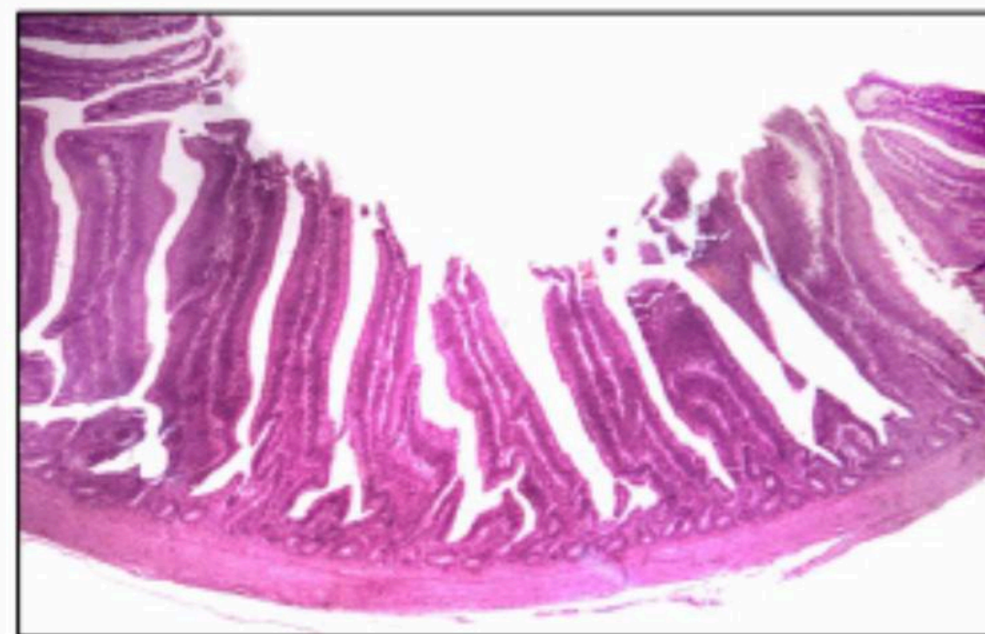




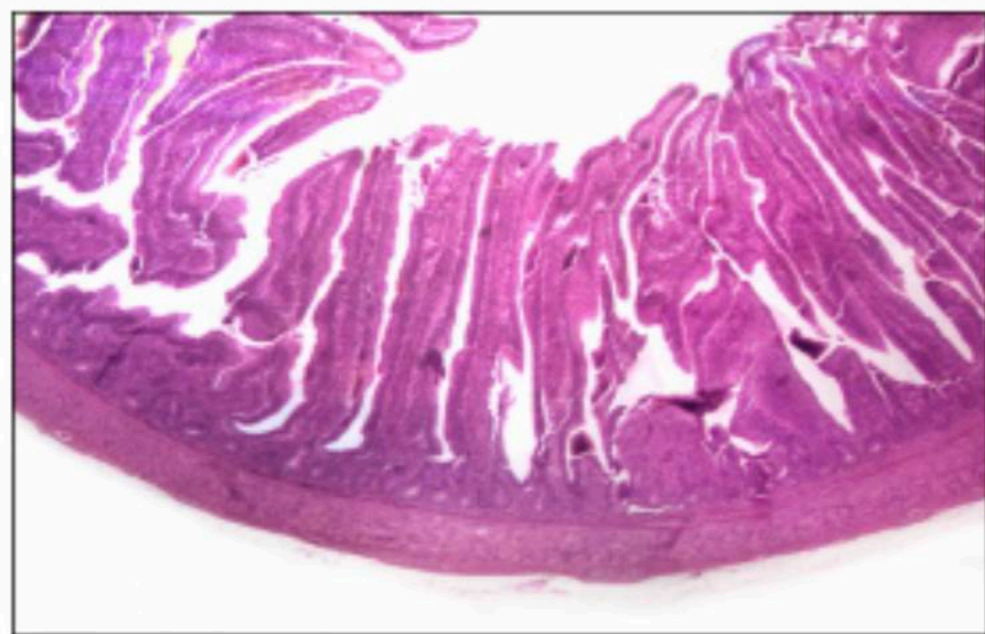
# Villi Morphology of Jejunum

PLATE 2

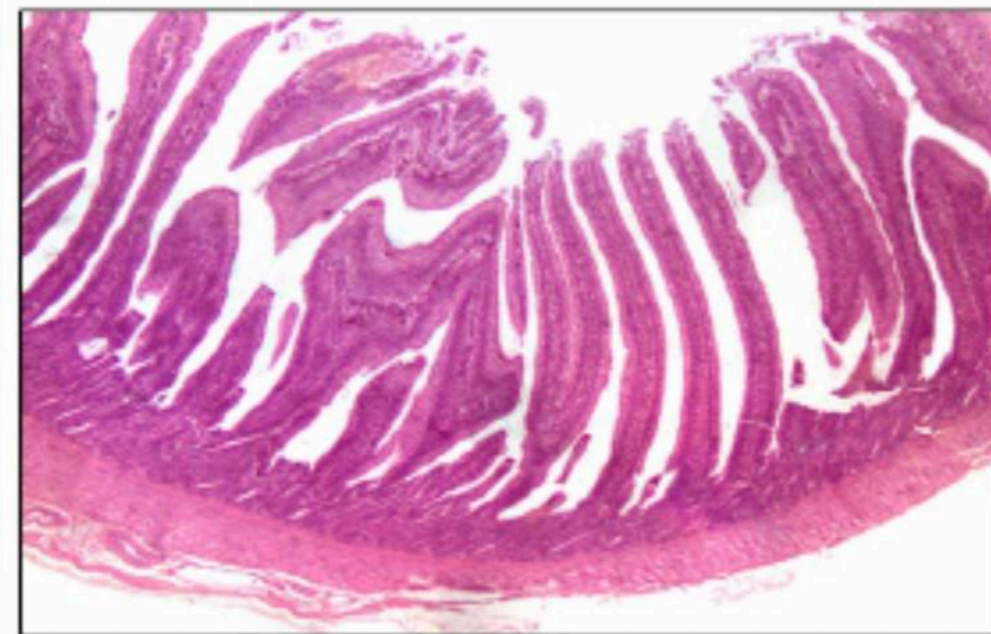
Jejunum *villi* length ( $\mu\text{m}$ ) of broiler