SCIENCE BASED USES OF PLANT EXTRACTS TO IMPROVE ANIMAL HEALTH IN POST ANTIBIOTIC ERA: WHERE ARE WE?

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PERFORMANCE HAS INCREASED CONSIDERABLY
**IS THIS TENDENCY ONLY IN BROILERS?**

<table>
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<th>BROIERS</th>
<th>LAYERS</th>
<th>BREEDERS</th>
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</thead>
<tbody>
<tr>
<td>FCR: 1.6 FOR 2Kg BW</td>
<td>320 EGGS</td>
<td>145-150 CHICKS</td>
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<tr>
<td>MORTALITY 5%</td>
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PRESENT TREND SHOWS A PHENOMENOL PROGRESS IN POULTRY INDUSTRY

Live Weight vs Mortality – Over the last 25 years, the mortality rate of birds on the farm has declined, even as the birds have gotten bigger. If birds were not healthy and thriving, mortality rates would have increased.

Genetic Progress in Egg Production

Eggs/Hen to 60 Weeks
WHAT HAS CONTRIBUTED TO THIS PHENOMENAL PROGRESS IN POULTRY PRODUCTION?

1. Genetic Selection
2. Advances in Nutrition and Management
3. Advanced climate controlled housing systems
4. Excellent Disease control
   - Improved Vaccines and vaccination techniques.
   - Effective use of Antibiotics and AGP”S

Obviously, genetic selection has changed the playing field of poultry nutrition.
WHAT HAS CONTRIBUTED TO THIS PHENOMENAL PROGRESS IN POULTRY PRODUCTION?

**Genetic Selection For-**
- Feed utilization efficiency
- Breast meat yield
- Ascites
- Skeletal abnormalities

**Genetic Selection For-**
- Egg Production and Size
- Egg Quality
- Selection in barn and free range environment
Genetic Selection and Productivity

Have nutritional advances kept pace with genetic potential for growth, and will it continue in the future?
AT PRESENT

Immense pressure on Poultry Industry because of

1. High meat demand

2. Frequent challenges & Diseases in the birds

3. Growing Antibiotic Resistance
High Global Meat Demand

Challenges In Animal Protein Production

- NEW LEGISLATIONS
- FEED INGREDIENT SUPPLY
- CONSUMER AWARENESS
- SUSTAINABLE PRODUCTION
- MAINTAIN PROFITABILITY

Global meat projections to 2050

Source: UN Food and Agriculture Organization (FAO)
Frequent challenges & Disease in the birds

AVIAR INFLUENZA AND NEW CASTLE DISEASE

INFECTIONOUS BRONCHITIS

NECROTIC ENTERITIS

COCCIDIOSIS

IMMUNITY OF THE ORGANISM
Antibiotic Resistance

DEVELOPING RESISTANCE
A Timeline of key antibiotic resistance events

- Penicillin
- Erythromycin
- Tetracycline
- Methicillin
- Gentamicin
- Imipenem and Cefazidime
- Linezolid
- Ceftraroline

Antibiotic Introduced
Antibiotic Resistance Identified
GLOBAL TRENDS IN AB CONSUMPTION

Global trends in antimicrobial use in food animals

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Contributed by Simon A. Levin, February 18, 2015 (sent for review November 21, 2014; reviewed by Delia Grace and Lance B. Price)

Objectives

1. Estimate and map the current consumption (2010) of antimicrobials

2. Project the trends for future consumption (2030), if the actions are not taken
GLOBAL Antimicrobial Consumption In Livestock

- **Global Increase:** +67%
- In India, the acreage of high consumption (30 Kg per Km²) is expected to grow 312% by 2030.
Different Tools To Improve Animal Health and Performance

ORGANIC ACIDS
PREHISTORIC TIMES

- No one knows .............
- Accidental discovery....... Pain..........folk knowledge
- Early evidence:
  - The grave of a Neanderthal man buried 60,000 years ago.
  - Pollen analysis indicated that plants buried with the corpse were all of medicinal value
RECORDED HISTORY

- Earliest record 4,000 year old Sumerian clay tablet recorded numerous plant remedies

- Ancient Egyptian civilization left a wealth of information on medicinal plants and medical practice
ANCIENT EGYPT

- Wealth of knowledge in medicine
- Physicians highly respected and very specialized
- Several important medical papyri
  - **Ebers Papyrus**
    - From 1550 B.C. one of the oldest
    - Most important and complete medical papyrus recovered
    - Hieratic script (similar to hieroglyphics)
    - 20.23 m in length and 30 cm. in height
    - 110 pages scroll contains 700 magical formulas and folk remedies
Using chemical analysis, the scientific team led by the Universities of York and Macquarie uncovered evidence that the mummy had in fact undergone an embalming process, with a plant oil, heated conifer resin, an aromatic plant extract and a plant gum/sugar mixed together and used to impregnate the funerary textiles in which the body was wrapped.

