Alternatives to Antibiotics in Poultry Diets

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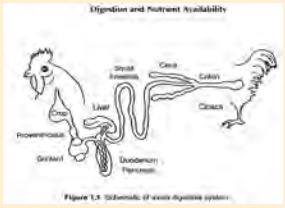
Poultry Production System

- Goals
  - To Optimize Performance
    - Feed Cost over 65% of Production
  - Minimize Nutrient Excretion
  - Promote Bird Health
    - Gastro-intestinal tract
      - Barrier
      - Microbiota
      - Immune organ



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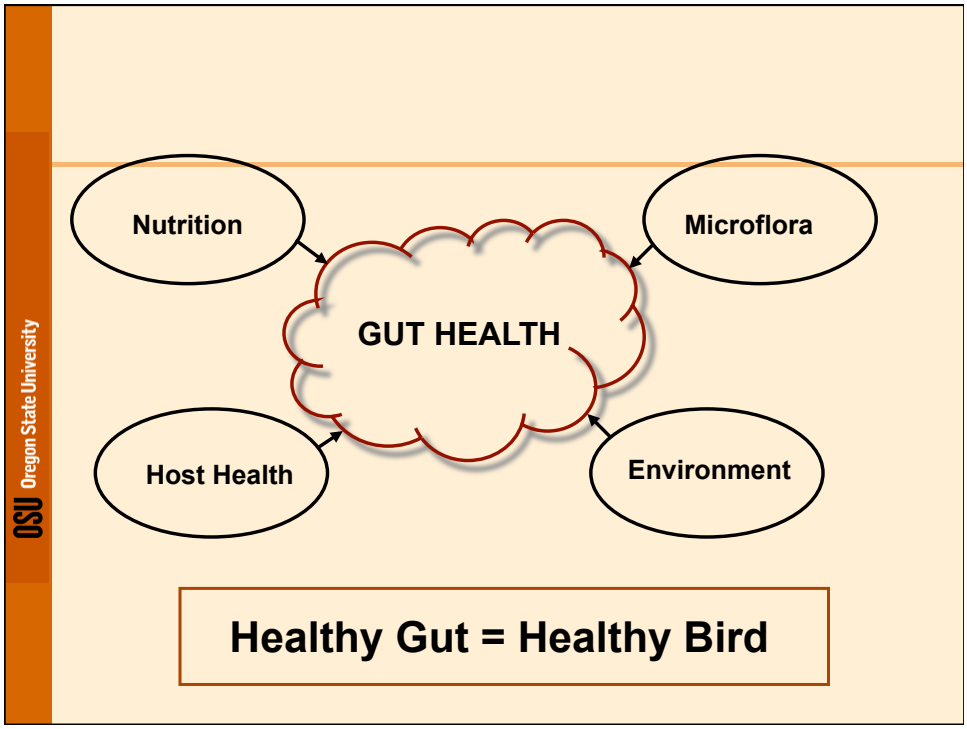
Nutrition
Microflora
GUT HEALTH
Host Health
Environment
Healthy Gut = Healthy Bird
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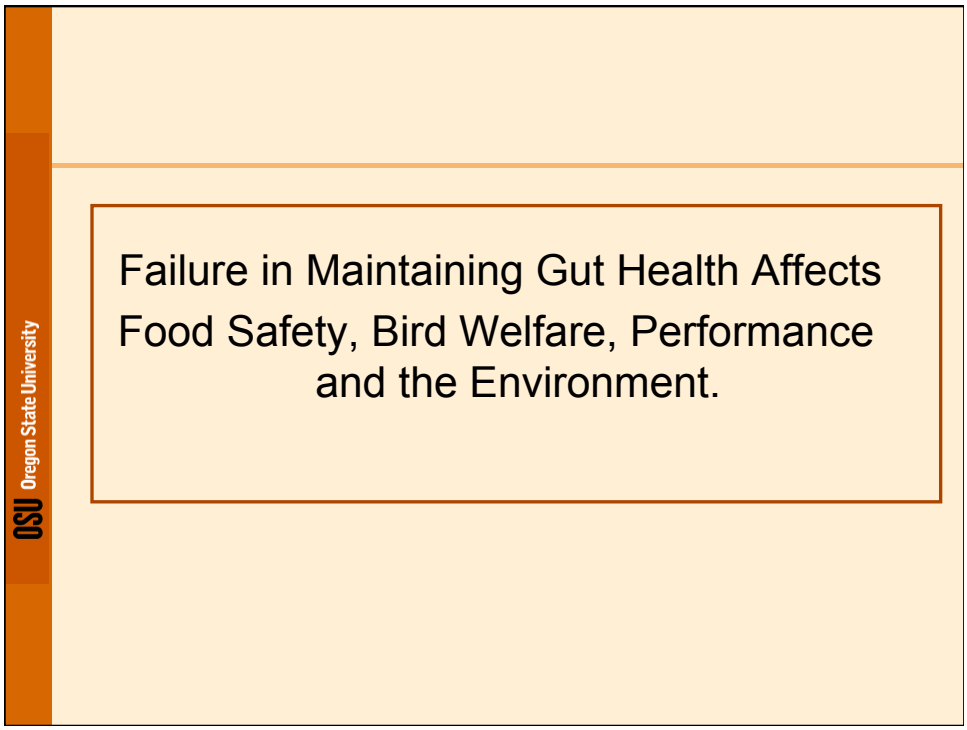
Failure in Maintaining Gut Health Affects
Food Safety, Bird Welfare, Performance
and the Environment.
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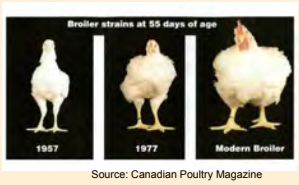
Nutrition: Jungle Fowl vs. Modern Poultry