birds at 35 days of age as influenced by supplementation of different sources of lauric acid (H&E x40)



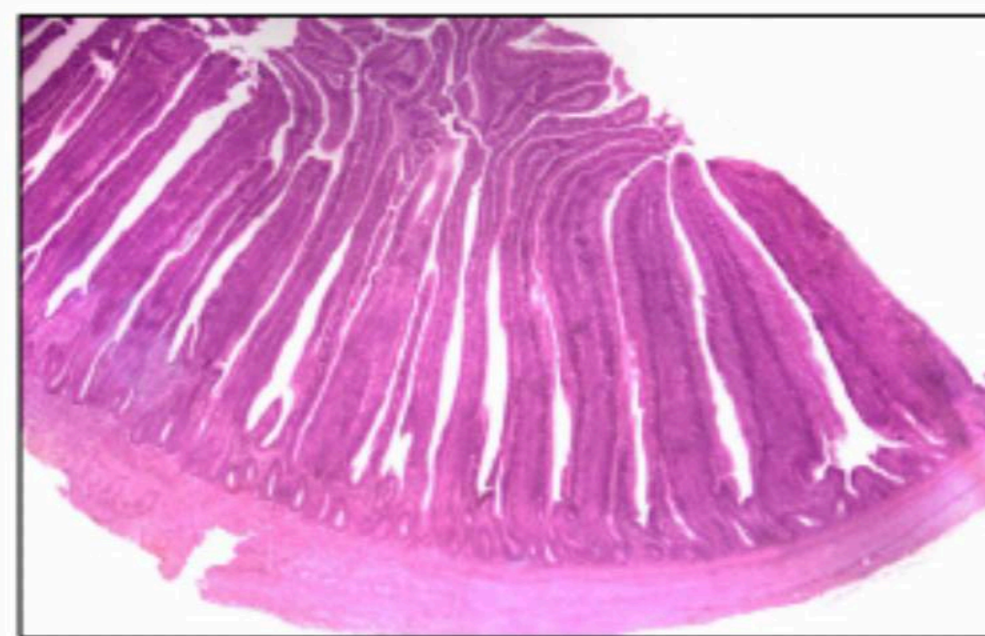
T<sub>1</sub> - Intestinal *villi* length (1091.26  $\mu\text{m}$ )



