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Early milk feeding impacts health and immunity in later life

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Early milk feeding impacts health and immunity in later life

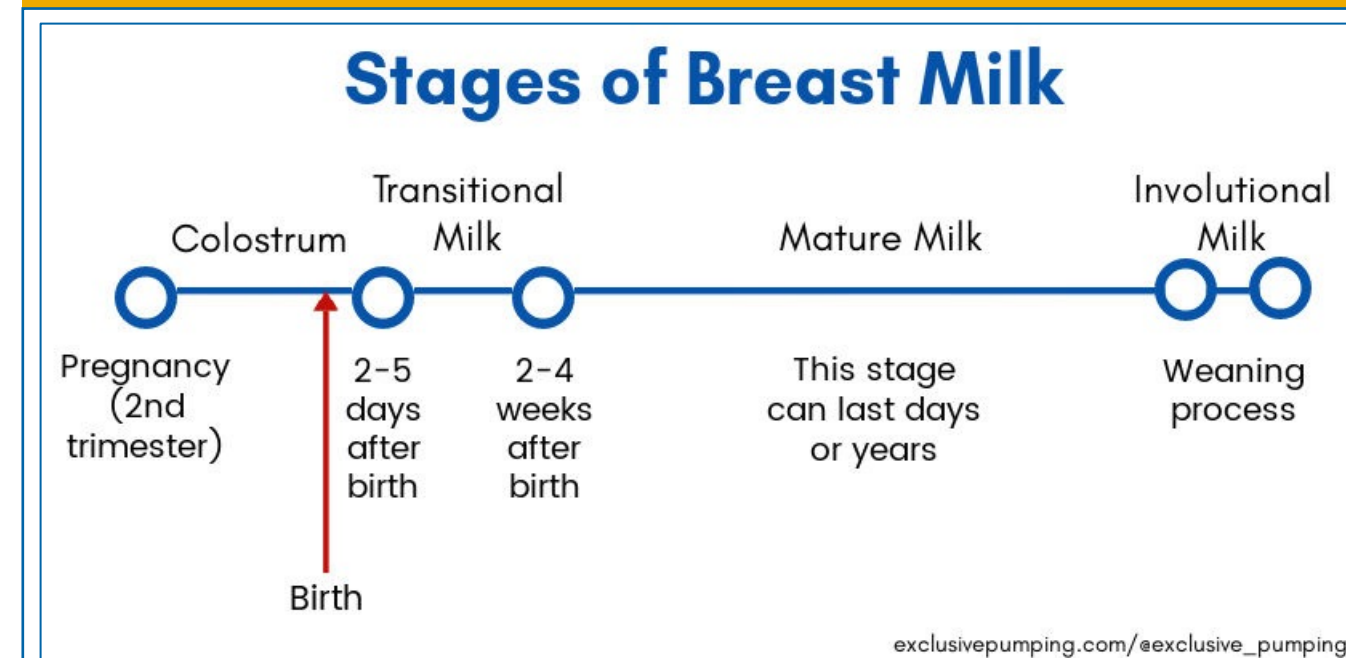
Rebecca McLennan, Eric S. Geanes, Angela Dickerson and Todd Bradley

