TECHNICAL SEMINAR – KIPF 2024

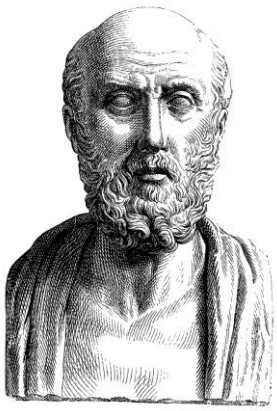
Welcome to Discussion on

Importance of Gut Health Management

YouTube

PoultryTroubleshooter_BDutta **www.drbcdutta.com**

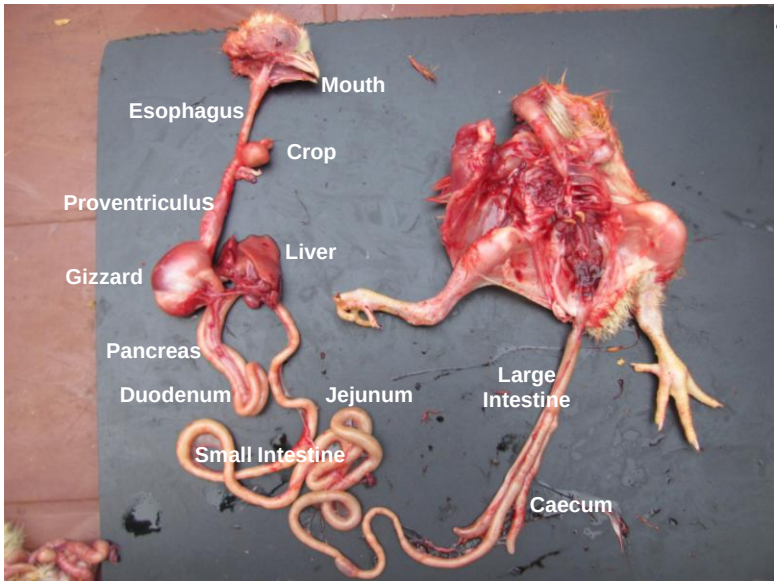
Why Gut Health Management?



Hippocrates
Greek Physician & Father of Medicine

All Disease begins in the Gut

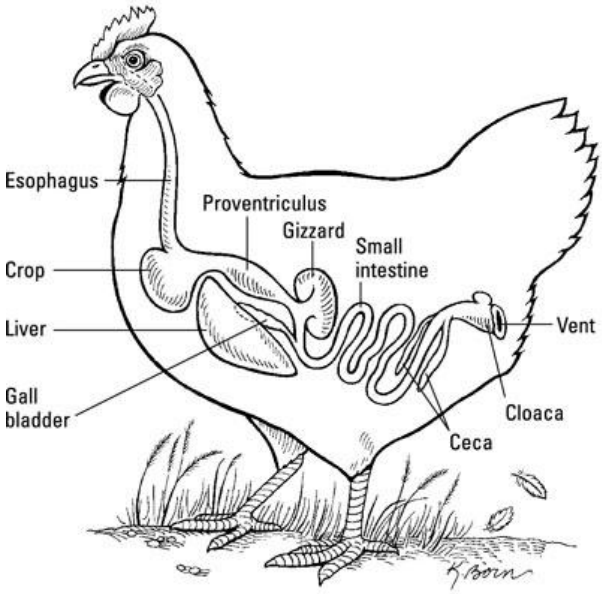
What is a Gut?



The Gut;
Gastro-Intestinal Tract (GIT)
or
Digestive System

GUT is the Biggest Organ surface exposed to foreign materials including Feed, Water, Toxins, Microbes which are delivered straight into it after ingestion

What is the Functions of the Gut?



Responsible for Digestion & Absorption of all feed Nutrients

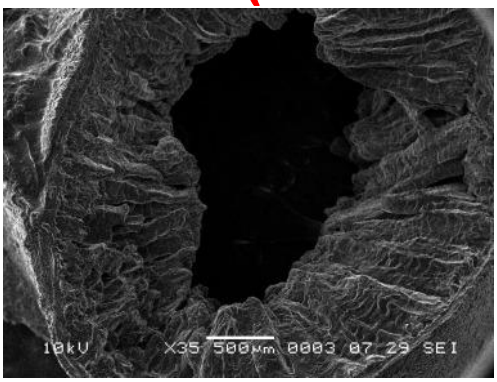
Its ability to function is directly linked to Poultry Health & Performance

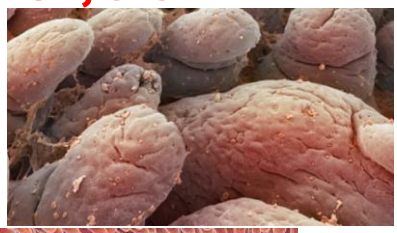
What is the Functions of the Gut?

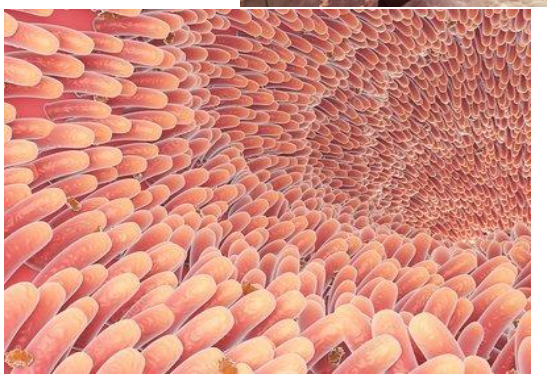
Transit Time of Feed Particle in Poultry GIT		
SEGMENT	pH	Transit Time (Minutes)
Crop	5.5	10 – 50
Proventriculus/ Gizzard	2.5 – 3.5	30 – 90
Duodenum	5.0 – 6.0	5 – 10
Jejunum	6.5 – 7.0	20 – 30
Ileum	7.0 – 7.5	50 – 70
Caecum/Colon/Cloaca	6.9 – 8.0	20 – 30

- Digestion & Absorption of all feed ingredients
- The 1st Barrier to any unwanted substances; prevents entry of any Microorganism, if remain Healthy
- The biggest Immune organ in chicken's body; almost 70%

