# Feeding Bovine Colostrum to Chickens Creates Healthier Guts and Better Growth

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JUNE 2025

doi.org/10.33548/SCIENTIA1272

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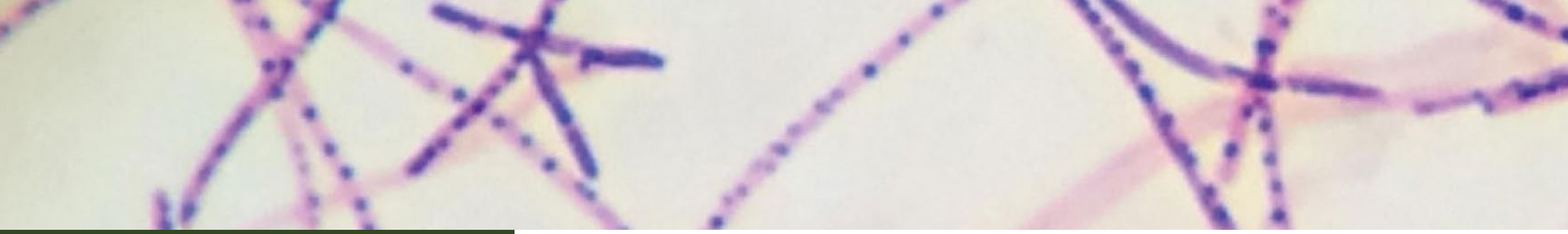


# Feeding Bovine Colostrum to Chickens Creates Healthier Guts and Better Growth

A research team at the University of Maryland School of Medicine has discovered that a simple food supplement, specifically defatted bovine colostrum, can significantly enhance chicken gut health, reduce inflammation, and improve growth efficiency. The findings have implications for both animal welfare and human health under the One Health concept.



## The Complex Relationship Between Diet, Gut Health, and Growth

Most parents are aware that a mother's first milk – colostrum – provides newborns with critical immune protection and essential nutrition for a healthy start in life. Now, researchers have discovered that bovine colostrum, the first milk produced by cows after giving birth, might offer surprising benefits beyond the mammals for which it was intended.

A research team led by Dr Ted Elsasser at the USDA Agricultural Research Service and Dr Alan Cross at the University of Maryland School of Medicine has found that adding defatted bovine colostrum to chicken feed results in significant improvements in gut health, reduced inflammation, and enhanced growth efficiency.

Their study, published in Animal Microbiome, represents a comprehensive assessment of how short-term, low-level colostrum supplementation affects gut inflammation specifically in the ileum, the final section of the small intestine.

This finding is particularly relevant as the agricultural industry moves away from antibiotic growth promoters in animal feeds. For decades, antibiotics were added to animal feed not only to prevent disease but also to enhance growth – a practice now largely curtailed due to concerns about antimicrobial resistance. Scientists and farmers have been searching for alternative approaches that can deliver similar benefits without contributing to this global health threat.

Both Dr Elsasser and Dr Cross emphasise that gut health in food animals isn't just about animal welfare – it also directly impacts human health. This is what scientists refer to as the One Health concept, which acknowledges the interdependence between animal and human health.

## Studying the Effects of Colostrum in Chickens

The commercial broiler chicken represents an ideal model for studying gut health interventions. These birds have been selectively bred for rapid growth and efficient feed conversion. However, this trait makes them particularly sensitive to even mild stressors, which can negatively impact their nutrient use efficiency.

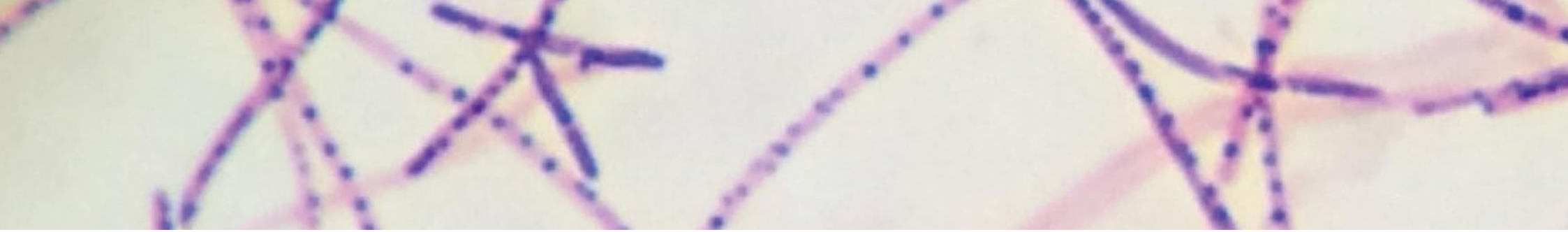
To investigate the potential benefits of colostrum, Dr Elsasser and Dr Cross conducted a controlled experiment using the rapidly growing Ross 708 chicken strain. They compared three diets: a standard diet (control), a standard diet supplemented with non-fat dry milk (NFDM) as a nutritional control, and a standard diet supplemented with centrifuge-defatted bovine colostrum (BC).