Children's Mercy Research Institute

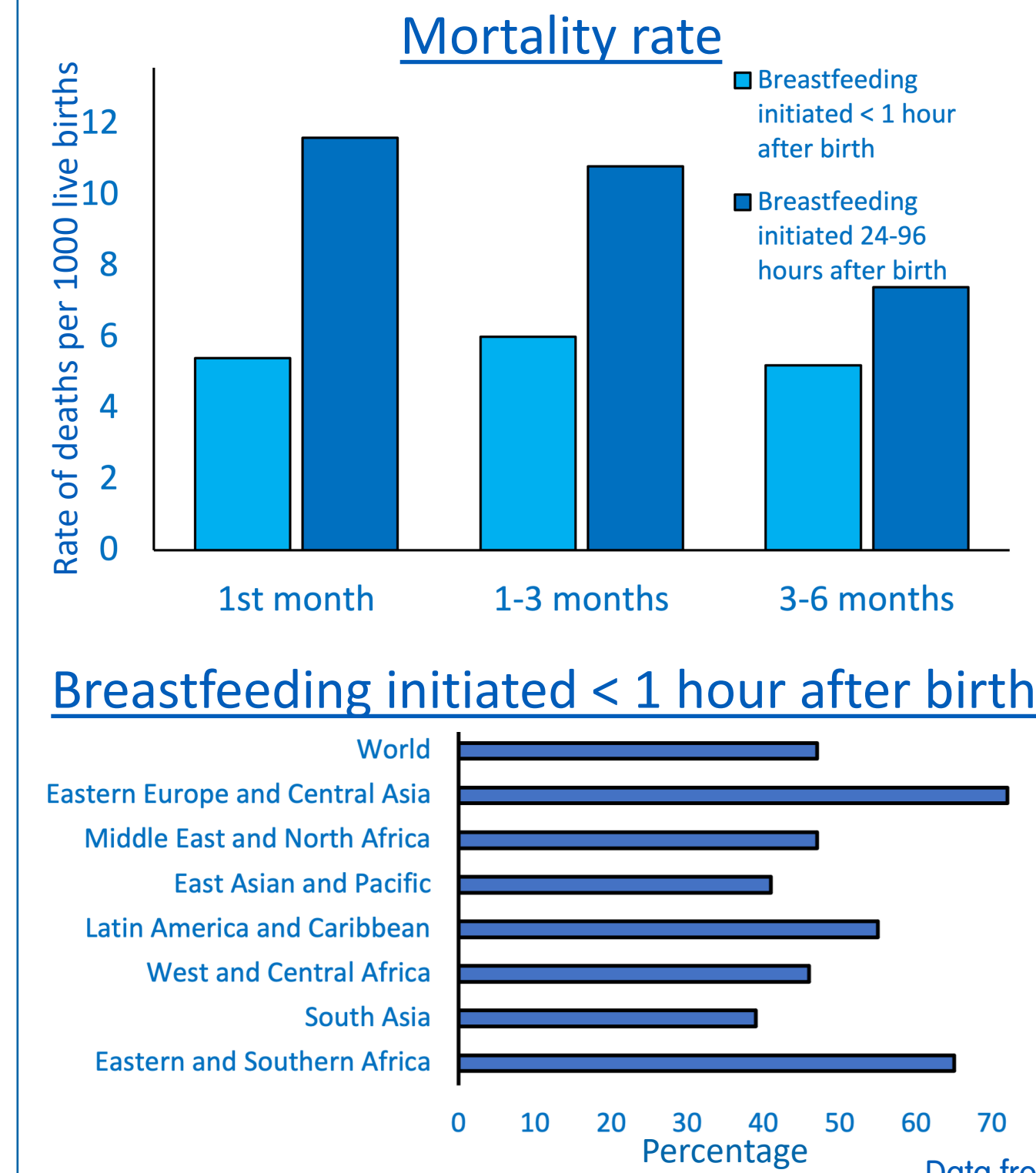
Abstract

Infants born premature have increased susceptibility to infection and other immune complications. Human milk feeding has been associated with fewer infections and reduced intestinal inflammation leading to improved health outcomes. The composition of milk is variable between mothers and changes over the course of lactation to meet the needs of the growing infant. There is an urgent need to define the components of milk that are critical for protecting against infection and improving infant health. Premature infants often receive combinations of feeding that includes donor milk that is derived from mature milk. Thus, premature infants could receive milk that lacks critical components present in early milk or colostrum. In this study, we determined the impact of early colostrum feeding had on long term health outcomes using a mouse cross-fostering feeding model. We compared body weight, fat composition, and antibody responses to Respiratory Syncytial Virus (RSV) vaccine over time in pups who were fed limited, normal, or excess amounts of colostrum. These conditions were achieved by cross fostering newborn and 1 week old mouse pups. We found that pups who ingested limited colostrum had a reduction in body weight compared to pups that ingested normal amounts of colostrum. Furthermore, this weigh discrepancy was maintained for at least the first month of life, corresponding to the juvenile stage of development. There were also differences in the antibody response to the RSV vaccine in the pups that did not receive colostrum. These experiments will provide key insights into the importance of colostrum and milk derived-immune factors on infant development.

