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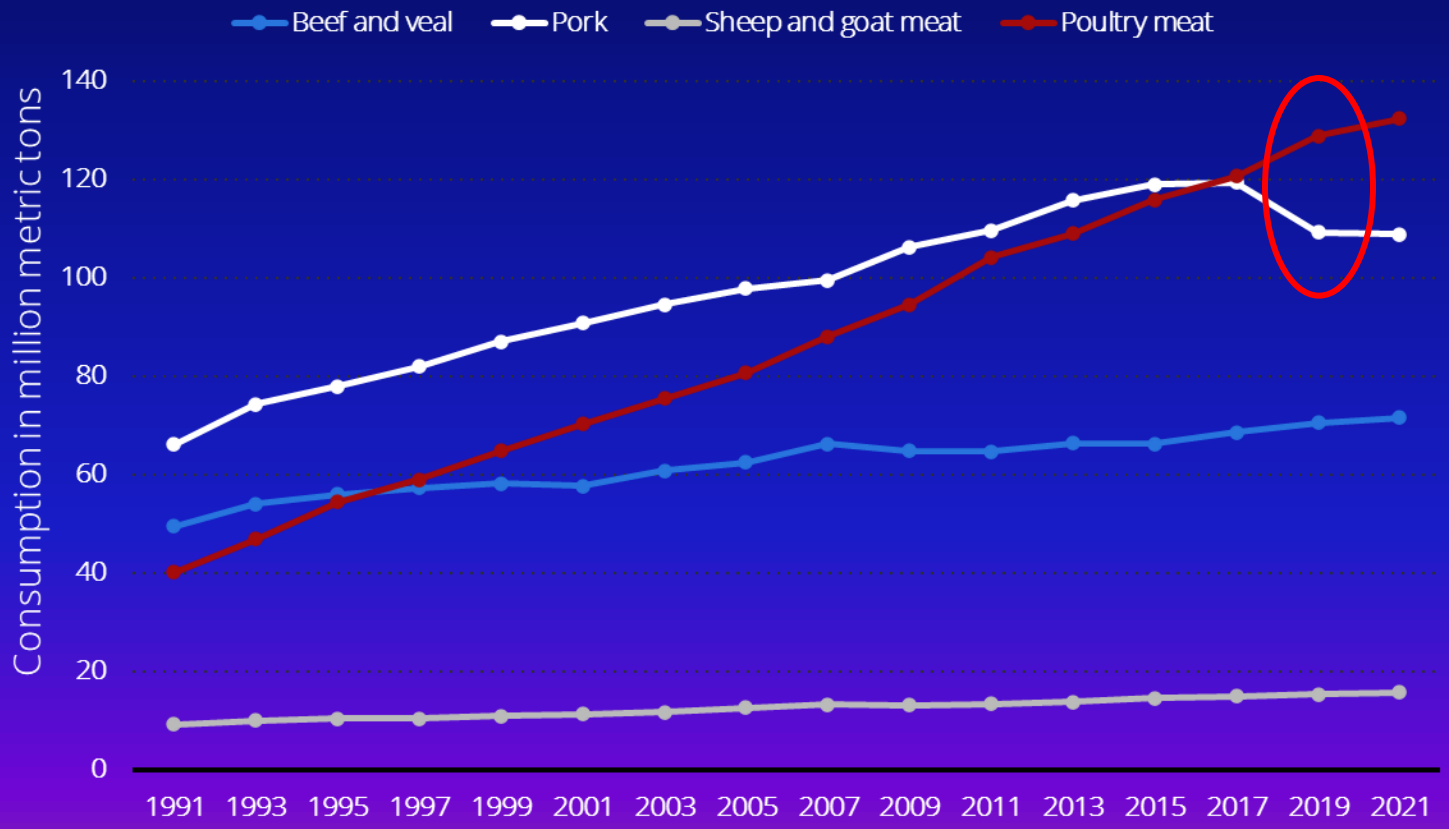
Effects of Dietary Sodium Alginate on Growth Performance and Renal Gene Expression in Broiler Chickens

Introduction

Poultry became the world's most consumed meat in 2019, with a cheaper, nutritious, and healthier choice over red meat species.