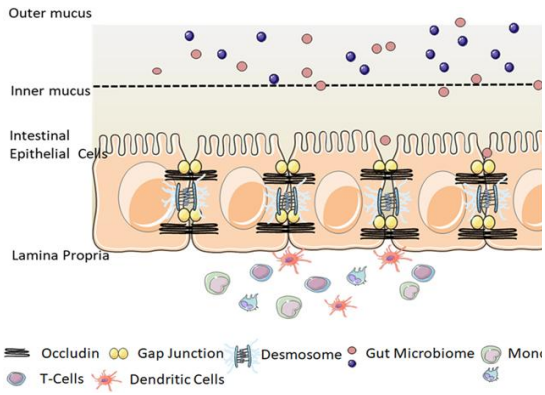
GUT (Small Intestine) SURFACE; the Villi

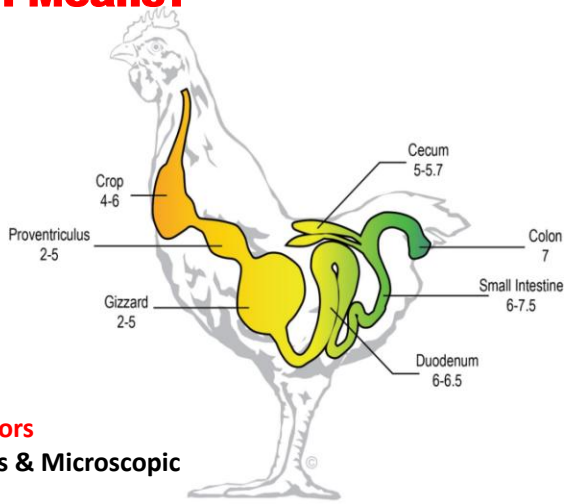






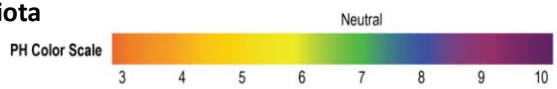
Gut Health Means?





Gut Health means Interconnection of these 5 factors

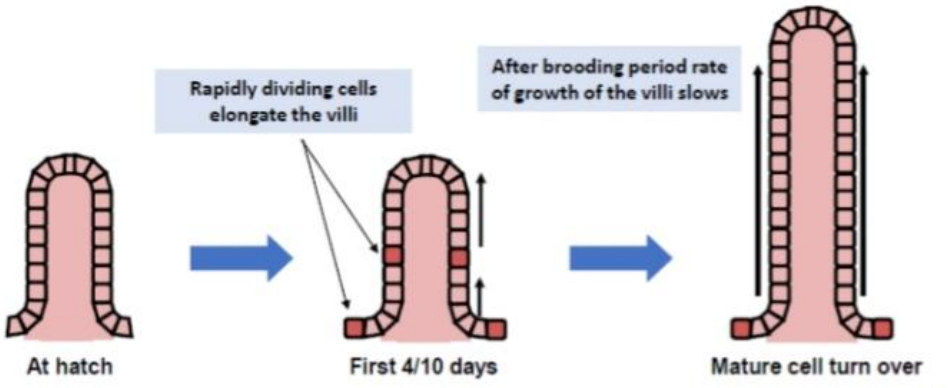
- **Good Structural Integrity of the Intestine; Gross & Microscopic**
- **Normalcy of Intestinal Mucus Layer**
- **Healthy balance & Diversity of Gut Microbiota**
- **Intact Tight Junction**
- **Healthy Status of Gut Immune System**



Gut Development

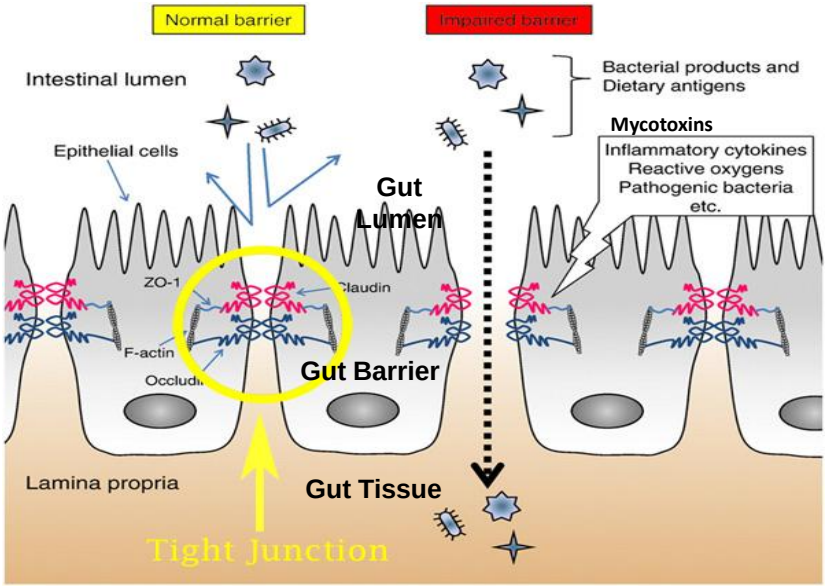
Incubation & Brooding plays important role in the development of Villi

- **Gut development starts in embryonic stage**
- **Growth depends on presence of Feed in the gut following birth**
- **Growth stimulated by helpful intestinal bacteria**
- **Growth inhibited by Stress**



The Gut Barrier (1st Line of Defence)

- The Gut Barrier is the mucus and a layer of epithelial cells with Tight Junctions
- Tight junction strengthen this barrier & prevents entry of pathogens into the body
- Maintaining the Gut barrier is essential for Optimal Gut Health, failure results entry of pathogens into the gut tissues & finally to blood



Unhealthy Gut or Poor Gut Health

1. Normal function of Gut disturbed

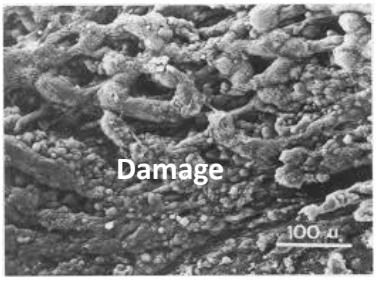
- Improper Digestion leading to Feed passage
- Poor Body Weight & FCR in Broiler
- Poor Vit D absorption affect Calcium & Phosphorus utilization resulting Lameness in Broiler
- Poor Vit D absorption and Ca & P utilization cause reduced Egg production with Size & Shell abnormalities in Layer & Breeder

2. Development & Immune function of GALT disturbed

- Immuno-suppression, Immediate Infection by existing microbes
- Permanent Immunity Compromise leading to Vaccine Failure & Viral Infections later

