"If You're For Healthy Animals We're For You"

Smart Science

The effect of prebiotics to control artificial infection of *Salmonella*

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µ micron BIO-SYSTEMS

Challenges in animal production

- **Major concerns in animal production:**

- **ensuring optimal animal health and welfare**
- **control of intestinal pathogens**
- **improvement of growth performance**
- **reduction of use of antibiotics**

Microbiota

- **Animal health and performance is directly related to the complex balance of the microbial populations that inhabit the digestive system.**

- **Intestinal tract of new-borns is rapidly colonised by a complex microflora.**

  1 day after hatching 10^8-10^{10} cfu/g digesta ileum&cecum

  4 days of age Lactobacilli 25%, Salmonella 40% of total cecum population

  25 days of age Lactobacilli and Bifidobacterium, 50%, Salmonella 20%

Amit-Romach et al., 2004, Apajalahti et al., 2004

Microbiota functions

- **Maintain "colonization resistance":**

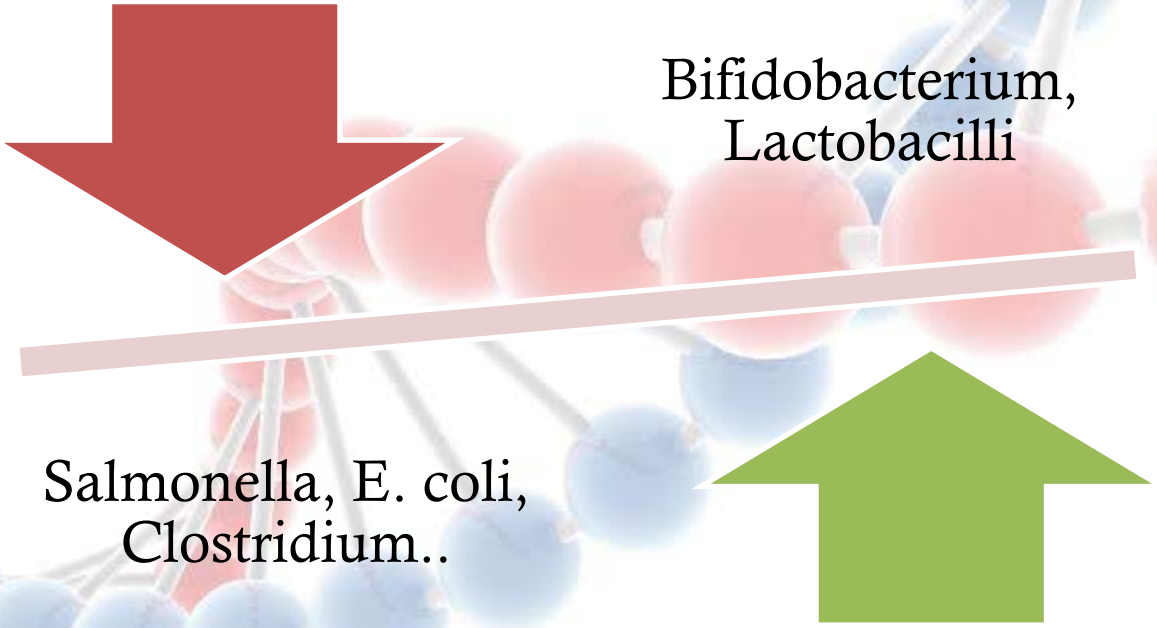
1) **Competitive exclusion**
2) **Immune modulation**

- **Stimulate development of digestive tract**
  -enzymes
  -digestive tract development
  -gut mucosal proliferation
  -vitamin synthesis
  -utilization of fermentation and endogenous products

Lan et al., 2000, Gabriel el al., 2006, Revolledo et al., 2006

Eubiosis

Balanced digestive tract microflora is a key driver in both production animals and particularly in young stock.