Source(s): OECD; FAO; ID 274522

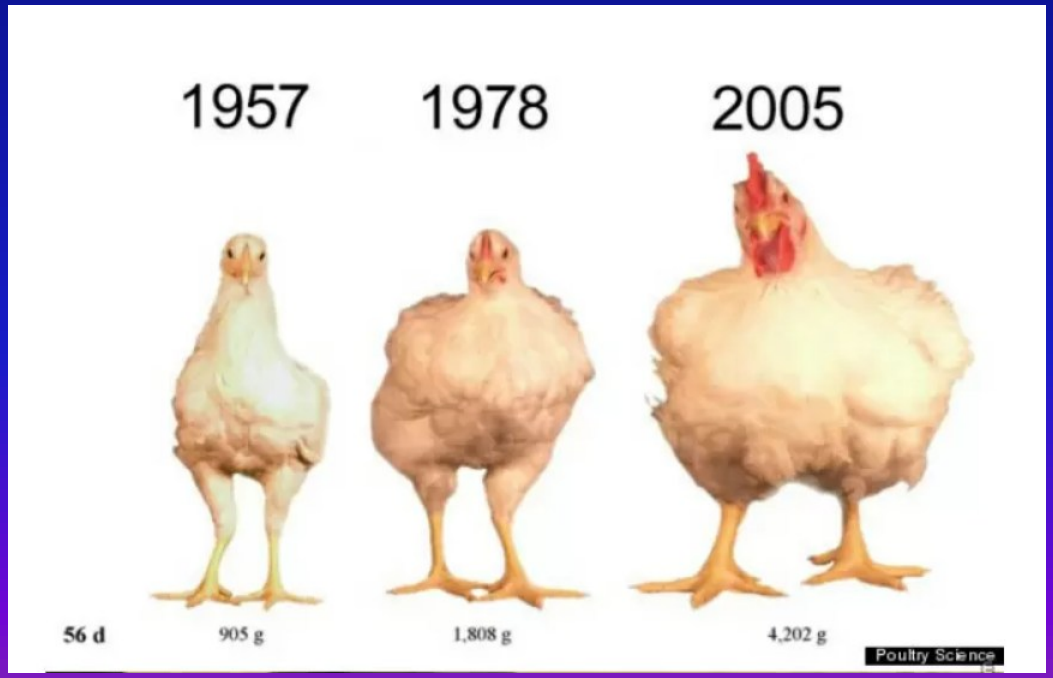
Introduction

- Poultry is less expensive and has fewer religious and cultural restrictions.

Introduction

- To meet this growing demand, the poultry industry has successfully implemented breeding programs, resulting in double body weights over the past 50 years.