Background



- Colostrum is the milk produced within the first few days after birth before transitioning to mature milk production.
- Compared to mature breast milk, colostrum is higher in proteins and immune factors and lower in sugars and fats.
- Early breastfeeding initiation is associated with lower mortality.
- Donor milk is mature milk not colostrum.
- Children who are breastfed for long periods have been shown to have lower infectious morbidity and mortality, fewer dental malocclusions, and higher intelligence. This inequality persists until later in life.
- Growing evidence also suggests that breastfeeding might protect against obesity and diabetes later in life.
- The scaling up of breastfeeding could prevent an estimated 823,000 child deaths every year.

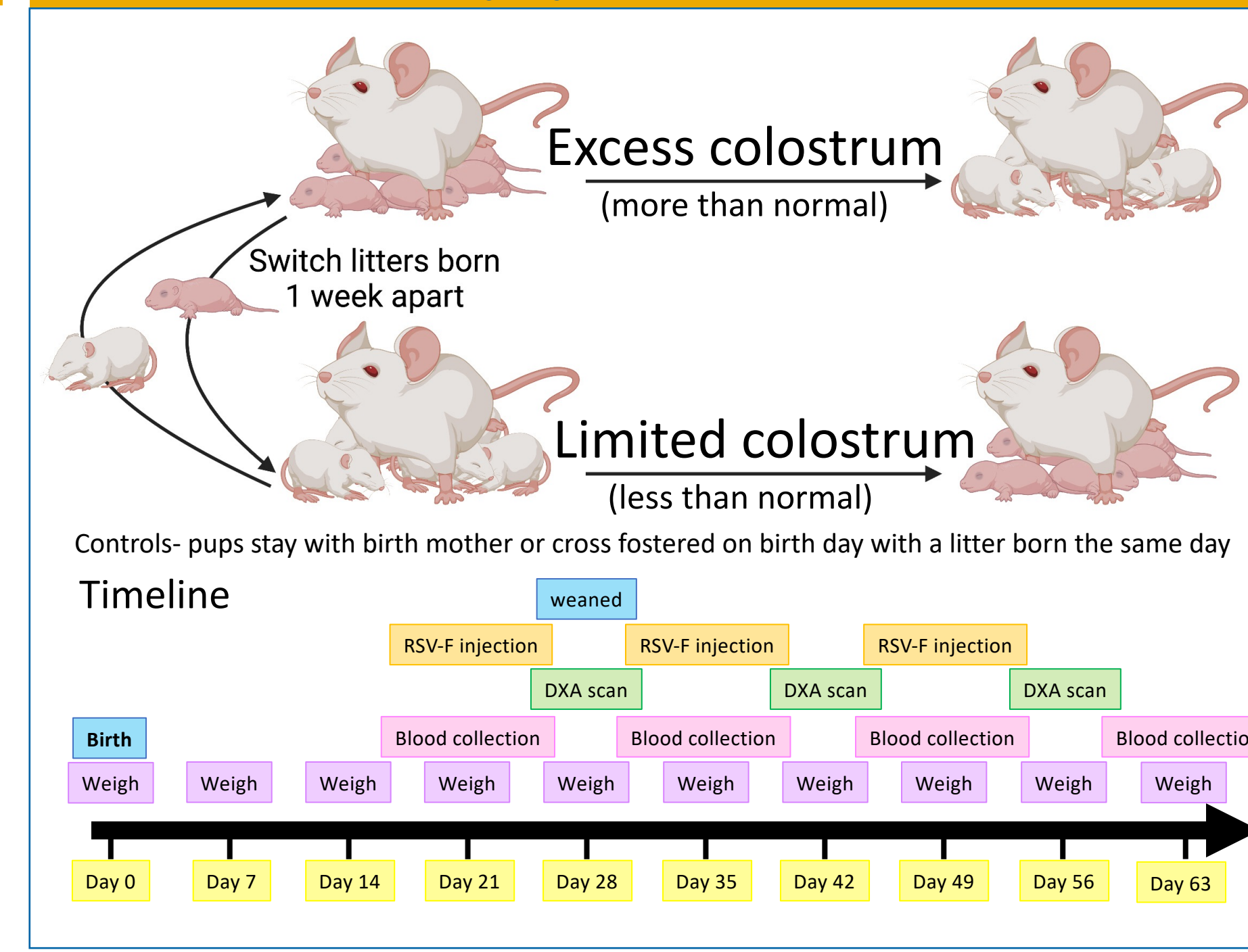


Data from WHO Collaborative Study Team, Lancet, 2000, UNICEF global databases and references cited