T<sub>2</sub> - Intestinal *villi* length (1161.52  $\mu\text{m}$ )



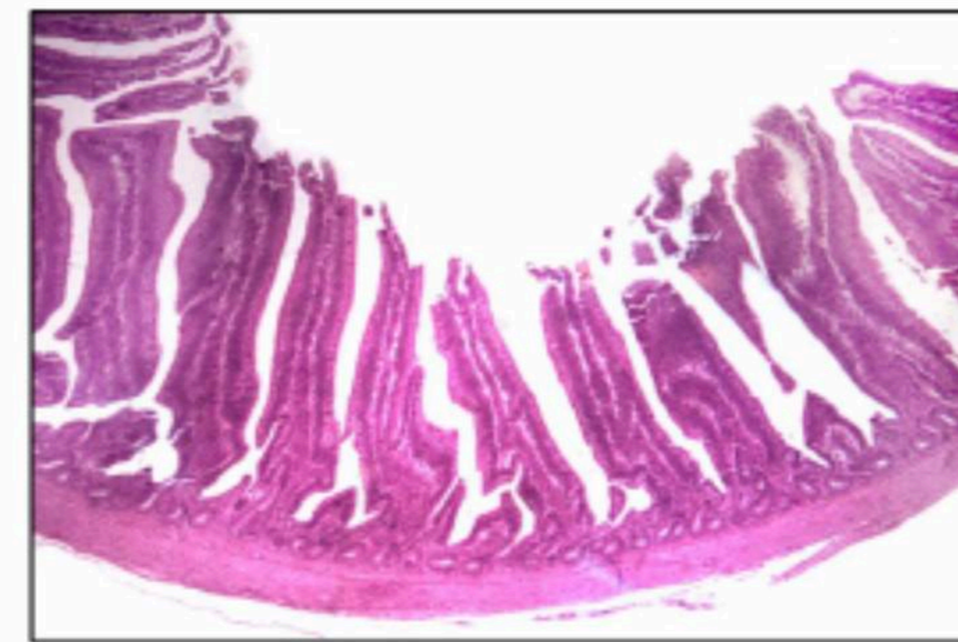
T<sub>3</sub> - Intestinal *villi* length (1172.83  $\mu\text{m}$ )



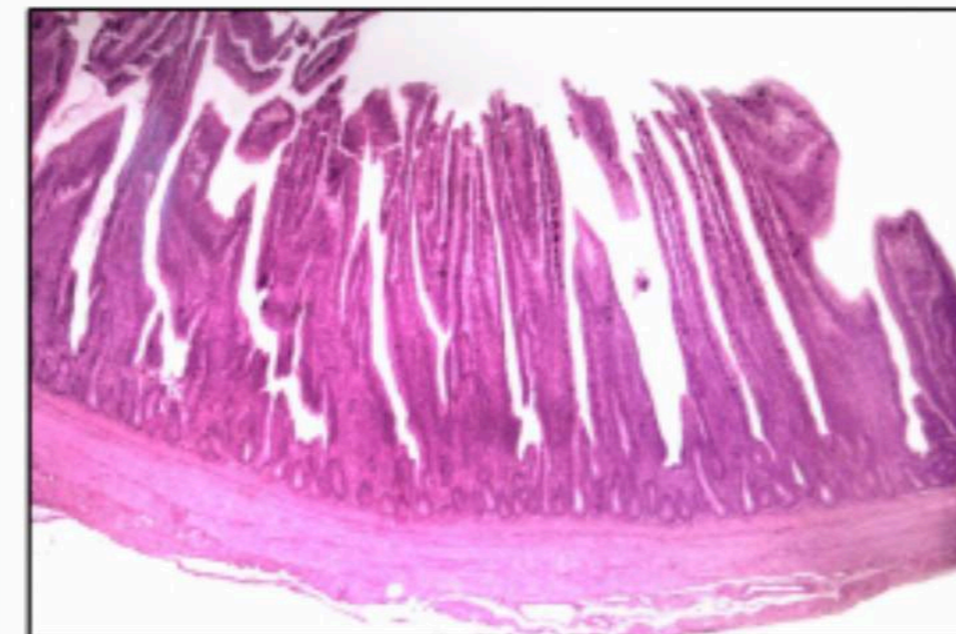
T<sub>4</sub> - Intestinal *villi* length (1195.44  $\mu\text{m}$ )