In stress situations (diet change, heat, laying, virus infection) the balance might change…*(Chamber et al., 2011)*

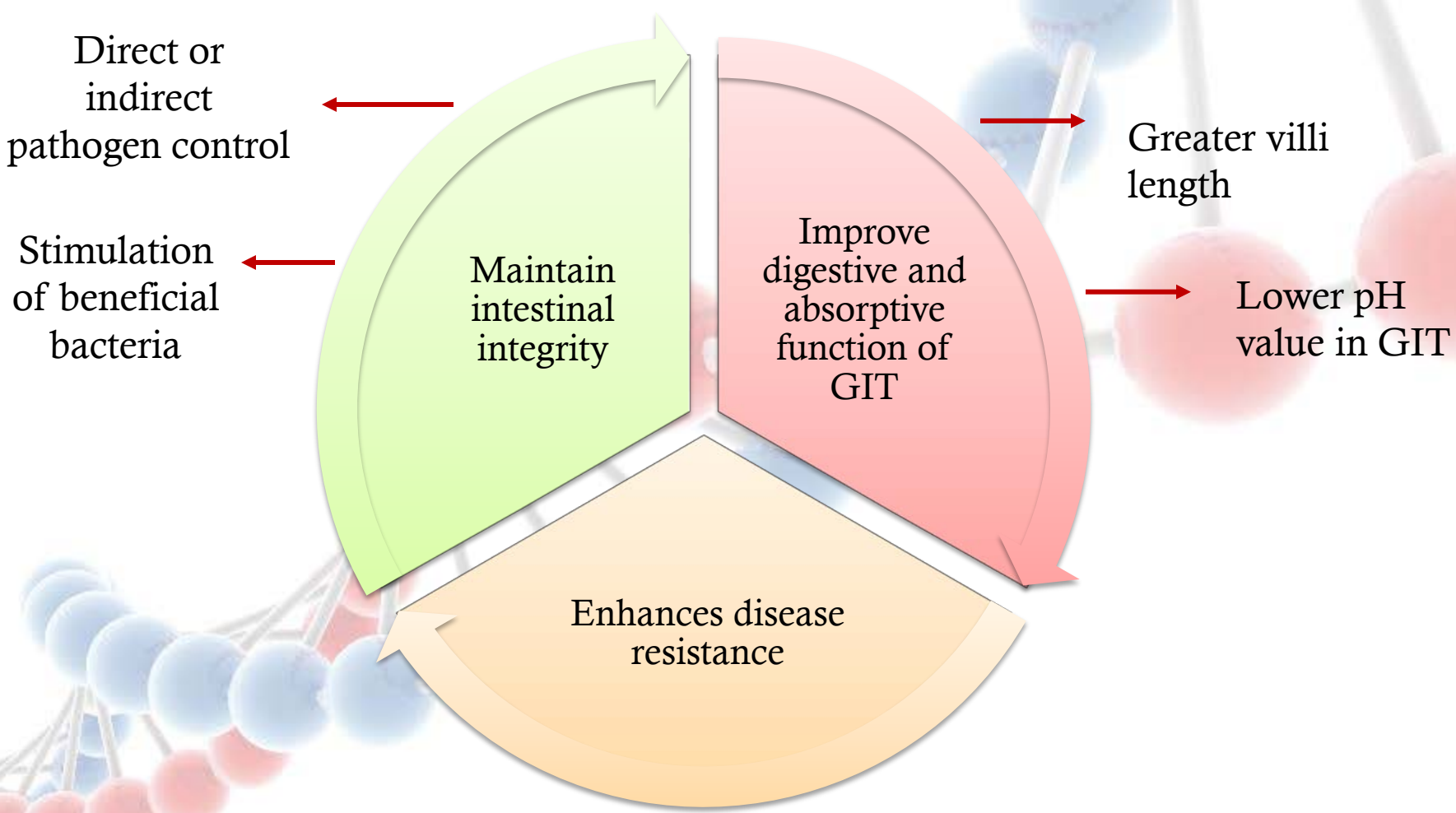
Modulation of GIT microflora

The use of probiotics/prebiotics – major approach in modulating microflora

Prebiotics are typically materials that are not directly digested by the host animal but are stimulatory to beneficial population of bacteria present in the host.