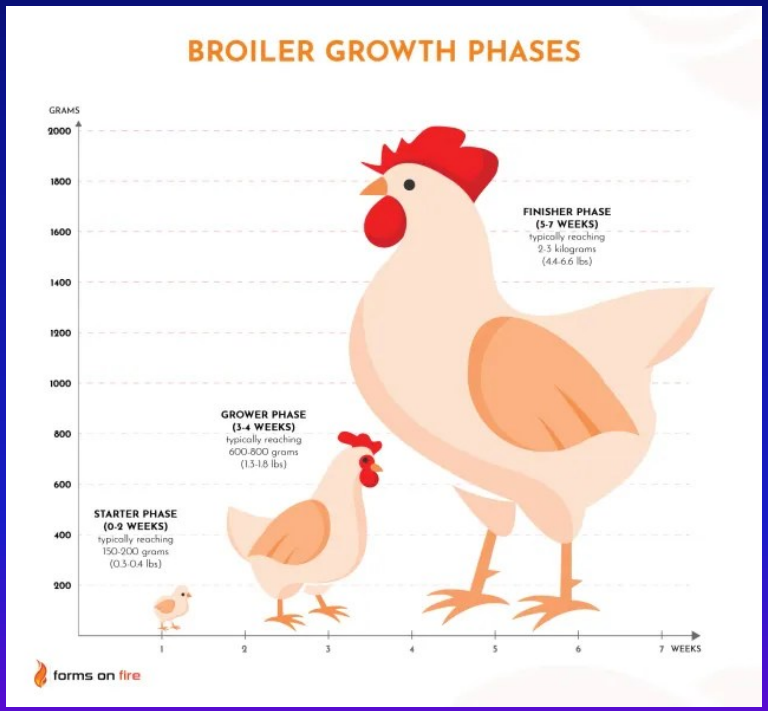
Zuidhof et al., 2014



Introduction

- Accelerated growth result in more reactive oxygen species (ROS) and nitrogen turnover, leading to:

1) More oxidative stress
2) More inflammatory stress
3) More hypoxic stress

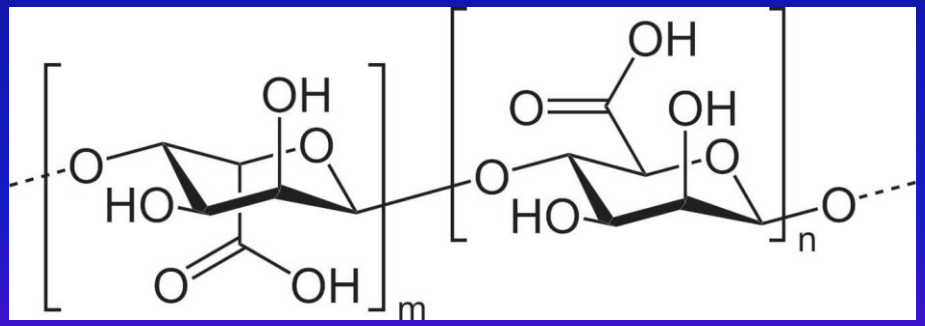


Oke et al., 2024

Introduction

- Previous studies shown that sodium alginate has improved immune functions and antibacterial effects by enhancing phagocytic activity in humans, rats, and chickens.

Yan et al., 2011



Objective

- The objective of this research was to evaluate the effects of sodium alginate supplement on broiler's

  1) Growth performance

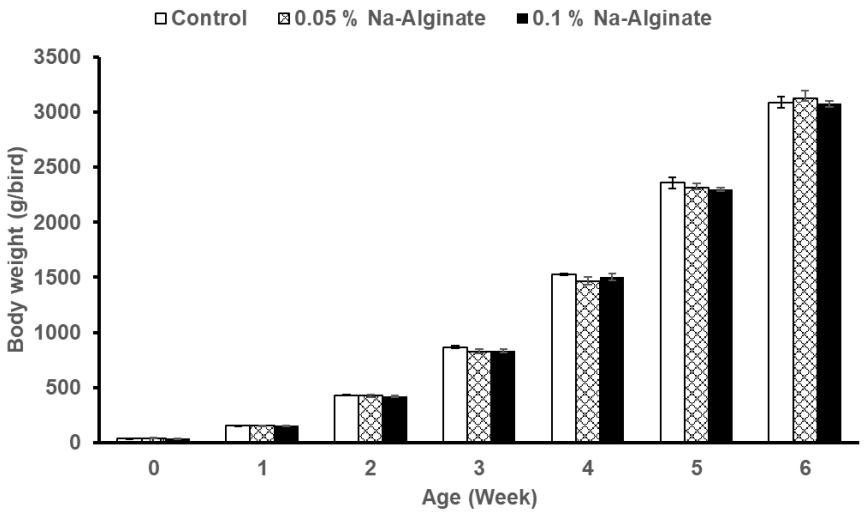
  2) 12 stress-related renal gene expressions

Experiment

270 Chicks
(1 day old)

Control	0.05 % Na-alginate	0.1 % Na-alginate
(N = 90)	(N = 90)	(N = 90)
6 pens (15 birds/pen)	6 pens (15 birds/pen)	6 pens (15 birds/pen)