PLATE 2a

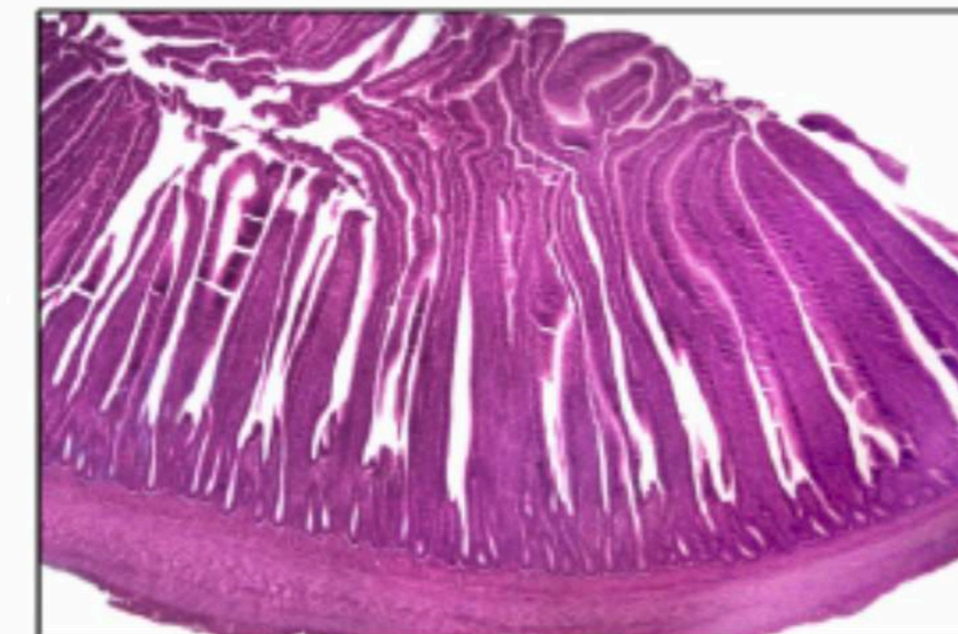
Jejunum *villi* length ( $\mu\text{m}$ ) of broiler birds at 35 days of age as influenced by supplementation of different sources of lauric acid (H&E x40)



