

SEARCHA PROFESSORIAL LECTURE

**PROBIOTICS AND PREBIOTICS
IN ANIMAL PRODUCTION**

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SLAUGHTERHOUSE



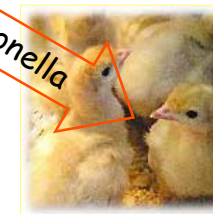
PUBLIC MARKET

BIG DEAL OR NO DEAL?



- ✿ ALL STRAINS OF *SALMONELLA* ARE PATHOGENIC
- ✿ IT IS AN INVASIVE ORGANISM

Salmonella



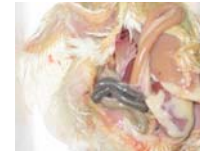
- cause septicemia
- acute and chronic enteritis
- chick mortality
- poor growth due to diarrhea and anorexia
- abortion in cows and ewes

CONVENTIONAL ON-FARM PRACTICES

1. Use of vaccines
 - * Argus SC™
 - * SC54™
 - * Endovac™
2. Use of antibiotics
 - * Flavophospholipol
3. Dietary Lactose

PROBIOTICS

- Derived from Greek word which means “pro-life”
- Mono or mixed culture of living microorganisms which beneficially affects the host (animal or man) by improving the properties of the indigenous microflora (Havenaar *et al.*, 1992)

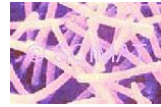


LACTIC ACID BACTERIA

- Gram positive organisms
- Aerotolerant anaerobes
- Ferment sugars to produce lactic acid



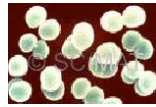
Lactobacillus casei



Lactobacillus bulgaricus



Streptococcus thermophilus



Pediococcus acidilactici

PREBIOTICS



Chicory Root



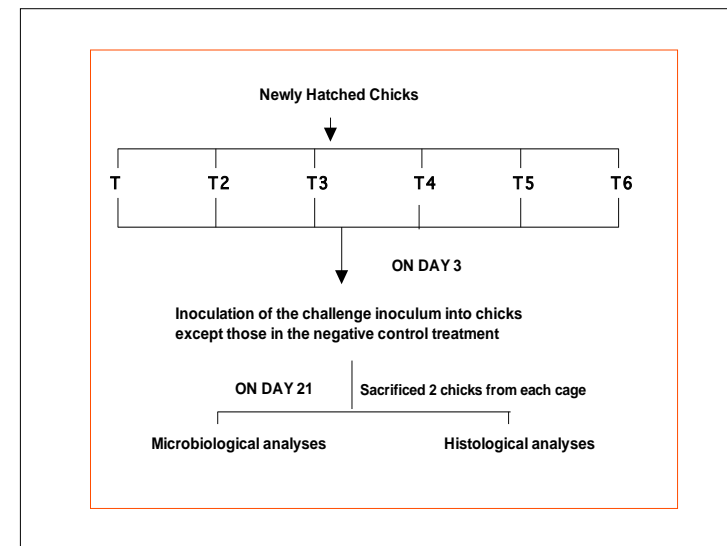
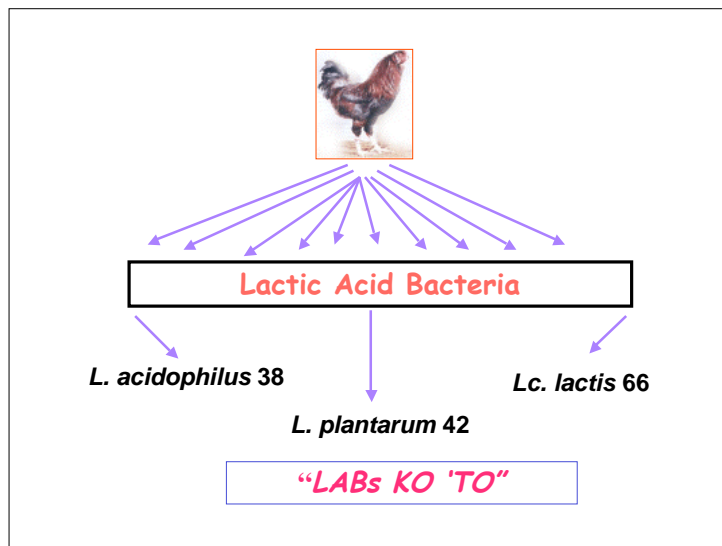
Fruits and vegetables