Results



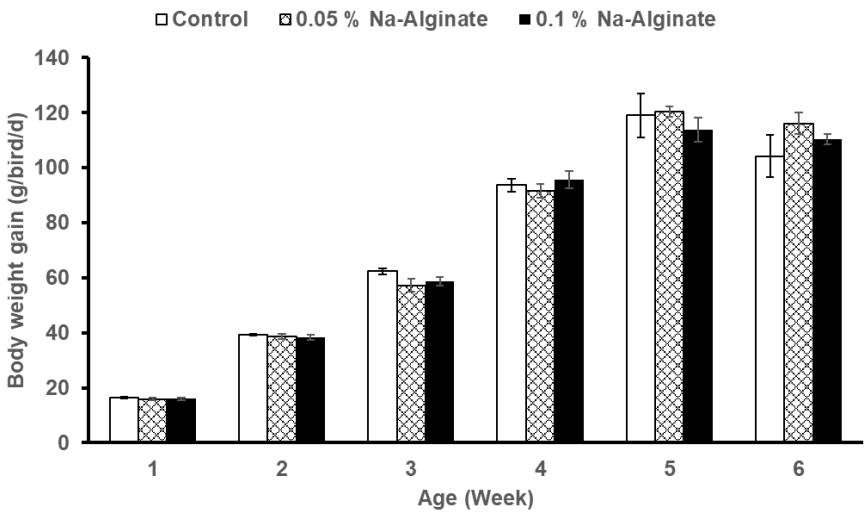


Fig 1. Effect of dietary sodium alginate on body weight and body weight gain of broiler chickens over 6 weeks

Results

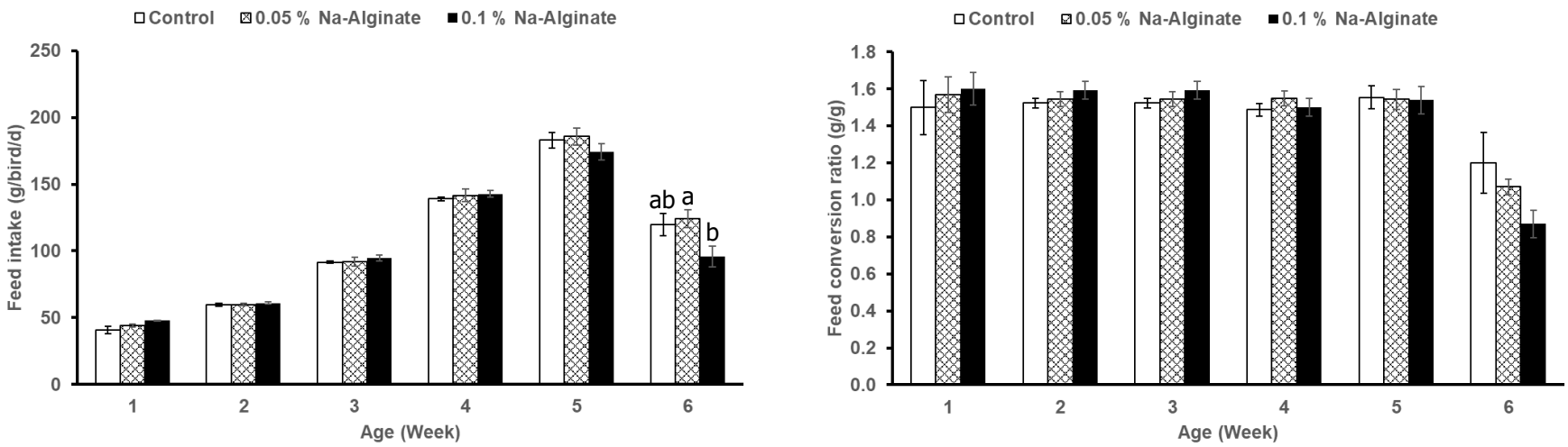


Fig 2. Effect of dietary sodium alginate on feed intake and feed conversion ratio of broiler chicken over 6 weeks