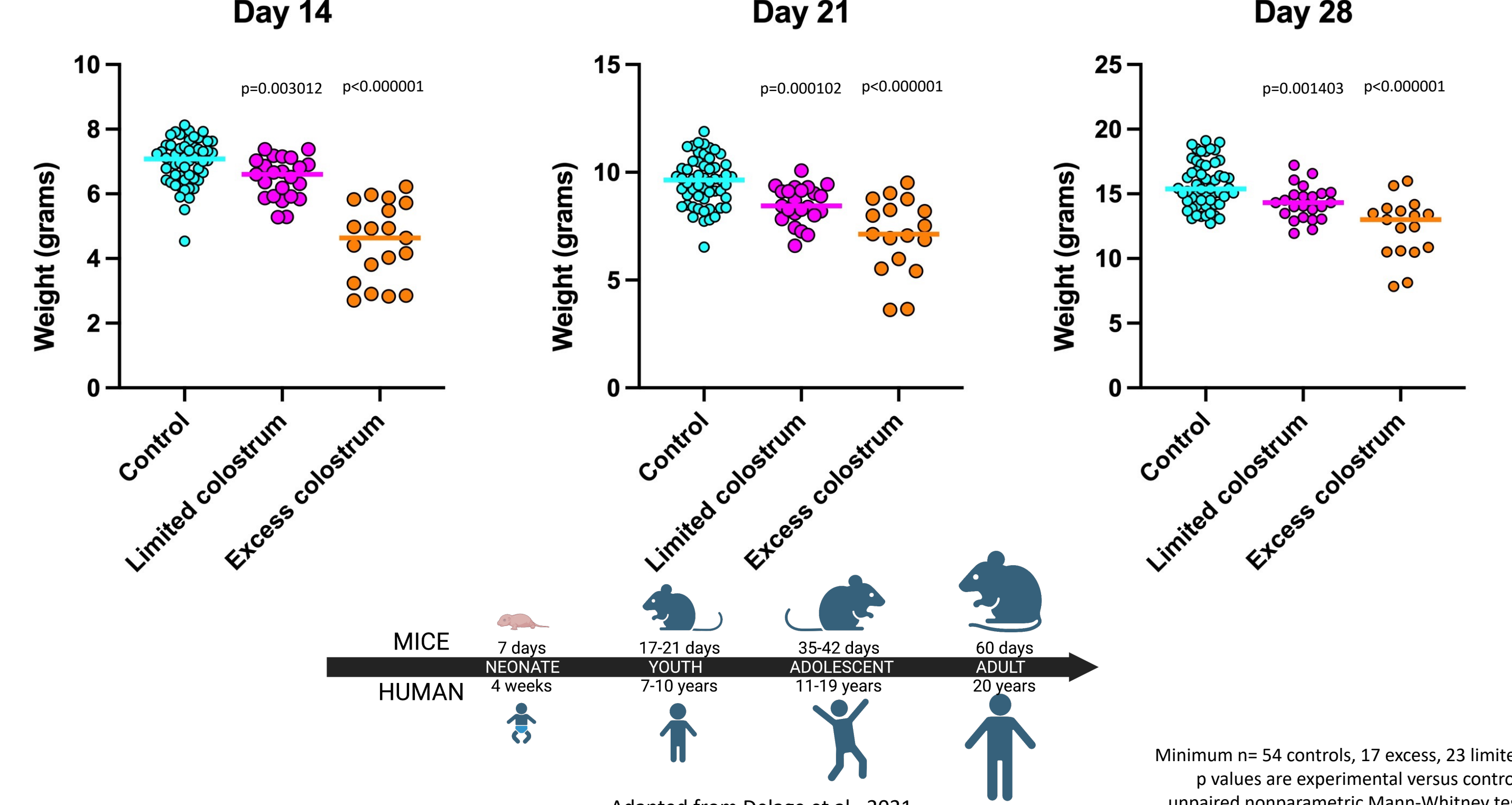