PREBIOTICS IN ANIMAL PRODUCTION

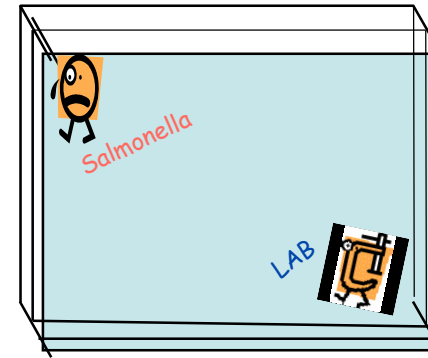
- become substrate for beneficial colonic bacteria
- reduction in the population of harmful bacteria
- increase absorption of calcium and magnesium
- better elimination of toxic compounds
- ease out weaning stress

PROBIOTICS IN ANIMAL PRODUCTION

1. Prevent growth of “bad” bacteria in the gastro-intestinal tract
2. Reduce risks of allergies
3. Enhance the immune response
4. Help reduce serum cholesterol
5. Reduce risk of recurring tumors
6. Reduce ammonia and urease activity
7. Aid in the digestion of nutrients



| TREATMENT | DESCRIPTION |
|-----------|---|
| 1 | Negative Control (No LAB culture and unchallenged with <i>Salmonella typhimurium</i>) |
| 2 | Positive Control (No LAB culture but challenged with <i>S. typhimurium</i> on day 3) |
| 3 | Incorporation of 5 ppm Flavomycin (flavophospholipol) in the feeds (challenged with <i>S. typhimurium</i> on day 3) |
| 4 | Sprayed with LAB culture on day 1 and provided with 2.5% lactose on the first 18 hours of brooding (challenged with <i>S. typhimurium</i> on day 3) |
| 5 | Incorporation of 0.1% Inulin (Sigma) in the feeds (challenged with <i>S. typhimurium</i> on day 3) |
| 6 | Combination of Treatment 4 and Treatment 5 (challenged with <i>S. typhimurium</i> on day 3) |



THE CENTENNIAL BOUT

Table 1. Microbial counts and protection factor of *S. typhimurium* challenged broilers sprayed with LAB culture or fed with inulin or combination of LAB culture and inulin or fed with flavophospholipol.

| TREATMENT ¹ | SALMONELLA ² | | LAB COUNT ^{NS} , log ₁₀ CFU/g |
|------------------------|--------------------------|-------------------|--|
| | Count, log ₁₀ | Protection Factor | |
| 1 | 2.12d | 3.03 | 9.25 |
| 2 | 6.43e | - | 9.06 |
| 3 | 1.25a | 5.14 | 8.39 |
| 4 | 1.53ab | 4.20 | 8.53 |
| 5 | 2.05cd | 3.14 | 9.35 |
| 6 | 1.75bc | 3.67 | 8.84 |

¹T1 – Unchallenged control ; T2 – Challenged control; T3- 5 ppm flavophospholipol T4 – LAB culture; T5 – 0.1% inulin; and T6 – LAB culture + 0.1% inulin

² Means in the column followed by similar letters are not significantly different (P<0.05).

^{NS} - not significantly different (P<0.05)

$$\text{Protection Factor} = \frac{\text{mean log}_{10} \text{ Salmonella count of the control group}}{\text{mean log}_{10} \text{ Salmonella of the treated group}}$$

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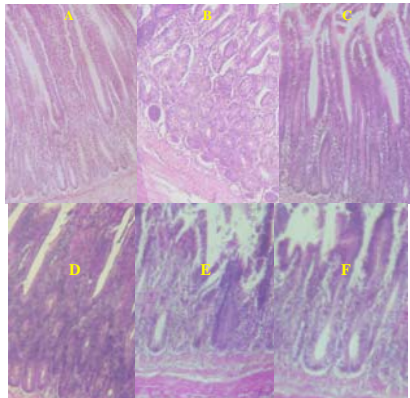
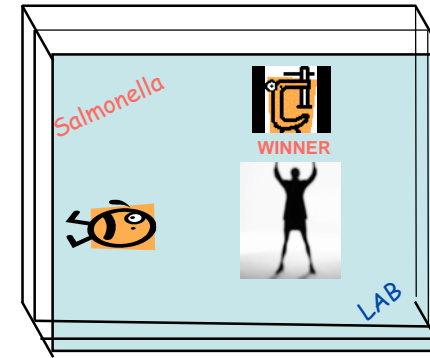


Figure 2. Sections of the ileum from 21-days old chicks challenged with *Salmonella typhimurium* at 100X magnification (LEGEND: A – Unchallenged Control, B – Challenged Control, C – Fed with 5 ppm flavophospholipol, D – Sprayed with LAB culture, E – Fed with 0.1% inulin and F – Provided with combination of inulin and LAB culture).