3. Failure of Gut Barrier as 1st Line of Defense

- Leaky Gut, Nutrients passing to hind Gut
- Growth of opportunistic microorganisms like *Clostridium* to produce Necrotic Enteritis
- Commensal bacteria like *E coli* flourishes producing Enteritis & Joint infections with Lameness
- Risk of many more bacterial & Viral infections like ND, Bird Flue



Factors Effecting Gut Health

- **INCUBATION: Temperature control in Hatchery Incubator affects Gut development**
- **BROODING: Chick level Temperature, early & easy access to Feed & Water**

- **STRESS/ WELFARE: Stocking Density, Temperature, Ventilation**
- **WATER QUALITY: pH, Hardness (specially Fe), contaminations**

- **FEED: Feed form, Access to Feed, Feed Changes, MYCOTOXIN**
- **NUTRITION: Feed component, Particle size, Micronutrients, Enzymes, Anti-Nutritional factors like NSP**

Factors Effecting Gut Health

- **LITTER: Moisture%, Ammonia**
- **HEALTH INTERVENTION: AGP, Therapeutic Antibiotic, Vaccination, Prebiotic, Probiotic**

- **INFECTIONS: Bacterial, Viral, Parasitic**
- **GUT MICROBIOTA: No of Species, Populations, Balance between Commensal & pathogenic, Competitive exclusions, etc**
- **BIOSECURITY: Hygiene, Sanitation**

Incubation and Brooding Effect on Gut Health

Hatchery Temperature control directly affect the length of Villi & depth of crypts, specially in Single Stage machine which finally impact poultry performance

Early & easy access of Feed & water helps developments of intestine, which is directly related to brooding efficiency; Temperature, Ventilation, Space & Lighting

Impact of Stress on Gut Health

Stress may be

- **Managemental (Stocking Density, Handling, Debeaking, Vaccination, Transfer, Peak Laying**
- **Environmental (Temperature, Humidity, Litter Ammonia) factors. Heat Stress is major one**
- **Nutritional (Feed & Water quality)**
- **Disease Stress**
- **Oxidative Stress is downstream of all these stresses**

Stress can cause Immuno-suppression

- **Impact Immunity Development and Increases susceptibility to infections**
- **Stresses negatively impact health & production**
- **Stress Hormones released in the gut may stimulate growth & activity of many pathogenic bacteria like, E coli, Salmonella, Strepto & Staphylococci**

Impact of Stress on Gut Health

- **Oxidative Stress in the cells/tissues results from an imbalance between free radical production & endogenous antioxidant defense and leads to lipid peroxidation, protein nitration, DNA damage, and Apoptosis (Cell Death)**
- **Excessive production of ROS (Reactive Oxygen Species) and RNS (Reactive Nitrogen Species) or their inefficient scavenging leads to Oxidative Stress**

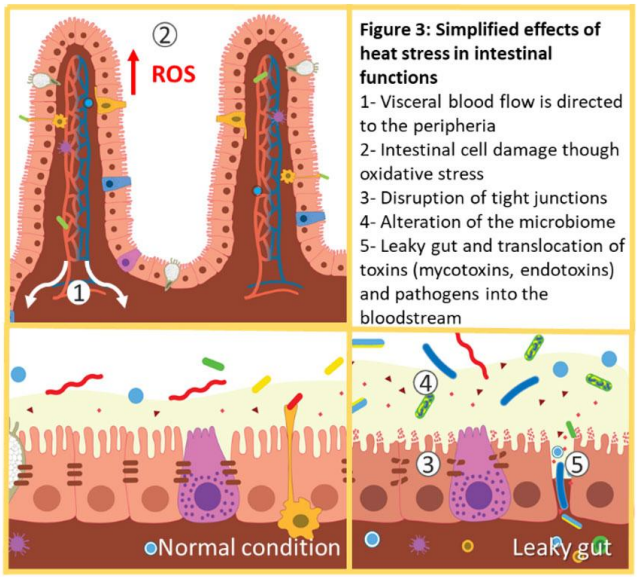


Figure 3: Simplified effects of heat stress in intestinal functions
1- Visceral blood flow is directed to the peripheria
2- Intestinal cell damage though oxidative stress
3- Disruption of tight junctions
4- Alteration of the microbiome
5- Leaky gut and translocation of toxins (mycotoxins, endotoxins) and pathogens into the bloodstream

Impact of Heat Stress & Ventilation on Gut Health

- **Under Heat Stress in Open farm > Broiler/Layer/Breeder > Water Intake increases**
- **Poor Temp/Ventilation Control or Wet Litter with Ammonia in EC Shed > Excess Water Intake**

- **Excess water dilutes Nutrients in the intestine causing mal-absorption & passage of nutrients in to hind gut**
- **Small Intestine pH changes towards alkaline with undigested frothy feed solution**

- **Opportunistic Organism like *Clostridium* gets the necessary nutrients for growth & multiplication at hind gut and starts moving upwards towards small Intestine to produce Necrotic Enteritis**
- **Commensal bacteria like *E coli* become pathogenic and start producing Endotoxin causing disease**

Impact of Heat Stress & Ventilation on Gut Health

- Leaky Gut > microorganisms to enter blood system to produce disease
- Symptoms are Dysbacteriosis, Enteritis, Feed Passage, Wet Litter, Litter Ammonia, Poor Body Wt, Reduced Egg No & Egg size and Egg Shell Deformities

- The birds will be dehydrated, consume more water and the cycle will repeat to aggravate the situation
- Heat Stress & Gut Health is a vicious cycle; no respite to come out, only comfort environment is the answer

Drinking Water Quality & Gut Health

- Water is major component of blood; transportation nutrients & O2 to the cells
- Essential for Digestion, absorption of Nutrients
- Water is essential for Gut health

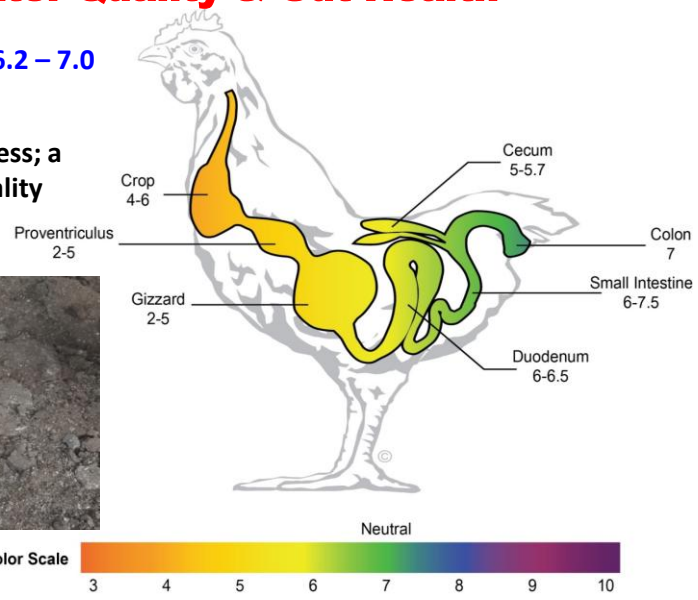
Water Quality Parameters affect Gut health