Results

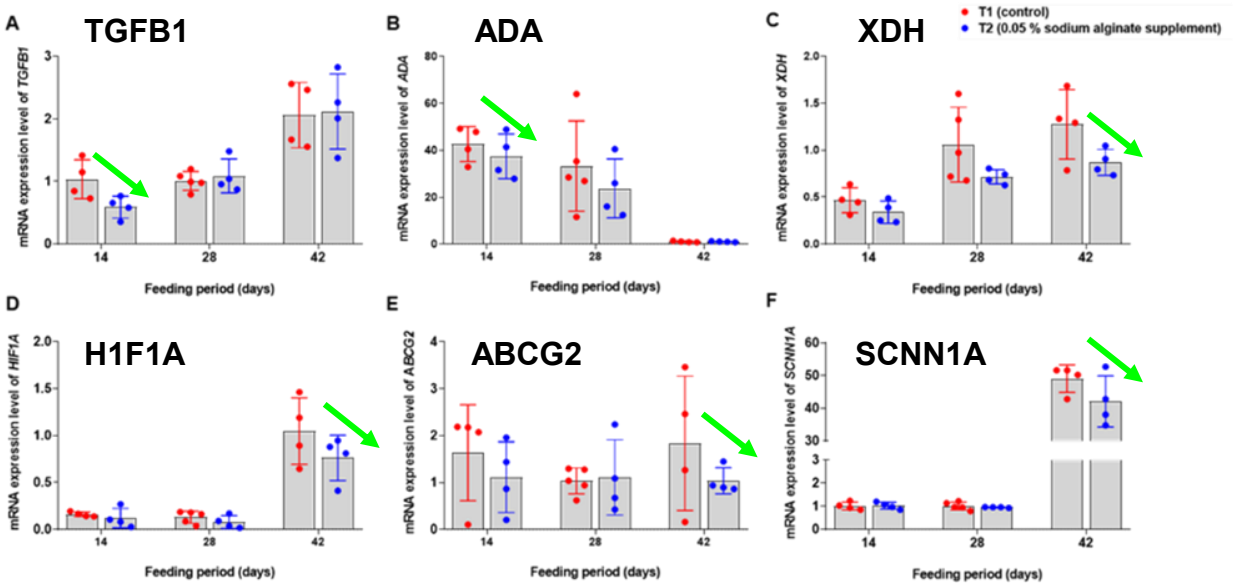


Figure 3. Time-course transcriptional profiles of five renal stress–related genes (*ADA*, *XDH*, *HIF1A*, *TGFB1*, ABCG2, and *SCNN1A*) showing differential modulation by 0.05% sodium alginate supplementation during the 42-day broiler rearing period.

(a) *TGFB1* expression representing delayed fibrotic activation and stable ECM remodeling. (b) *ADA* expression indicating attenuation of inflammatory purine metabolism. (c) *XDH* expression reflecting reduced oxidative load and uric acid synthesis. (d) *HIF1A* expression showing decreased hypoxic stress under alginate feeding. (e) *ABCG2* expression demonstrating lowered demand for metabolic waste efflux and improved renal metabolic efficiency. (f) *SCNN1A* expression indicating enhanced sodium reabsorption and epithelial barrier integrity, contributing to improved renal ion homeostasis and fluid balance.

Conclusions

- No significant difference was observed in live bird weight during the period of 6 weeks.
- No significant difference seen for feed consumption, expect week 6.
- Broilers in control diet inducted oxidative burden, hypoxic adaptation, and ionic stress, respectivelyl, by increasing upregulation in TGFB1, XDH, HIF1A, and SCNN1A,
- However, broilers in 0.1% alginate supplement enhanced transcriptional stability by significantly reducing these expression for ADA and TGFB1 at day 14, and ABCG2 at day 42.

Acknowledgement

We thank USDA-NIFA for funding for this research and Foster Farms for proving their birds.

Questions???