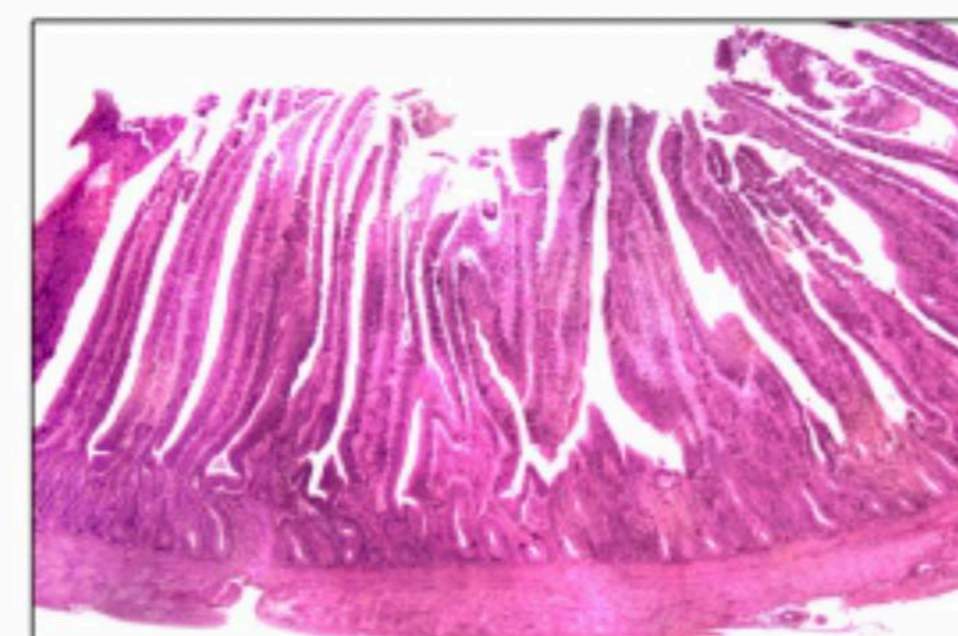
T<sub>1</sub> - Intestinal *villi* length (1091.26  $\mu\text{m}$ )



T<sub>5</sub> - Intestinal *villi* length (1164.60  $\mu\text{m}$ )



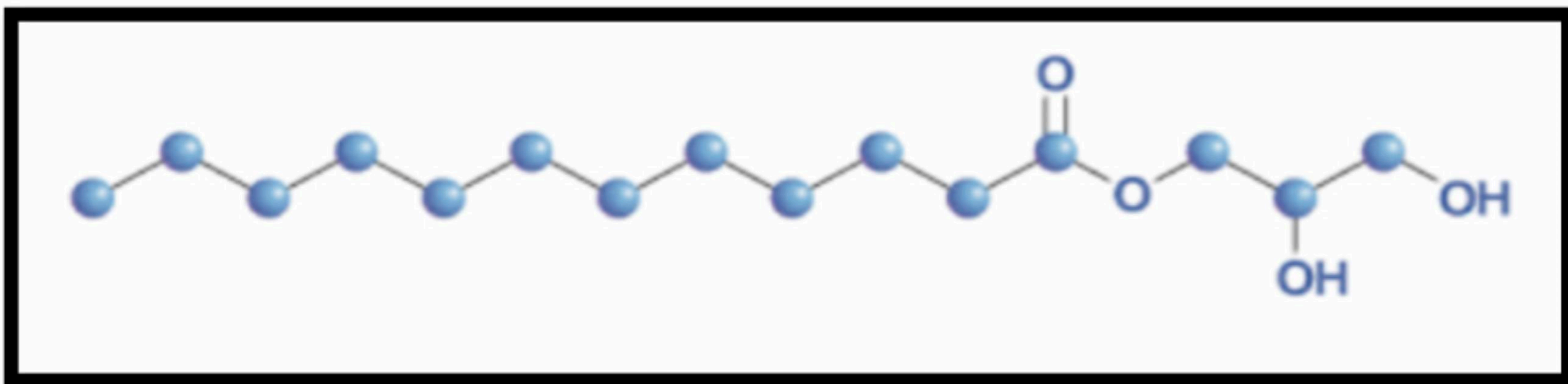
T<sub>6</sub> - Intestinal *villi* length (1182.80  $\mu\text{m}$ )



T<sub>7</sub> - Intestinal *villi* length (1180.78  $\mu\text{m}$ )



- ▶ **Monolaurin at 300 g/ton** followed by **palm kernel oil (supplying lauric acid at 500 g/ton)** could **replace the antibiotic growth promoters** in feed in terms of production performance, ileal health, villi morphology and positive economic return in broiler chicken ration