- Contamination; Chemical or Microbial
- Mineral contents like Fe, Ca, Mg of which Fe is very important if excess > TDS or Hardness
- pH of water influence physiology of the gut and activity of bacteria. Acidic pH inhibits growth of harmful bacteria

Drinking Water Quality & Gut Health

Need Drinking Water pH between 6.2 – 7.0 & TDS 100 - 150

Chicken became less tolerant to stress; a significant one is poor water quality



Feed, Feed Management on Gut Health

- **FEED FORM: Pellet, Crumb or Mash**
- **ACCESS to Feed**
- **Feeding Management at farm**
- **Feed Changes**
- **FEED STORAGE: System, Time**
- **Mycotoxin, even suboptimal level**

- **FEED COMPONENT: source of ME & CP globally varies widely besides Corn & Soya**
  - **Particle Size – Dusty feed is all the problem**
  - **Micronutrients like Vitamins,**
  - **Enzymes to enhance feed utilization**
  - **Anti-Nutritional factors (NSP)**

Feed Management on Gut Health

Feed Form & Particle Size is Important for Gizzard Function & Subsequent Gut health

- In Gizzard Feed particle is broken to small parts & selective passage to duodenum continues for digestion considering particle size
- Feed is mixed with Acid and Pepsin in gizzard which breaks protein into Peptides for absorption in small intestine

Small Feed particle size or Dusty Mash feed stays less time in gizzard leading to

- Inefficient Peptide Preparation
- More protein reaches hind gut for microbes
- Increased Gut viscosity leading to improper digestion
- Poor absorption, poor body weight gain & FCR

Feed Management on Gut Health

FEED STORAGE

- Feed bags must be stacked with a gap of 1 feet from the walls
- Feed bags to be stacked with a gap of 1 ft from the ground using wooden pallets
- First in First out (FIFO) system for feed distribution

Feed Mismanagement on Gut Health



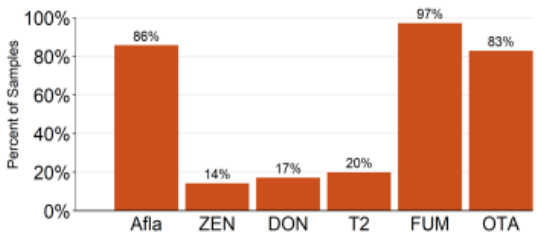


Mycotoxins and Gut Health

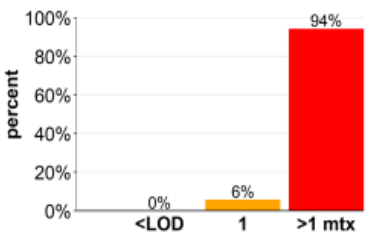
India Finished Feed Jan 2020 to Mar 2020

Total Risk Level: 97%*	Afla	ZEN	DON	T2	FUM	OTA
Number of samples tested	35	35	35	35	35	35
% Contaminated samples	86%	14%	17%	20%	97%	83%
% Above risk threshold	86%	9%	17%	0%	57%	37%
Average of positive (ppb)	84	100	385	30	889	14
Median of positive (ppb)	26	87	380	32	559	9
Maximum (ppb)	1252	261	480	37	4939	43

Prevalence of Mycotoxins Detected



No. of Mycotoxins per Sample



All 3 commonly found Mycotoxins; Aflatoxin B1, Fumonisins B1 & Ochratoxin A severely affects Gut Health

Naturally ahead © BIOMIN Holding GmbH 2018 Biomin

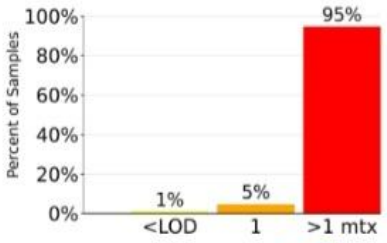
Mycotoxins & Gut Health

Summary for All commodities in India from Jan 2022 to Dec 2022

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Number of samples	524	524	524	524	524	524
% Contaminated samples	86%	60%	33%	73%	68%	78%
Average of positives (ppb)	39	66	818	33	1537	19
Maximum (ppb)	1134	1303	8690	150	15530	403

Prevalence of Mycotoxins Detected

No. of Mycotoxins per Sample



DSM

Mycotoxins and Gut Health

Aflatoxin B1 is very common in Maize, Soya & other ingredients and in Finished Feed.

- **AFB1 causes enlargement & damage of Liver includes Necropsy & Fatty Liver resulting Malabsorption due to reduction of Bile Salts production**
- **AFB1 damages the Tight Junction Integrity of Intestinal Epithelial cells resulting leakage of nutrients & facilitates entry of pathogen through damaged mucosa**
- **Fumonisins B1 affects proliferation of Intestinal Epithelial cell, reduces villi height & crypt surfaces; thus affects the normal atmosphere of intestinal epithelium and intestinal microbial homeostasis resulting increase incidence of NE & Coccidiosis.**
- **Reduced functional activity of intestine results nutrient leakage & Enteritis**
- **Ochratoxin A impacts Tight Junction Integrity**
- **OTA also damage intestinal mucosa affects digestive functions**
- **T2 Toxins disturbs Intestinal epithelial cell proliferation, Mucous production & Immunoglobulin production; thus affects Intestinal health & nutrient utilization**
- **DON impaired Nutrient absorption**
- **It affect Tight Junction Integrity of Intestinal epithelial cell**

Loose Dropping & Feed passage is almost common in Poultry Farms Now a Days

Infections & Gut Health

- Gut health remain under pressure from both Clinical & Subclinical Infections at any age
- Infections may be Bacterial, Viral or Parasitic
- Mortality may not be high but Performance always Poor due to reduced feed utilization

