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Alternatives to Antibiotics in Poultry Diets

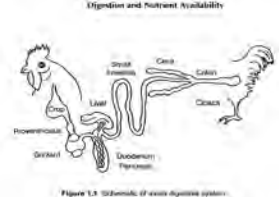
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Presented at Poultry Institute, WSU, Nov 5, 2013
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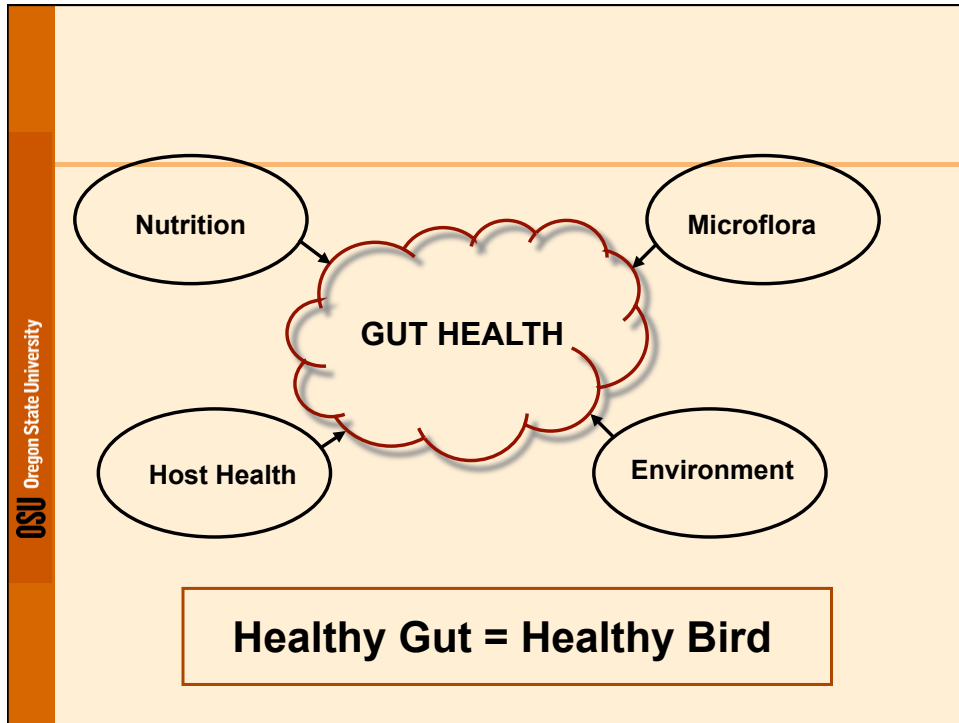
Poultry Production System

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



The diagram, titled "Digestion and Nutrient Availability", shows a chicken's internal organs. Labels include: Crop, Gizzard, Intestine, Cecum, Caecum, Cloaca, Duodenum, Pancreas, Gallbladder, and Proventriculus. The diagram illustrates the path of food from the crop through the gizzard and intestines to the cloaca.

Figure 1.3 (2/20/04), (Poultry Digestive System)



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

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

Managing Gut Health

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

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

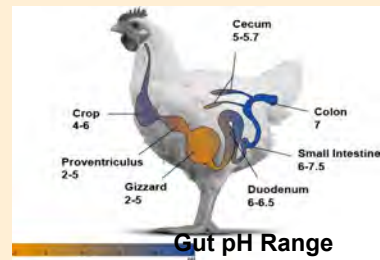
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Alternatives Measures?

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

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



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’

Alternatives Measures

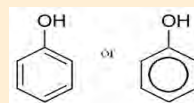
- Pre-biotics
 - Non-digestible feed ingredients
 - “Food for the good microflora”
 - Improving the intestinal balance
 - Selectively stimulating the growth of one or a limited number of bacteria
 - e.g. Mannan Oligosaccharides (MOS)
 - Pro + Pre-biotics = Synbiotics

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



Alternatives Measures

Studies with Broilers on Phytogetic 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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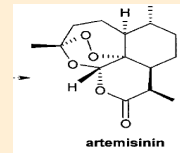
Artemisia *annua* as Feed Additive in Poultry



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Artemisia *annua* as Feed Additive

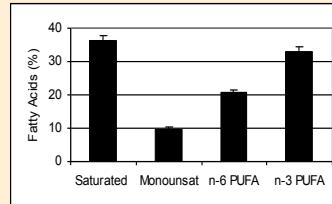
- What is Known
- Anticoccidial Properties
 - Artesimin
 - Reduce Cecal Lesion
 - Dried leaves of Artemisia annua protect chickens against cecal lesions due to *E. tenella* infection (Allen et al. 1997)



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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*