The researchers collected colostrum from both Jersey and Holstein dairy cows, from both first and second milkings after giving birth. They then processed this colostrum by centrifuging it to remove the fat and cellular components, retaining only the liquid portion, which was then added to the feed.

The chickens received these diets for eight days. Throughout this period, the researchers measured feed consumption and weight gain to calculate feed efficiency. After eight days, the chickens were humanely euthanised, and their intestinal tracts were examined for structural changes, inflammation markers, beneficial metabolites, and alterations in the gut microbiome.

## Improved Feed Efficiency and Reduced Inflammation

Dr Elsasser and Dr Cross found that chickens fed the bovine colostrum-supplemented diet showed approximately 9% better feed efficiency compared to those fed either the control or NFDM-supplemented diets.



In other words, these birds gained more weight from the same amount of feed.

This improved efficiency correlated with significant changes in gut structure. The BC-fed chickens had a 42% greater calculated villus surface area compared to the control group. These villi are finger-like projections that increase the gut's absorptive surface. Moreover, the BC group had a lower villus-to-crypt ratio, indicating more active cell production and turnover – a sign of healthy intestinal function.

Beyond these structural changes, the team found that chickens fed the BC-supplemented diet had 37% less tyrosine-nitrated protein content in their ileal epithelial cells compared to both the control and NFDM groups. These proteins serve as indicators of nitro-oxidative stress and inflammation, suggesting that their reduction may indicate a healthier gut environment.

## Anti-inflammatory Metabolites and a Transformed Microbiome

To understand how colostrum supplementation might be creating these benefits, Dr Elsasser and Dr Cross conducted comprehensive metabolomic profiling of the ileal digesta (the intestinal contents) across all three dietary groups. They identified 649 named compounds and 300 unnamed compounds, creating a detailed picture of the gut's chemical environment.

The BC-fed chickens showed a significantly more complex metabolite profile than either the control or NFDM groups. They had higher levels of several classes of compounds with documented anti-inflammatory properties, including flavonoids, bile acids, glutathione precursors, tryptophan metabolites, and prebiotic oligosaccharides.

To make sense of this complex metabolic data, Dr Elsasser and Dr Cross developed an 'anti-inflammatory index' (A-i-i) based on metabolites that consistently demonstrated anti-inflammatory properties. This index revealed that the BC-fed chickens had a significantly higher A-i-i than either the control or NFDM groups, and a strong negative correlation existed between this index and the level of inflammatory proteins – the higher the A-i-i, the lower the inflammation.

The most striking changes, however, were in the gut microbiome. In conjunction with Drs Jacques Ravel and Bing Ma at the Institute for Genomic Sciences at the University of Maryland School of Medicine, using 16S rRNA gene sequencing, the researchers conducted a comprehensive survey of the microbial communities in different sections of the intestinal tract. The BC-fed chickens showed significant enrichment of beneficial bacteria, particularly in the ileum.

One of the most striking findings was the dramatic increase in segmented filamentous bacteria (SFB), specifically *Candidatus Arthromitus*, in the ileal mucosa of BC-fed chickens. These specialised bacteria attach directly to the intestinal epithelial cells and play a crucial role in developing a healthy immune system.

Interestingly, the raw colostrum itself did not contain these bacteria, suggesting that components in the colostrum were creating an environment that favoured their growth. Further analysis showed a strong positive correlation between the oligosaccharide content of the ileal digesta and the abundance of *Candidatus Arthromitus*.

## A Comprehensive Model of Gut Health

By combining all these findings, Dr Elsasser and Dr Cross propose a comprehensive model explaining how bovine colostrum supplementation enhances chicken gut health and growth efficiency.