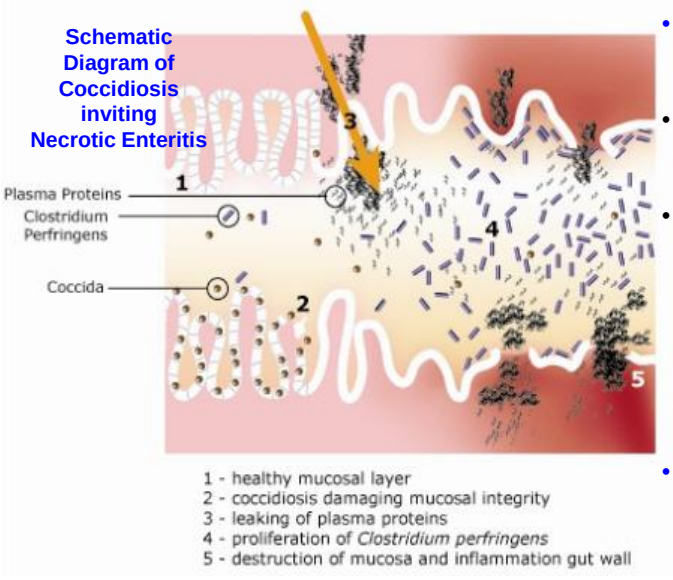
Bacterial Infections are Necrotic Enteritis (*Clostridium perfingens*), *E coli*, Salmonella, Staphylococcus, Campylobacter

Infections & Gut Health

Viral Infections affects gut health are IB, IBH, ND, LPAI, IBD, REO etc

Infections & Gut Health

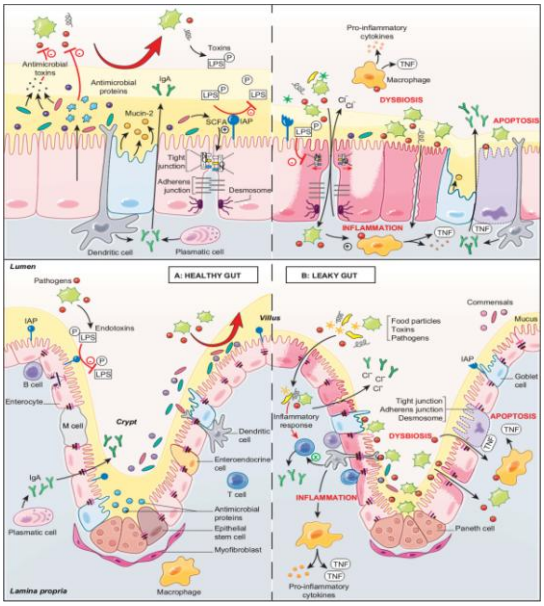
Infections & Gut Health



- **Coccidiosis & Necrotic Enteritis are most common & economically important poultry Intestinal diseases**
- **Eradication of Coccidiosis is impossible and Coccidiosis invites Necrotic Enteritis**
- **Clostridium is natural habitat of hind gut which multiplies & moves forward when excess Nitrogen reaches hind gut due to poor protein digestion /absorption and/or due to mucosal damage by Coccidiosis or Mycotoxin or Oxidative Stress leading to passage of dead cell protein**
- **Clostridium causes Necrosis of Intestinal mucosa (NE), severely affecting nutrient utilization resulting Poor Performance**

Infections & Gut Health

- **Lipopolysaccharide (LPS), an Endotoxin secreted by Avian Pathogenic E coli (APEC)**
- **This LPS increases intestinal permeability, enters systemic circulation and alter intestinal structure & function, resulting in impaired absorption & utilization of nutrients with negative impact on both heath and growth**
- **Acute exposure to large amounts of LPS suppresses feed intake in chickens and activation of the innate immune system; promotes the synthesis of pro-inflammatory cytokines and induces oxidative stress in broiler chicken.**

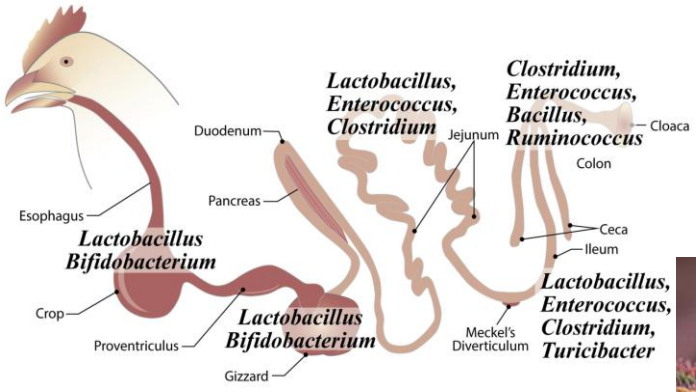


Infections of Gut & Performance Changes

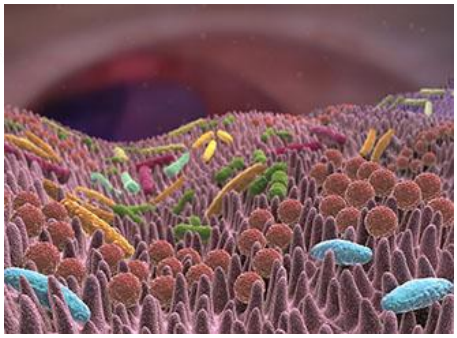
Climate Control Farm Performance, Thailand									
Auanglong Farm, Nakhonratchasima				Integrator: Thai Food					
Breed: Arbor Acre			Normal Performance						
Hatch Dt	SEX	Chicks	Mort%	Av Wt	FCR	M Age	D Gain	EEF	C FCR
07-Jul-17	Male	22,000	2.35	3.050	1.610	41.00	74.39	451	1.347
	Female	24,000	2.08	2.820	1.620	42.00	67.14	406	1.415
As Hatch		46,000	2.21	2.930	1.615	41.52	70.56	427	1.382

Same Farm next flock Performance Deviation due to Poor Gut Health									
Auanglong Farm, Nakhonratchasima				Integrator: Thai Food					
Breed: Arbor Acre			Poor Female Shed Performance						
Hatch Dt	SEX	Chicks	Mort%	Av Wt	FCR	M Age	D Gain	EEF	C FCR
13-Sep-17	Male	22,500	2.16	3.210	1.660	41.00	78.29	461	1.357
	Female	24,500	4.54	2.780	1.810	42.00	66.19	349	1.615
As Hatch		47,000	3.4	2.989	1.732	41.52	71.99	402	1.485