**Monolaurin**



## ► **SYNERGISTIC EFFECT OF CINNAMON OIL AND SODIUM BUTYRATE IN COMMERCIAL BROILER CHICKEN**

**To assess the efficiency of cinnamon oil with sodium butyrate as an antibiotic substitute of broiler chicken performance**



► **Nutrigenomic evaluation of *Andrographis paniculata* on the performance of broiler chicken**



## Conclusion

- ▶ The growth promotion with APWP powder could be due to the phyto-constituents present in Alcoholic extracts than its Aqueous extracts.
- ▶ Supplementation of APWP at 500 ppm can be used by replacing AGPs for better production performance and cost effectiveness in broiler chicken ration.

## Organic Acids

Commonly used - acetic, butyric, citric, formic, propionic, malic, tartaric, and lactic acids.

### Mode of Action

- ▶ Manipulate the intestinal microbial populations and improve the immune response, in countering pathogenic bacteria.
- ▶ Acidifiers also improve the digestibility of nutrients and increase the absorption of minerals.

**Butyric acid** is most efficacious against pathogenic bacteria such as *Salmonella* spp. and *Escherichia coli*, and stimulates the population of beneficial gut bacteria.

Supplementation of salts of organic acids at 0.5% level is used in poultry feeds to improve the layers' performance.

## Probiotics

**Bifidobacterium, Bacillus, Streptococcus, Lactobacillus and Lactococcus** are the genera commonly used as probiotics in poultry.

### Mode of action

- ▶ modification of the intestinal microbiota, (2) stimulation of the immune system, (3) reduction in inflammatory reactions & neutralize toxins.
- ▶ (4) prevention of pathogen colonization, (5) enhancement of growth performance, (6) alteration of the ileal digestibility and total tract apparent digestibility coefficient, and (7) decrease in ammonia and urea excretion.

**Bacillus subtilis** has been a popular bacterium used.

**Saccharomyces cerevisiae**, when used as probiotic (live yeast), or as prebiotic (auto-lyzed yeast and its components) - serve as a growth enhancer in healthy broiler chicken through improved gut health and digestive enzyme activities.



## Probiotics

- ▶ Post-pellet spraying of combination of *L. acidophilus* and *B. bifidum* and pre-pellet supplementation of *B. amyloliquefaciens* improved gut morphology and mucosal immunity (SIgA) of broilers.
- ▶ Probiotics - modulate the immune response and competitive exclusion mechanism - colonization by pathogenic bacteria is prevented.
- ▶ Inconsistency in results could be due to numerous biotic and abiotic factors.





## Prebiotics and synbiotics

- ▶ Prebiotics are indigestible carbohydrates by the host animal but can be utilized by useful GIT microorganisms
- ▶ Fructo-oligosaccharides (FOS, oligofructose and inulin), galacto-oligosaccharides (GOS), trans-galactooligosaccharides (TOS) and lactulose.
- ▶ Prebiotics increase short chain fatty acid (SCFA) production in the cecum.
- ▶ **Synbiotics** are defined as a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host – **Synergistic effect**



# Prebiotics and synbiotics

## ► Examples of synbiotics

**Bifidobacteria and Fructooligosaccharides (FOS)**

**Bifidobacteria or lactobacilli with FOS or inulins or galactooligosaccharides (GOS)**

**Lactobacillus and inulins.**

**Lactobacillus spp. And Saccharomyces cerevisiae yeast and 2% inulin.**

*Bifidobacterium animalis, Enterococcus faecium, Lactobacillus: reuteri, salivarius, Pediococcus acidilactici*

Inulin

*Lactobacillus: acidophilus, casei, salivarius, plantarum, rhamnosus, brevis, Bifidobacterium: bifidum,*

inulin

## Feed enzymes

- ▶ Feed enzymes include proteases, phytases, lipases and carbohydrases such as amylase, beta-glucanase and xylanase
- ▶ Phytase – phosphorus utilization
- ▶ NSP degrading enzymes – substrate specific – Wheat / sunflower / cotton seed meal / rape seed meal - Fibre rich ingredients
- ▶ Proteases – Mono and multi proteases.
- ▶ Lipases – Young chicks
- ▶ Cocktail enzymes – combined effect.
- ▶ **Matrix value** - When the savings exceed the cost of the enzyme - the enzyme will appear attractive to the formulation software and be included in the ration