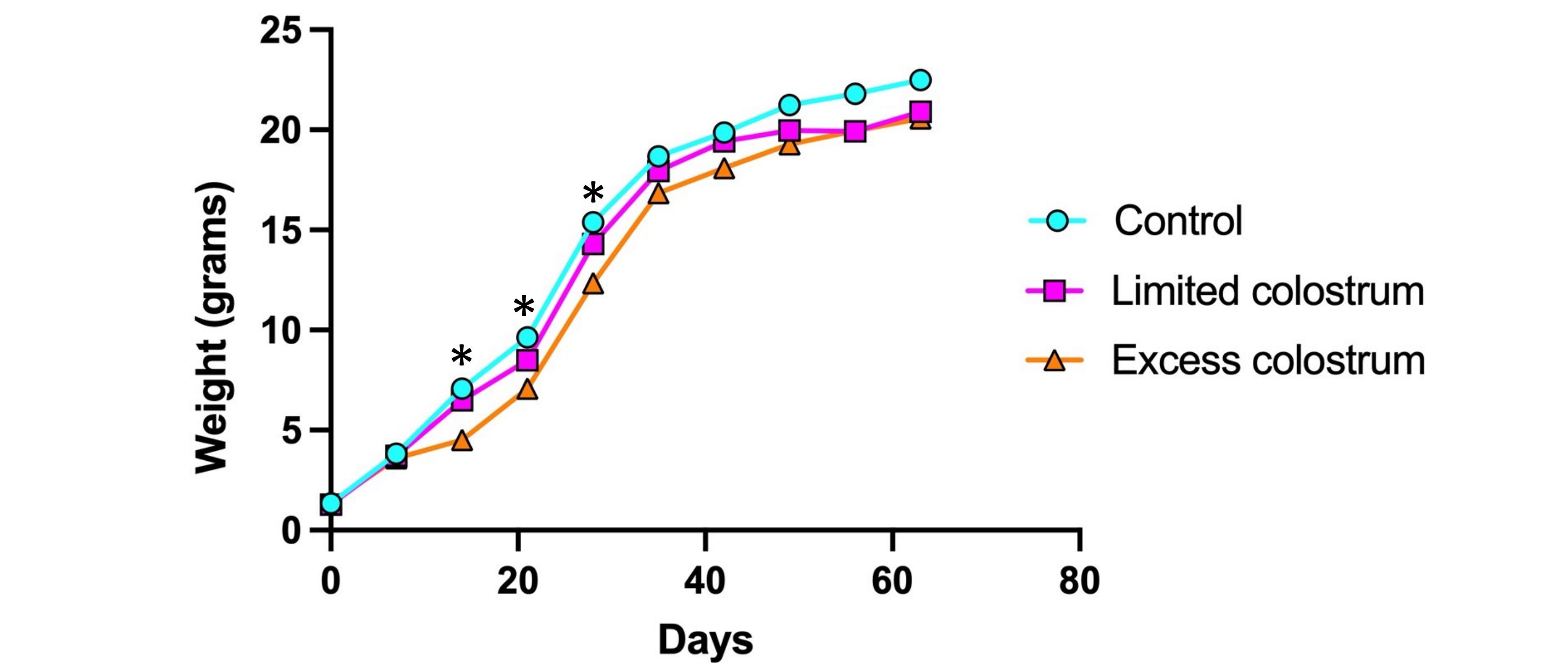
Goal