This 'recipe' contained antibacterial agents, used in similar proportions to those employed by the Egyptian embalmers when their skill was at its peak some 2,500 years later.
ANCIENT CHINA

- The Pun-tsao, a pharmacopoeia published around 1600
- Contained thousands of herbal cures that are attributed to the works of Shen-nung, China's legendary Emperor who lived 4500 years ago
- Emperor Shen-nung investigated the medicinal value of several hundred herbs
- Knowledge passed on orally for centuries
- Use of *Ephedra* for asthma one of these
ANCIENT INDIA

- Herbal medicine dates back several thousand years to the Rig-Veda, the collection of Hindu sacred verses.
- This is the basis of a health care system known as Ayurvedic medicine.
- One useful plant that has come from Ayurvedic tradition is snakeroot, *Rauwolfia serpentina*.
OLD WINE IN NEW BOTTLE
PLANT EXTRACTS AS FEED ADDITIVES IN ANIMAL PRODUCTION

- Naturally occurring bioactive plant compounds (plant extracts)
- Have properties designed to protect plant of origin
  - Antibacterial
  - Antifungal
- Used for years in traditional medicine & for food preservation
- Agriculture: High Potential to use as natural pesticide
- Food- To replace different chemicals
- Animal Health and Nutrition
  - Treatment or prevention of bacterial infection, parasites
  - Reduce the use of AGPs
  - Intestinal Health, Immune response and other health issues
ESSENTIAL OIL BLEND- WHAT WE KNOW?

- Always recommended to use blend of EO
- Well documented synergic effect between different EO
- Effect at gene level at low inclusion
- Gene to gene interaction
ESSENTIAL OIL BLEND - WHAT WE KNOW?

- **Plant essential oil**: Oregano, Cinnamon, Clove
- **Active**: Carvacrol, Cinnamaldehyde, Eugenol
- **Intestinal receptor**: TRPV3, TRPA1, TGR5
- **Animal response**: ↓ inflammation, ↑ nutrient absorption, ↑ intestinal integrity
ESSENTIAL OIL BLEND - WHAT WE KNOW?

**Plant/EO/OR**
- Turmeric Oleoresin
- Piperine
- Capsicum oleoresin

**Active**
- Curcumin
- Capsacinoids

**Intestinal receptor**
- TLR-4
- PPAR-γ
- TRPV-1

**Animal response**
- NFk-B
- MAP-K
- Inflammation
- Lymphocytes
- Phagocytosis
- Antibody production
- Inflammation
COMBINATION OF PIPERINE WITH CURCUMIN

- Bioavailability enhancer
- Major active component of black pepper
- Is associated with an increase of in the bioavailability of curcumin

PIPERINE INCREASES CURCUMIN BIOAVAILABILITY

Plant extract based Additives- what the future holds in its hands?
Curcumin inhibits influenza virus infection and

Da-Yuan Chen, Jui-Hung Shien, Laurence Tiley, Shyan-Sor Tien-Jye Chang, Ya-Jane Lee, Kun-Wei Chan, Wei-Li Hsu

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**Department of Veterinary Medicine, National Chung Hsing University, Taichung 402, Taiwan.
***Department of Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES, UK.
****Department of Forestry, National Chung Hsing University, Taichung 402, Taiwan.
*****Teaching Hospital of Veterinary Medicine, National Chung Hsing University, Taichung 402, Taiwan.

A) Virus Titre (% of Mock Control)

- 0 nM
- 10 nM
- 20 nM
- 30 nM

100%
99.5%
91.68%
54.16%
70.00%

Hours post infection (hpi)
12hr
18hr
24hr
30hr

B) Virus Titre (% of Mock Control)

- 12 hpi
- 18 hpi
- 24 hpi
- 30 hpi
- Mock

1st
2nd
3rd
4th
5th passage

Timing
prior to infection
upon binding
after entry
after entry

curcinum

HA
NA
MI
β-actin
COMMERCIAL TRIAL

AGE OF THE BIRDS 43 WEEKS

CONTROL AND EXPERIMENTAL GROUP

60,000 LAYERS PER GROUP

BOTH THE GROUPS WERE INFECTED

Plant/EO/OR

Active

Turmeric
Oleoresin

Curcumin

Piperine

Capsicum oleoresin

Capsacinoids
Pre-trt 43 44 45 46 47 48 49 50
0
5
10
15
Semana
Mortalidad (acum,%)
Control
Oleoboost
P < 0.01

Pre-trt 43 44 45 46 47 48 49 50 51
1.6
1.8
2.0
2.2
2.4
2.6
Semana
FCR
Control
Oleoboost
P < 0.05
PLANT EXTRACT BASED ADDITIVES- WHAT THE FUTURE HOLDS IN ITS HANDS?

Traditional Approach

Future Approach

Feed Additives

INTERACTOMICS

Current Trend - Nutrigenomics

PLANT EXTRACT BASED ADDITIVES

WHAT THE FUTURE HOLDS IN ITS HANDS?
INTERACTOMICS & PHYTOGENIC FEED ADDITIVES

- Molecular Mechanism of action
- Cumulative effect
- Cross reactivity/Adverse Effects
- Alternate applications
PLANT EXTRACT BASED ADDITIVES- WHAT THE FUTURE HOLDS IN ITS HANDS?

SwissTargetPrediction report:

Reference:
Gfeller D., Michelin O. & Zoete V.
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EFFECT OF CURCUMIN ON DIFFERENT PHYSIOLOGICAL PROCESSES
CONCLUSION

- The use of Phytogenics for improving Health is an Ancient Concept.

- Studies in production animals show that traditional medicine applies to them as well.

- The application of novel modern technologies to this ancient practice Will allow for clarified mechanisms, refined applications.

- New concepts to address challenged in animal production.