- Diets
  - Varied diets vs. Corn-soy
    - Omnivore vs. Granivore
- Gut Structure
  - Less processed feeds
- Selective Breeding
  - Fast growth
  - Increase in nutrient requirements
  - Dampened Immunity



Source: Canadian Poultry Magazine

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Managing Gut Health

- Current Situation
  - 1. Vaccines
    - Protection against a particular pathogen
    - Response to vaccination
      - Feed withdrawal
    - Vaccination not an option for the many less virulent pathogens

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Managing Gut Health

- Current Situation
  - 2. Antimicrobials
    - Broad spectrum protection
    - Growth promotion
    - Continual usage
    - Species-specific

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Alternatives Measures Needed- Why?

- Global Problem
- Trend for Eliminating Antibiotics
  - Ban in EU
- Niche Markets
- Demand from Consumers, Scientific Community

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Alternatives Measures Needed- Why?

- Transfer of Antibiotic-Resistance Genes
  - (supergerm)
- Residues in Food Products
- Resistance Development
- Antibiotic Shuttling

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Alternatives Measures?

- Big Question
  - Not enough options or answers
- Using Feed Additives
  - Pro/Pre-biotics, Plant Extracts, Acidifiers, Enzymes, Neutraceuticals
- Enhancing Bird's Own Immune Health

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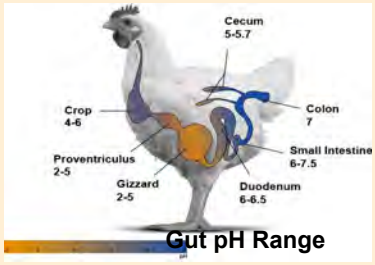
Alternatives Measures

- Use of Feed Additives
  - Diverse Functions
    - Influence Gut Health, Enzyme action, Antioxidant roles
    - Alteration in VFA production
      - pH shift in the gut
      - Reduce pathogens



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Alternatives Measures

- Probiotics or "Direct-Fed Microbials"
  - Mixed cultures of live protective microbes
    - Gut sterile, establish strong populations of beneficial 'good' gut microflora
      - e.g. Lactobacillus
    - Prevent colonization by 'bad' pathogens
      - e.g. E. coli
    - Administered at hatching
      - 'CenBiot', 'Biomate'

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Alternatives Measures

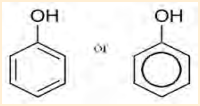
- Pre-biotics
  - Non-digestible feed ingredients
    - "Food for the good microflora"
      - Improving the intestinal balance
      - Selectively stimulating the growth of one or a limited number of bacteria
      - e.g. Mannan Oligosaccharides (MOS)
  - Pro + Pre-biotics = Synbiotics

Alternatives Measures

- Fiber Degrading Enzymes
  - Non-starch polysaccharides (NSP)
  - Increase the rate of digestion
  - Limit the amounts of substrates available to the microflora
    - Volatile fatty acid production
    - Digesta viscosity

Alternatives Measures

- Essential Oils, Herbs, Botanicals
  - Volatile oils, plant-derived, drugs from plants, roots, leaves
    - e.g. thymol, carvacol, eugenol, cinnamaldehyde
  - Phenolic compounds
    - Appetite, saliva, digestive enzymes, antioxidant action
    - Variability in the product/studies
    - Can be potent, odor, feed intake reduction, volatile, stability aspects



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Alternatives Measures

Studies with Broilers on Phytogenic Compounds in my lab

Feeding *Artemisia annua* alters digesta pH and muscle lipid oxidation products in broiler chickens

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Use of Organic Acid, Herbs and Their Combination to Improve the Utilization of Commercial Low Protein Broiler Diets

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Artemisia *annua* as Feed Additive in Poultry

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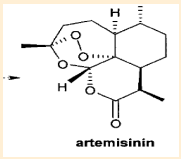
Artemisia *annua* as Feed Additive

- What is Known
- Anticoccidial Properties
  - Artesimin
  - Reduce Cecal Lesion
    - Dried leaves of Artemisia annua protect chickens against cecal lesions due to E. tenella infection (Allen et al.1997)