Intestinal Microbiota & Gut Health



- **Large community of Microorganism lives in the gut**
- **700 – 800 species & Trillions in no made the Gut Microbiota – both favourable & unfavourable**

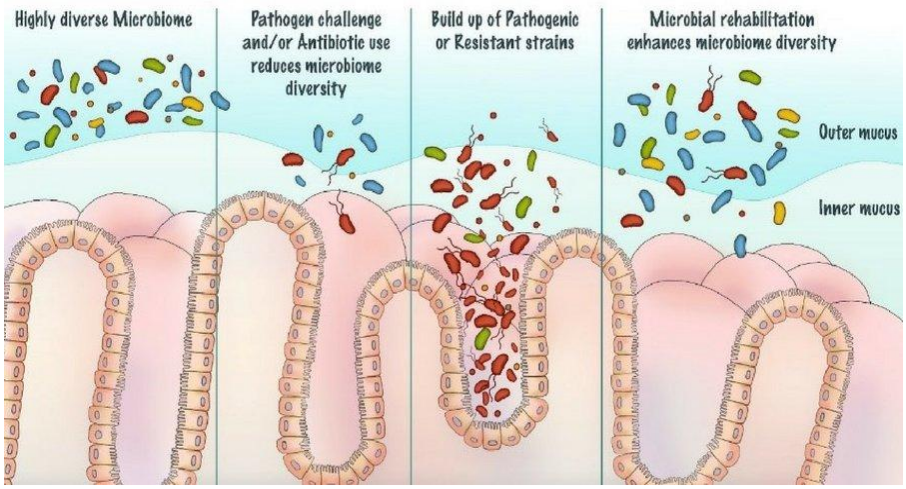


1. **Healthy Microflora releases Organic acids and makes the gut unfavorable to harmful microbes**
2. **Occupy the receptors of lining cells and minimizes adhesion & colonization the harmful bacteria (Competitive Exclusion)**

Intestinal Microbiota & Gut Health

Healthy Microbiota being compromised & gradually changed species & populations

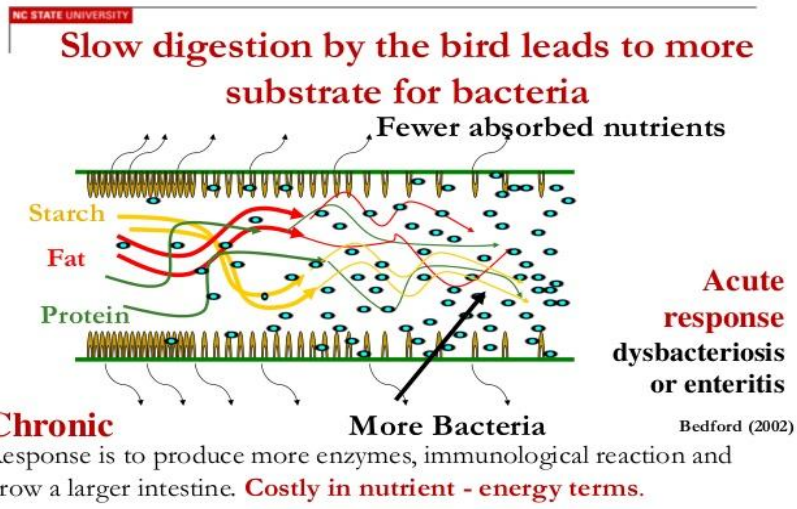
3. **Releases Antibacterial Bacteriosins to inhibit growth of harmful bacteria**
4. **Stimulation & Development of gut associated Immune system (GALT)**
5. **Produces nutrients by fermentation of undigestible plant fibers**



Impact of Gut Health Compromise

Deviation in Microbiota results Mal-absorption

- **Poor absorption of Fat, Protein & Carbohydrate**
- **More Fat, Protein & Sugar available at hind gut; Caeca**
- **More nutrients available for microbes like *Clostridium***



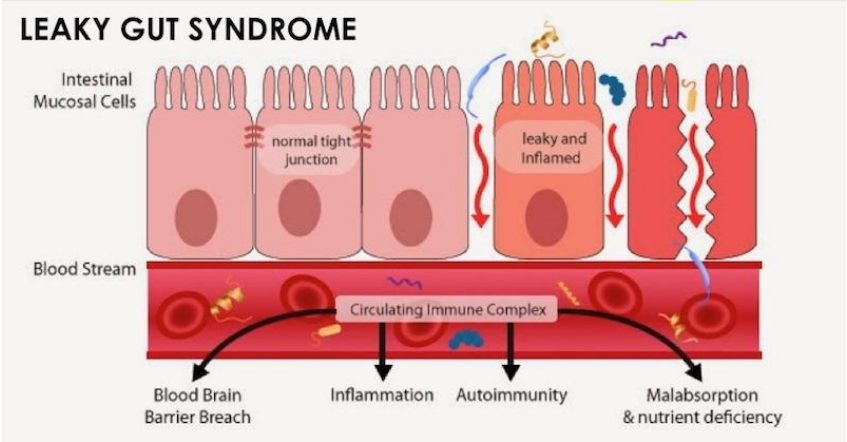
Effect of Gut Health Compromise

Unwanted Microbial Overgrowth

- **Excess Production of Toxic gas like CO2, NH3 & H2S**
- **Production of Toxic Chemical (Amines); irritates gut & reduced body growth**
- **Inactivation of Bile acid impacting Fat absorption**
- **Immune reaction leading to Leaky Gut**

This leads to further disruption & damage of Intestinal mucosa leading to many more infections

This is called Dysbacteriosis



Impact of Gut Health Compromise > Farm Pictures

- Poor Gut Health Management cause Enteritis, diarrhoea & Pasty Vent condition in chicks
- Continuation of the problem cause mal-absorption leads to undigested protein in hind gut resulting Necrotic Enteritis
- Maggot development is a common outcome of persistent NE in broiler

20230922_120853.mp4

Poor Gut Health Impact on Layer & Breeder

Poor Gut health reduce Nutrient absorption

- Poor growth, Poor Egg Wt & Egg production and Egg Shell Deformity
- Poor flock Uniformity
- Reduced antibody accumulation in Hatching Eggs leading to low MAb Titer chicks
- More nutrient to hind gut results bacterial overgrowth