Determine the significance of colostrum on long term growth and antibody response

Approach

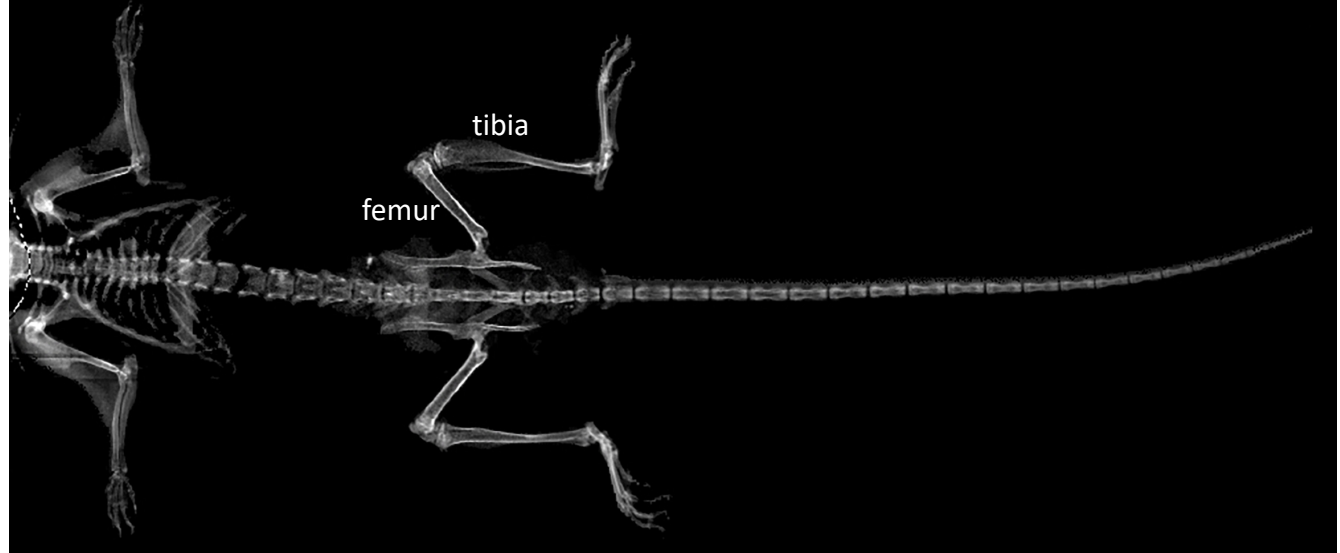
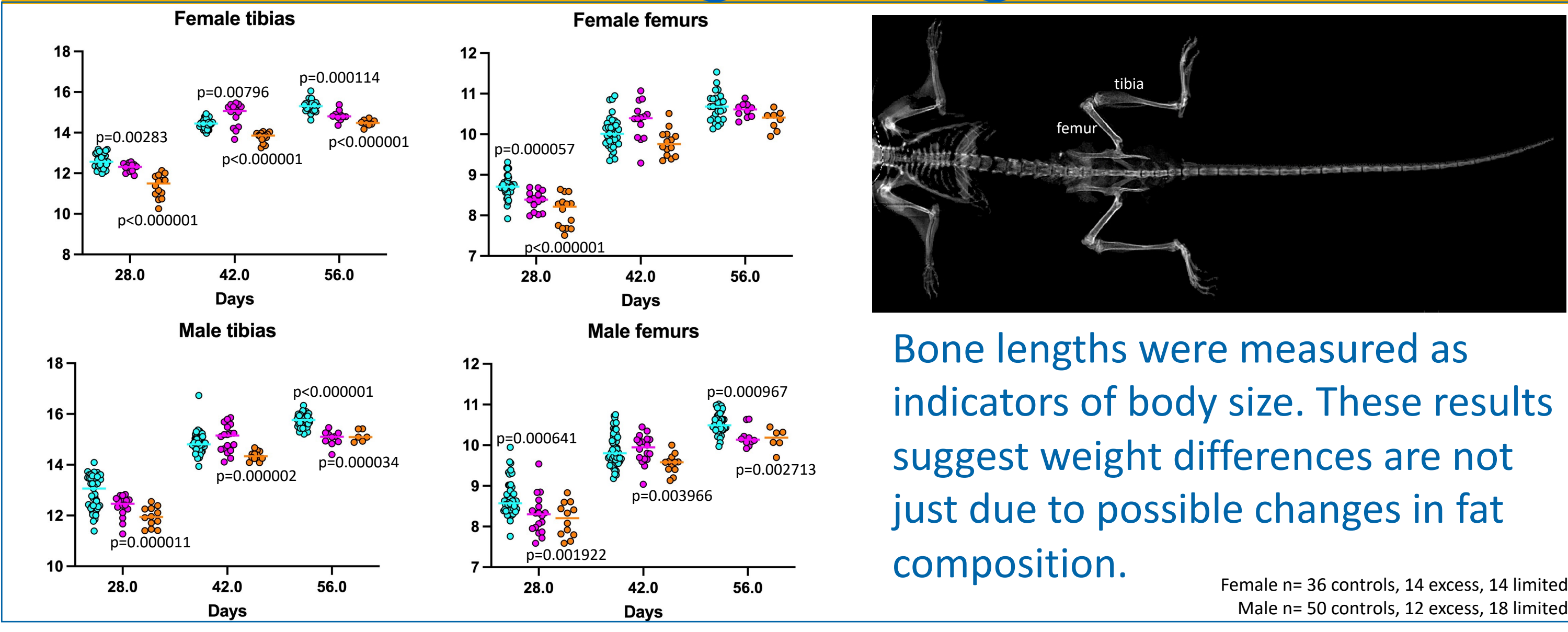


