodyweight in **Phase 1**
 - Increase average daily gain in **Phase 1**
 - Increase average daily feed intake in **Week 1**
 - Reduce the frequency of diarrhea in **Phase 1**, and throughout the experiment

Ongoing research

- **Effect of non-nutritive sweeteners on intestinal health**
 - Small intestinal histology
 - Intestinal microbial profiles
- **Effect of non-nutritive sweeteners on metabolic pathways**
 - Metabolomics

References

- Campbell, J. M., J. D. Crenshaw, and J. Polo. 2013. The biological stress of early weaned piglets. *J Animal Sci Biotechnol.* 4:19. doi:10.1186/2049-1891-4-19.
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Abstract

Introduction &
Objective

Materials &
Methods

Results

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