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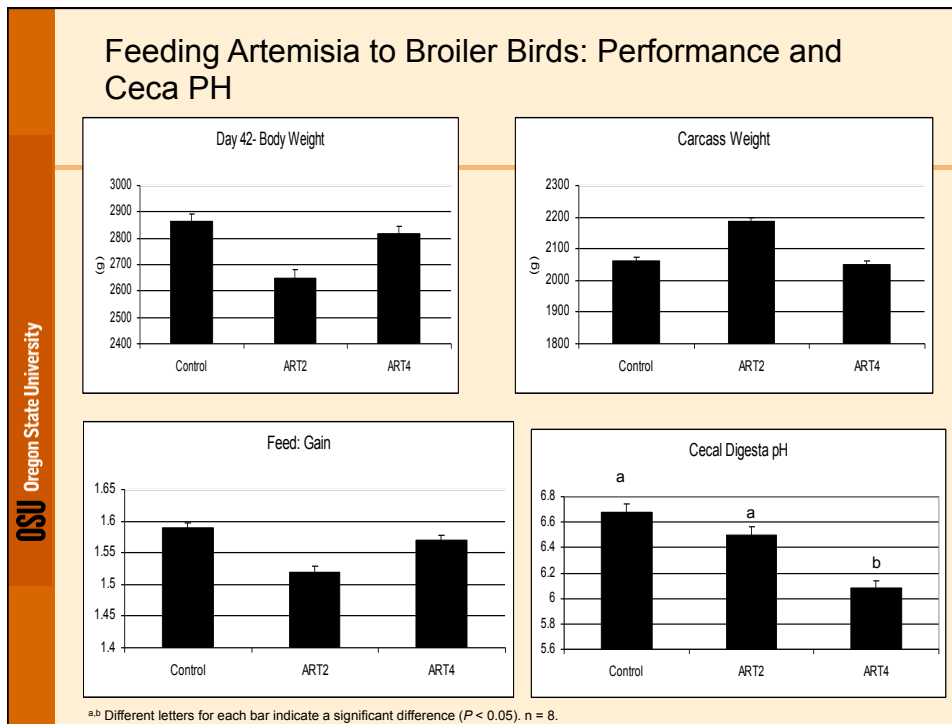
Testing *Artemisia annua* as Phytogenic Additive in Poultry

- 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

Artemisia annua as Feed Additive?

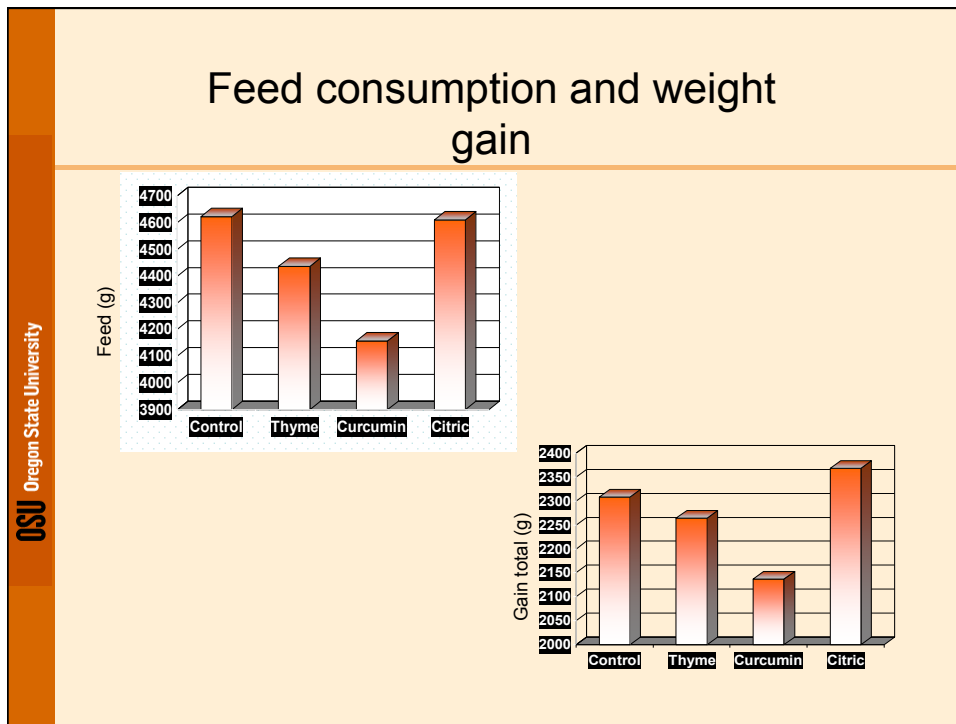
- Digesta Collection
 - Ileal, Ceca Digesta
 - Gut pH
- Fecal oocyst count
- Meat Quality
 - White and Dark Meat





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



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.

Summary

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

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

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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