## Feed enzymes

- ▶ **Composition and dose – As recommended by the manufacturer**

### **Benefits expected**

- ▶ Protein Digestibility: 2-2.5%
- ▶ Fiber Digestibility: 8-10%
- ▶ Energy by 80-120 kcal/kg feed

### **Phytase**

- ▶ 5000 FTU/kg dietary supplementation with bacterial (*E. coli*) or fungal (*Aspergillus niger* and *Trichoderma reesei*) sources of phytase - supplementation of 30 % less available P – Saves Di-calcium phosphate.

## Emulsifiers

Emulsifiers are used to increase digestibility of the nutrients, especially fats / oils.

**Fat digestibility is considerably reduced when emulsifying molecules like bile salts are absent.**

Soy-lecithin, milk derived casein, lysophatidylcholine or lysolecithin (lecithin), bile salt, glycerol polyethylene glycol ricinoleate (E 484), and sodium stearoyl-2-lactylate (SSL)

**Dose:** As per the direction of the manufacturers.

## Anti-oxidants

### Natural Antioxidants

Non enzymatic antioxidants are minerals, vitamins, carotenoids, polyphenols, and other antioxidants.

vitamin E is major membrane antioxidant, which cannot be replaced by other antioxidants

### Synthetic antioxidants

BHT (butylated hydroxytoluene), BHA (butylated hydroxyanisole), and EQ (ethoxyquin) are the most frequent.

Ethoxyquin (EQ, 6-ethoxy-1,2-dihydro-2,2,4-trimethylquinoline) is widely used in animal feed - lipid peroxidation.

Recommended for fat / oil rich diets such as broiler chicken ration.

## Toxin binders

Aflatoxins are a major problem in poultry production

**Inorganic binders** (including bentonites, activated charcoal and aluminosilicates), and

**organic binders** (lactic acid bacteria & yeast cell walls and polymers)

In terms of performance, inorganic binders provided more protection than antioxidants and organic binders.

Bentonites are safe for all animal species, the consumers and the environment when used at a maximum level of **20 gram/kg complete feed**.

Aluminosilicates are commonly used as mycotoxin adsorbents.

**Caution:** aluminosilicates and activated charcoal can adsorb vitamins, minerals and other additives present in diets.



## Pellet Binders

- ▶ Pellet binders - added at 2.5% of the diet.  
E.g. Sodium Bentonite (Clay), Lignin, Molasses, Guar meal, Sunflower meal, Guar Gum, Polyacrylamide,
- ▶ Incorporation of food-grade surfactants into mash feed can enhance the overall conditioning of the feed during pelleting by reducing the surface tension of water. They also have antimicrobial properties. E.g. Alkyl benzene sulfonates, lauryl ethylene oxide.
- ▶ Binders like lignosulfonate, bentonite and sepiolite enhance pellet strength and durability.





## Immunomodulators

- ▶ Vit – E, Selenium, zinc,  $\beta$ -glucans etc.
- ▶ Supplementing poultry diets with  $\beta$ -glucans improves growth performance (weight gain and FCR), meat quality and stimulate both specific and non-specific immune responses



# Premix preparation

Mixing of feed additives and supplements

Purpose : Uniform mixing of micro nutrients

► **Protein Concentrate**

All ingredients except grains are mixed

Locally available grains can be used

Feed additives and supplements need not be procured



## **Poultry Nutrition – Practical Approach**

- 1. Nutrient specifications and ration formulation for chicken**
- 2. Feeding management of broiler, layer and breeder chicken**
- 3. Designer eggs and meat through nutrient manipulation**
- 4. Feeding management of native chicken, ducks, quails and turkeys**
- 5. Feed additives and supplements for poultry**



*Thank you*