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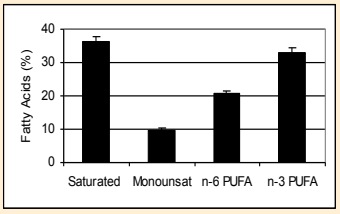
Artemisia Meal: Nutritional Characterization

Energy	4271 cal/g
Protein	27.8 %
Total Lipids	4.74%
Total Phenolics	4852 µg/g
Total Vitamin E	111.0 µg/g
α-Tocopherol	84.5 µg/g
γ-Tocopherol	27.5 µg/g



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Testing Artemisia as Phytogenic Feed Additive

Broiler Diets prepared with 0, 2, 4% Artemisia *annua*

Testing Artemisia *annua* as Phytogenic Additive in Poultry

- Broiler Study
  - One Day Old Broiler Chicks (n=96)
    - 32 birds per treatment
  - Control, 2% (ART2), 4% Artemisia (ART4) diets for 42 days
    - Corn-Soy-based
  - All other nutrients balanced
    - 22% Crude Protein
    - 3,200 kcal/Kg ME
  - Bird Growth and Carcass Characteristics
    - Feed consumption, Body weight
    - Organ weight, Abdominal fat pads

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Artemisia *annua* as Feed Additive?

- Digesta Collection
  - Ileal, Ceca Digesta
  - Gut pH
- Fecal oocyst count
- Meat Quality
  - White and Dark Meat

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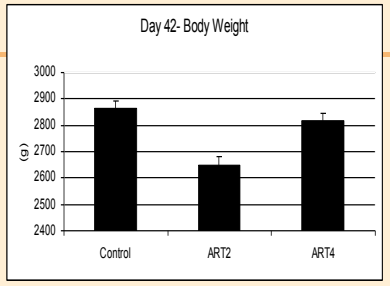
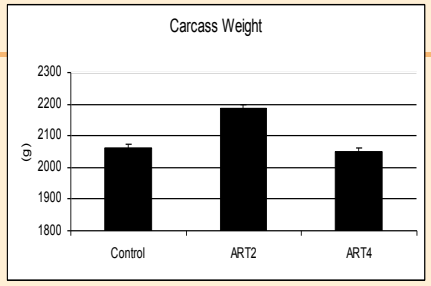
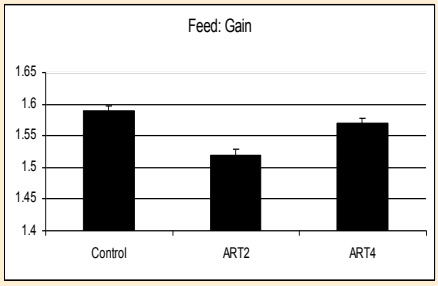
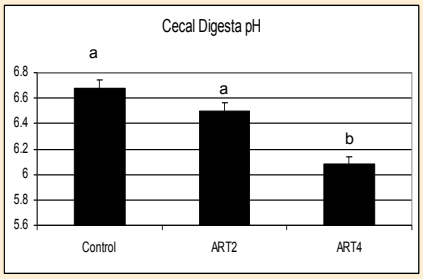
Feeding Artemisia to Broiler Birds: Performance and Ceca PH









[a,b] Different letters for each bar indicate a significant difference ($P < 0.05$). n = 8.

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Alternatives Measures: Use of Herbs

- Thyme, Curcumin, Citric acids in Broiler Feeding
  - Birds
    - n =210
  - Low protein diets
    - 18% CP
    - 2900 ME
    - 0.2% of alternatives
    - Fed for 42 days

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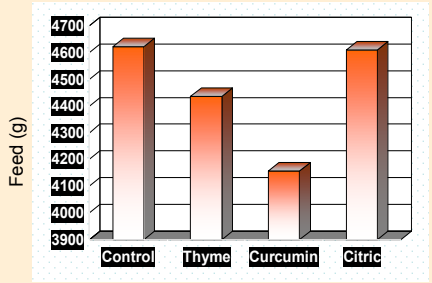
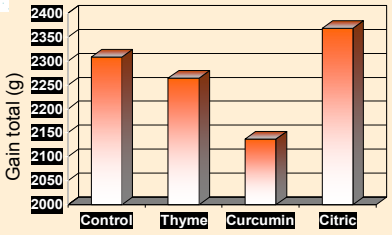
Feed consumption and weight gain





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Summary

- Nutrition becomes even more critical as antibiotics are (or will) eliminated
- Gastrointestinal tract is continuously exposed to foreign materials and challenges
- Gastric acidity is protective against intestinal colonization and translocation of pathogenic bacteria.

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Summary

- Products that can replace
  - Economically affordable
  - Efficacious
  - Easy to use/process
  - Safe to the users, feeds, animals
  - Gut enzyme/pH resistant

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Products that can Replace Antibiotics ?

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The Answer is

No Logical Substance

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Take-Home Message

We Need a Combination of Nutrition, Management, Housing, Biosecurity, Hygiene, Education

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Take Home Message

Diets are not Just Calories

Diet Affects Bird Health, Welfare, Disease Resistance

Ultimate Attainment of Full Genetic Potential

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