The BC supplement provides precursors for anti-inflammatory compounds and supports the growth of beneficial bacteria that produce these compounds. This healthier metabolic environment results in reduced inflammation and protein nitration in gut cells. With reduced inflammation, the gut develops a larger absorptive surface area, characterised by an increased number of villi.

The colostrum supplement simultaneously promotes a healthier, more diverse microbiome, including beneficial bacteria like *Candidatus Arthromitus*. With less energy diverted to inflammatory processes and a larger absorptive surface, more nutrients can be directed toward growth rather than fighting inflammation. The culmination of these changes is the more efficient conversion of feed into body weight.

Further, unlike antibiotics which have been continuously administered, the beneficial effect of the BC supplement can be given for just a short period of time during the growth cycle (e.g., 8 days), making it cost-efficient as well.

## Wider Implications for the One Health Concept

While this research focused on chickens, the implications extend far beyond poultry production. For decades, low-dose antibiotics were used to promote growth in livestock, a practice now being phased out due to concerns about antimicrobial resistance. The research suggests that colostrum supplementation might provide similar benefits without contributing to this serious public health threat. The findings underscore the crucial role of the gut microbiome in overall health and the potential for diet to influence this complex ecosystem. Many of the anti-inflammatory compounds identified in this study have also been shown to have benefits in humans, suggesting potential applications beyond animal agriculture.

This research represents a significant step toward understanding how dietary interventions can promote gut health and enhance feed efficiency without the use of antibiotics. By focusing on natural supplements like colostrum, researchers are discovering ways to work in harmony with the body's own systems rather than override them. As agriculture continues to face the dual challenges of producing more food while reducing environmental impact and antibiotic use, such natural approaches to improving animal health and efficiency could prove increasingly valuable. Through the lens of One Health, these benefits for animal health may ultimately translate to improved human health as well.

Find out more at **scientia.global**

## MEET THE RESEARCHERS

### Dr Alan Cross

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Dr Alan Cross earned his BA in Government from Harvard College in 1966 and his MD from the University of Pennsylvania School of Medicine in 1970. Following medical training and military service as a Colonel in the U.S. Army Medical Corps at Walter Reed Army Institute of Research until 1994, he joined the University of Maryland School of Medicine, where he is currently a Professor in the Department of Medicine. Dr Cross is internationally recognised for his work on bacterial sepsis, focusing on developing vaccines against endotoxin and Gram-negative bacteria. He has received numerous honours, including the Frederik Bang Award from the International Endotoxin and Innate Immunity Society (2024). He is a Fellow of both the American Academy of Microbiology and the Infectious Diseases Society of America. With over 230 peer-reviewed publications and 23 patents, his research has been continuously funded for decades, recently focusing on Klebsiella pneumoniae vaccine development to combat antimicrobial resistance.


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#### FUNDING

This work was supported by the USDA-ARS base funds for the National Program 101 as conducted under CRIS 8042-3100-108-00D and the Maryland Innovation Initiative Technology Assessment award from the Maryland Development Corporation (TEDCO)

### Dr Ted Elsasser

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Dr Ted Elsasser earned his BA in Microbiology from Rutgers University (1972), MA in Biology from Hunter College (1974), and PhD in Physiology from the Medical University of South Carolina (1979). He served as a Research Animal Scientist and Lead Scientist at the USDA Agricultural Research Service for over 35 years until his retirement in 2018. His research focused on hormone-cytokine interactions, proinflammatory perturbations to growth, and alternatives to antibiotic growth enhancement in livestock. His work includes developing critical models of proinflammatory stress in livestock and nutritional interventions to combat inflammation-driven pathologies. He has published 189 peer-reviewed articles, 9 book chapters, and served as Project Officer at the National Academy of Science – yielding the National Academy Press book titled "The use of Drugs in Food Animals: Benefits and Risks". He was awarded the 2012 American Society for Animal Science International Award for Research in Growth and Development. Dr Elsasser was on the organizing committees for several research organizations, including the American Society for Animal Science Symposia on Animal Health, International Conference on Farm Animal Endocrinology, and the NIH Technology Assessment Conference on the human health aspects of use of recombinant bovine somatotropin in dairy cattle. Presently, he is an Adjunct Professor at the School of Medicine, University of Maryland, Baltimore.


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#### FURTHER READING


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