Poor gut integrity results Entry of microbes in bloodstream

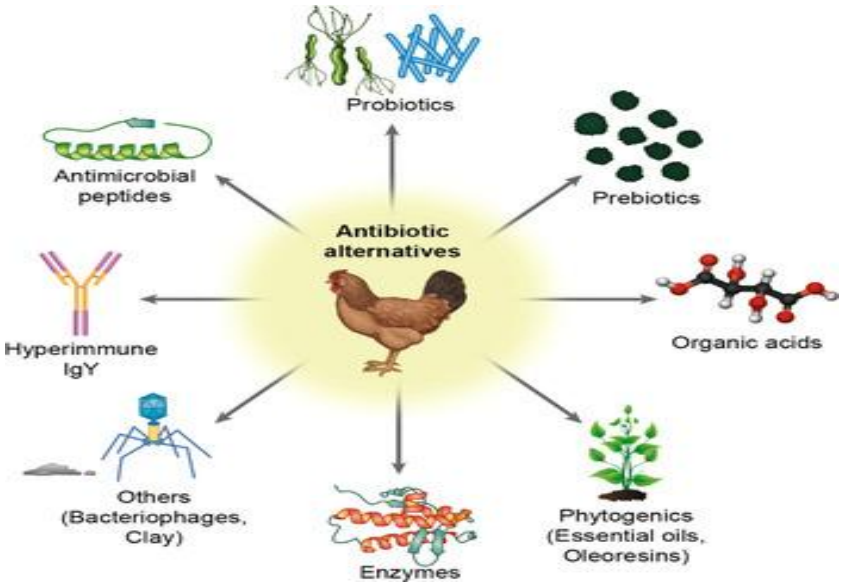
- Peritonitis
- Infectious joint disease

Microbial Imbalance in Gut may effect Egg

- During lay when egg passes through the cloaca, it may come in contact with the bacteria present there
- These bacteria may enters the egg and impact the embryo & chicks

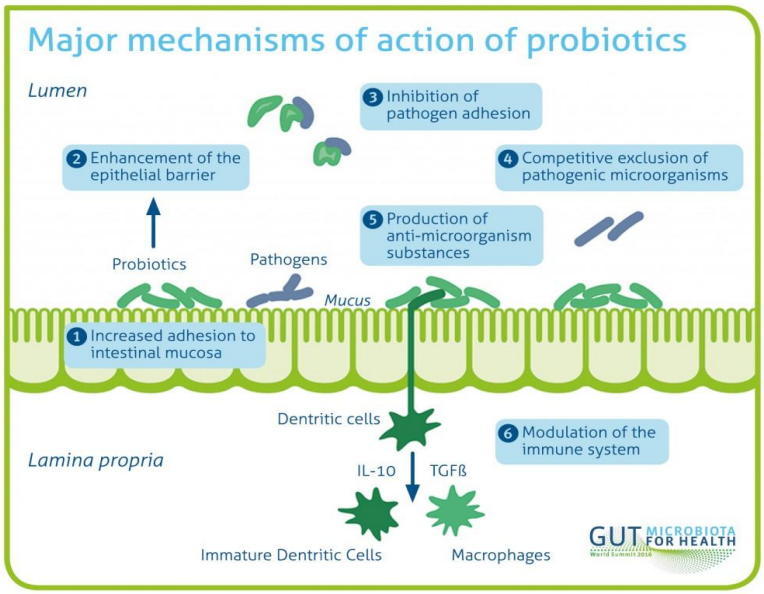
Gut Health Management Strategies

- Alternative to Antibiotics OR Alternative Strategies
- Therapeutic VS Prophylactic
- Tailor made Program from Farm to Farm OR Area to area

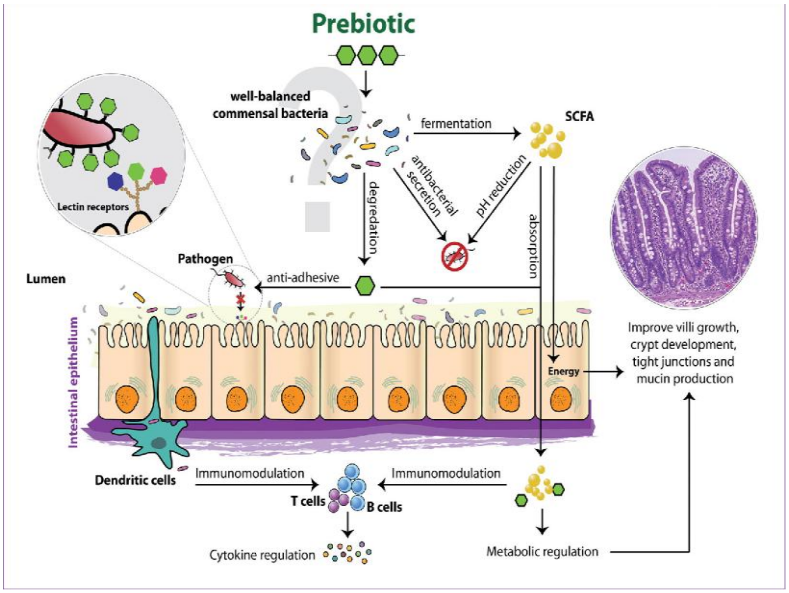


Role of Probiotic on Gut Health

- Lactic acid bacteria like Lactobacillus are the first Microorganisms to colonize the GIT of newly hatched chicks
- Lactobacillus dominate the upper GIT; Crop, gizzard & duodenum, but also in middle & lower gut
- Bifidobacterium also present in upper GIT
- Enterococcus & Clostridium are present in middle & lower GIT
- Ruminococcus & Bacillus are present in lower gut



Role of Prebiotic on Gut Health

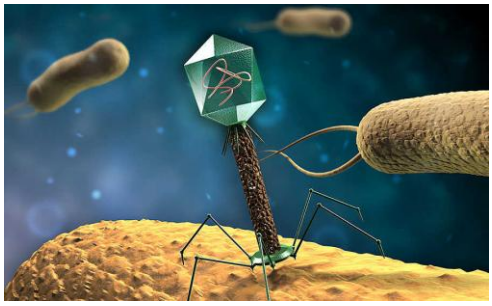


- Prebiotics are non-digestible feed ingredients that are metabolized by intestinal microbiota and provide health benefits for the host.
- Fermentable oligosaccharides are best prebiotics in poultry e g Fructooligosaccharides (FOS) & Mannanoligosaccharides (MOS)
- They act through diverse mechanisms, such as providing nutrients, preventing pathogen adhesion to host cells, interacting with host immune systems and affecting gut morphological structure, all presumably through modulation of intestinal microbiota