Limited and excess colostrum reduced pup weight



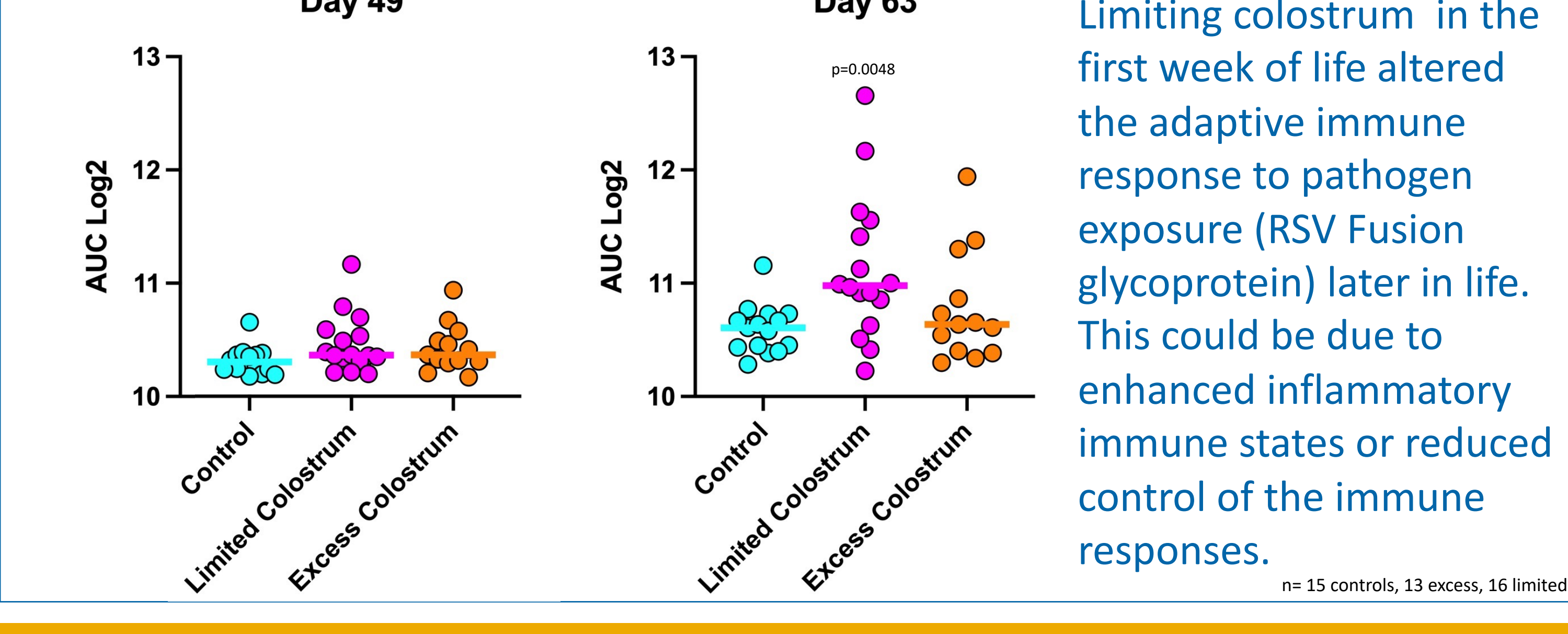
Minimum n = 54 controls, 17 excess, 23 limited p values are experimental versus control, unpaired nonparametric Mann-Whitney test