Table 2. Average cumulative feed efficiency of *Salmonella*-challenged broilers given flavophospholipol or sprayed with LAB culture or inulin or combination of LAB culture and inulin.

| TREATMENT ¹ | FEED EFFICIENCY ² , kg feed/kg gain in weight | | | | |
|------------------------|--|---------|---------|---------|---------|
| | 7 days | 14 days | 21 days | 28 days | 35 days |
| 1 | 2.53 | 2.05a | 1.90a | 1.68a | 2.05a |
| 2 | 2.42 | 2.33a | 2.27b | 2.18b | 2.32b |
| 3 | 2.55 | 2.47ab | 2.63c | 2.30b | 2.35b |
| 4 | 2.11 | 2.46ab | 2.49bc | 2.18b | 2.34b |
| 5 | 2.37 | 3.63c | 2.59c | 2.44b | 2.37b |
| 6 | 2.37 | 2.85b | 2.46bc | 2.10b | 2.10a |
| CV % | 6.77 | 9.22 | 6.09 | 10.50 | 4.14 |

| TREATMENTS | DESCRIPTION |
|------------|--------------------------------------|
| 1 | Control (no intervention) |
| 2 | 2.5% lactose added in the feeds |
| 3 | LAB culture spray on day 1 |
| 4 | 0.1% inulin added in the feeds |
| 5 | Combination of 3 and 4 |
| 6 | 5 ppm flavophospholipol in the feeds |



- Roasting up to an internal temperature of 180°F
- Determination of cooking losses
- Preparation of samples for sensory evaluation
- Evaluation for juiciness, tenderness, flavor, off-flavor and general acceptability

Table 2. Sensory scores¹ and cooking losses of roasted breast samples from broilers fed with lactose or sprayed with CE culture or fed with inulin or combination of CE culture and inulin or fed with flavophospholipol.

| TRAIT ² | TREATMENT ³ | | | | | |
|--------------------|------------------------|--------|--------|--------|---------|---------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Juiciness | 3.06a | 3.52b | 3.00a | 3.03a | 2.94a | 3.30ab |
| Tenderness | 4.27ab | 4.55c | 4.18a | 4.48bc | 4.39abc | 4.30abc |
| Flavor | 3.45a | 3.70a | 3.39a | 3.15a | 3.42a | 3.45a |
| Off-flavor | 4.67a | 4.67a | 4.76a | 4.55a | 4.52a | 4.64a |
| Gen. Acceptability | 3.79ab | 4.09b | 3.88ab | 3.64a | 3.64a | 3.85ab |
| % Cooking Losses | 22.59a | 22.72a | 24.41a | 21.80a | 23.72a | 23.93a |

¹T1 – Control; T2 – 2.5% lactose; T3- CE culture; T4 – 0.1% inulin; T5 - CE culture + 0.1% inulin and T6 – 5 ppm flavophospholipol

²means in the same row with different letters are significantly different (P<0.05).

³ Juiciness: 1-Dry 5-Very juicy; Tenderness: 1-Tough 5- Very tender; Flavor: 1-none 5-Full flavor; Off-flavor: 1- offensive 5-none; General acceptability: 1- unacceptable 5- Very acceptable

FINDINGS

1. Probiotics composed of *Lactobacillus acidophilus*, *Lactococcus lactis* and *L. plantarum* and/or prebiotic inulin are effective in reducing cecal *Salmonella* colonization;
2. They can also minimize the structural damage caused by *Salmonella* colonization in the intestines;

FINDINGS

3. They provide the same degree of protection as the growth promotant antibiotic flavophospholipol, indicating its potential as an alternative to the use of such;
4. At a challenge level of 10^4 *Salmonella* cells, the treatments did not show any significant effect on feed efficiency of the birds;

FINDINGS

5. All treatments did not exhibit any ill effects on the sensory traits of roasted chicken;



FACING THE GIANT

1. Development of the culture in easy to use and store form
2. FOOD SAFETY



“They deserve to have safe and healthy food!”