Other Gut Health Promoting Products

Organic Acids reduces pH of GIT

- Reduce gut pH which is always under threat from ingestion of feed & poor quality water
- Makes the Gut unfavourable for the pathogenic bacteria for adhesion & colonization
- Increases Villi length & crypts depth and thus improves digestion & absorption capacity
- Improves digestion of amino acids & plant Fibers



Phytogenic Extracts or Phytobiotics

- Include Saponins, Flavonoids & Essential Oils; acts on bacterial cell wall & inhibits growth of harmful bacteria
- Stimulates digestive secretion & improves feed intake
- Stimulates specific immune response
- Antioxidant properties
- Reduce Ammonia

Bacteriophages

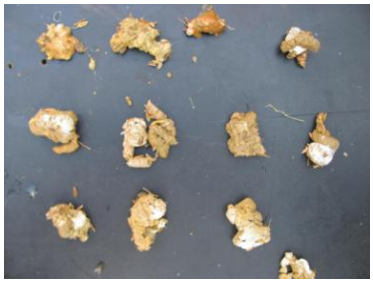
- Bacteriophages are viruses that can infect and kill bacteria and going to be a good replacement of antibiotics against E coli, Salmonella, Compylobactor, Clostridium, etc.
- Bacteriophages are very specific and hence more than one phage might be needed to eliminate different strains of the same pathogen. A possible solution is the application of selected phage cocktails containing multiple bacteriophages.

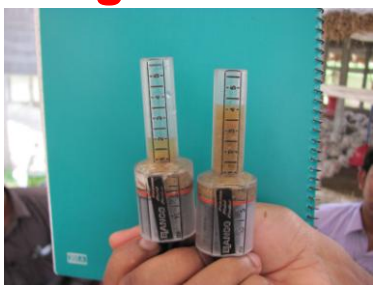
Butyrate on Gut Health

- **Direct Bactericidal Action: After sodium butyrate is converted to butyric acid, it has the ability to enter the bacterial cell wall mainly through diffusion (Clark and Cronan, 1996) which causes toxicity inside the bacterial cell (Warnecke and Gill, 2005), the reduction in the cytoplasmic pH of the bacterial cell (Choi *et al.*, 2000) leading to the death of bacteria**
- **Indirect Bactericidal Action: It lowers the pH of intestine that favors the growth of lactic acid producing bacteria such as *Lactobacilli* and *Bifidobacteria spp which stops growth, adhesion & multiplication of Harmful bacteria in the gut by competitive Exclusion & through releasing bactericidal chemical bacteriocin***
- **Gut Morphology: As sodium butyrate is converted to butyric acid after ingestion, it is preferably absorbed by enterocytes as a source of energy (Mahdavi and Torki, 2009). It accelerates the growth of enterocytes and villus elongation that results in increased villi height and deeper crypts.**

Early Detection of Gut Health Issues

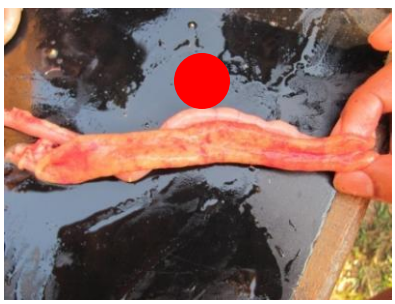
Regular Gut Health Scoring

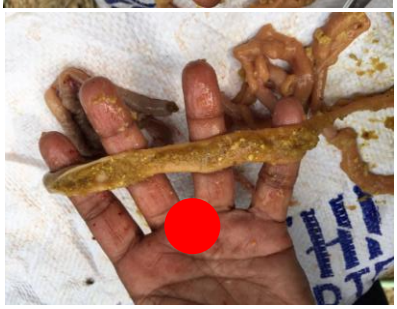




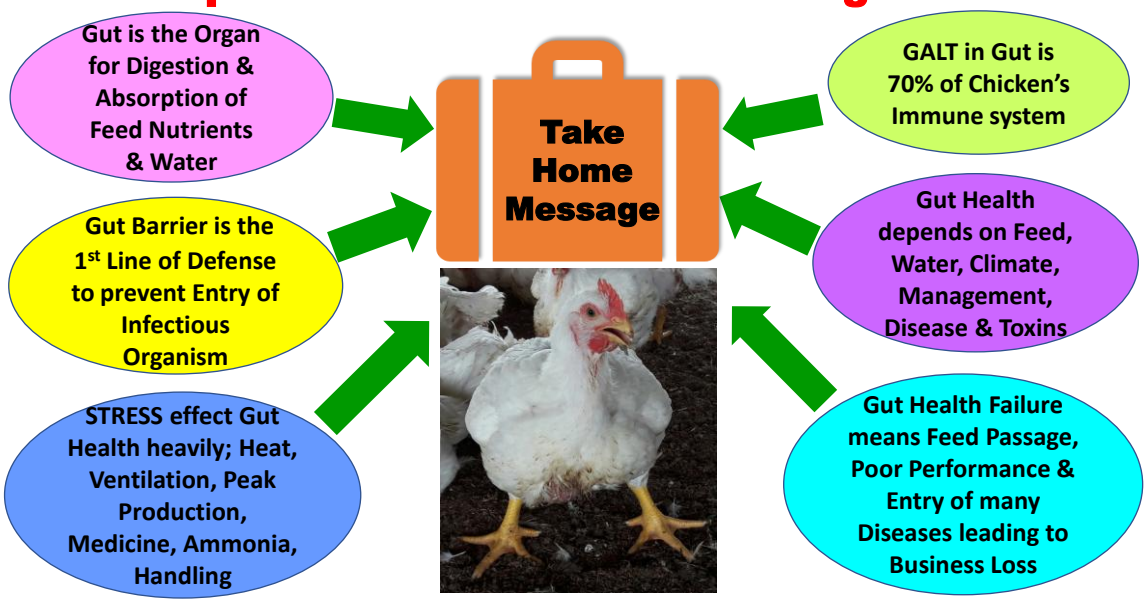

Regular Gut Health Scoring



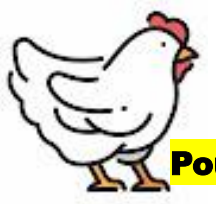




Importance of Gut Health management



Thank You



YouTube

PoultryTroubleshooter_BDutta

www.drbcdutta.com