Limited and excess colostrum reduced bone length long term



Bone lengths were measured as indicators of body size. These results suggest weight differences are not just due to possible changes in fat composition.

Limited colostrum increased long term antibody response to RSV-F

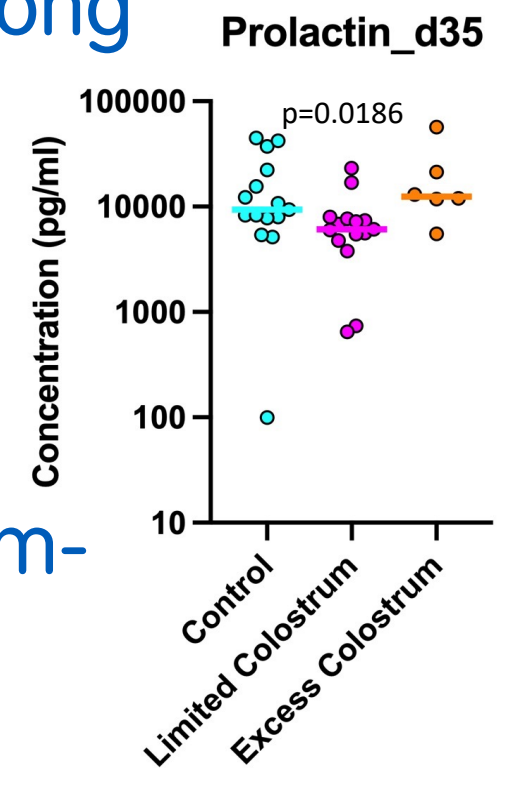


Limiting colostrum in the first week of life altered the adaptive immune response to pathogen exposure (RSV Fusion glycoprotein) later in life. This could be due to enhanced inflammatory immune states or reduced control of the immune responses.

Summary and current directions

Early feeding patterns can affect growth and imprint the innate and adaptive immune system for responses in later life

- Both excess and limited colostrum reduced pup weight and size long term, suggesting that all stages of milk are important for growth
- Normal long term immune responses require colostrum
- Currently determining any possible changes in fat percentage, cytokine and hormone levels based on colostrum ingestion
- Currently investigating importance of immune system on colostrum-mediated changes in weight, cytokine and hormones levels by performing cross fostering experiments between wildtype and immunodeficient mice strains



Minimum n = 15 controls, 13 excess, 16 limited