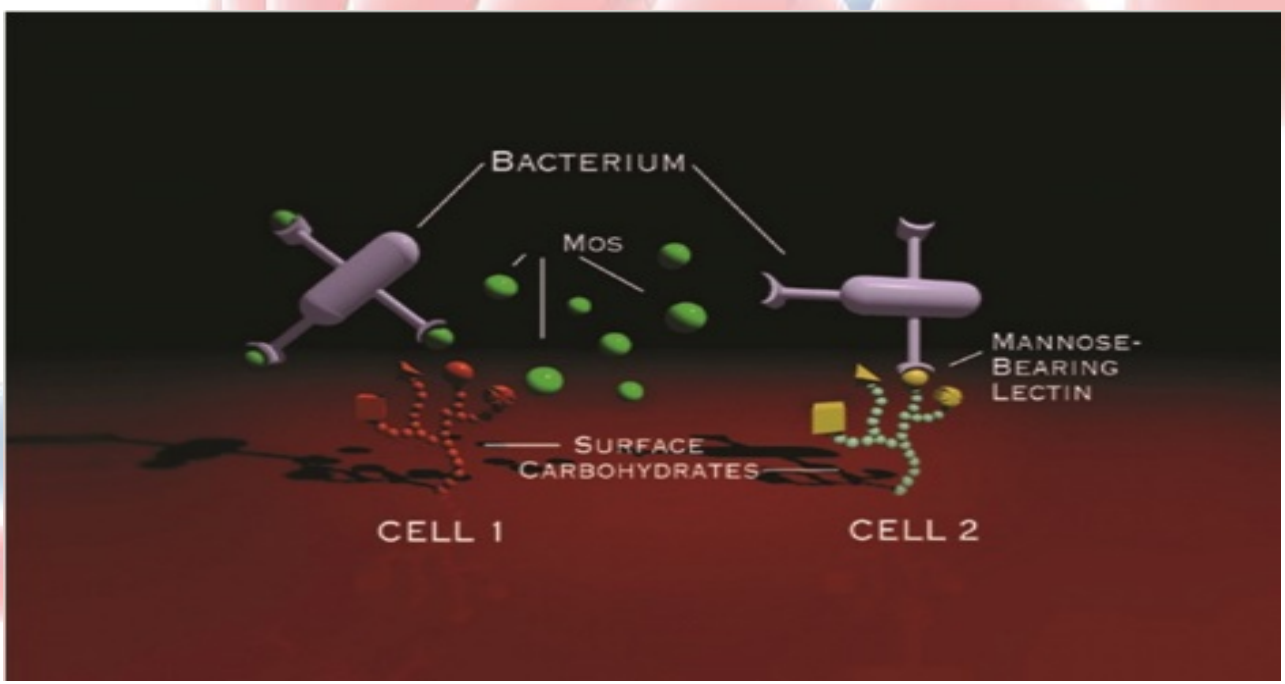
Prebiotic examples: fructan and mannan oligosaccharides, ß-glucans

Mode of action of prebiotics



MOS: Direct pathogen control

Mannan-based oligosaccharides may occupy bacterial binding sites - prevents attachment of pathogens to the intestinal mucosal wall.



MOS – pathogen binding

- **Pathogens with fimbriae which are specific for mannose attach to mannose-containing cells in intestinal tract and cause its colonization.**
- **Pathogenic bacteria such as *Salmonella spp.*, *Escherichia coli* and *Vibrio cholera* have mannose specific lectins on their cell surface.**
- **MOS provides a mannose-rich source for attachment which will adsorb bacteria that would otherwise attached to the gut wall.**
- **Pathogens become bound to MOS and are washed out of the digestive system**

Salmonella challenge trial

- **Introduction:**
- Non-typhoidal *Salmonella* represents a major cause of food poisoning in humans *(Chimalizeni et al. 2010)*

- The avian species have been frequently implicated as a source of salmonellosis *(Revolledo et al., 2006)*

- Economic losses associated with foodborne salmonellosis is significant

- **Aim of the study:**

To evaluate the effect of supplementation with MOS (FerMos, Micron Bio-Systems, UK) and FOS on the Salmonella Enteritidis shedding in broilers.

Salmonella challenge trial

- **Materials&Methods**
- 80 one-day-old broiler chicks (Ross) were randomly divided into 4 groups (20 birds each).
- On the day 4 the birds were challenged with *Salmonella enteritidis* (strain PT-4) by oral administration of 8 x 10^5 live cells per bird

- **Study design:**
- Control group: no treatment
- MOS (45% of gluco-mannans) I: 0.5 kg/t
- MOS (45% of gluco-mannans) II: 2.0 kg/t
- FOS (inulin): 5 kg/t

- The duration of the trial 56 days.
- Qualitative analysis of *Salmonella* was carried out in cloacal swabs twice a week.

Results

Days after challenge	Control	0.5 kg/t MOS	2 kg/t MOS	5 kg/t FOS
8	+	+	+	+
10	+	+	+	+
14	+	+	+	+
17	+	+	+	+
21	+	+	+	+
24	+	+	+	+
28	+	+	-	+
31	+	+	+	+
35	+	+	+	+
38	+	+	-	+
42	+	+	+	+
45	+	+	-	+
49	+	+	-	+
52	+	+	-	+
56	+	+	-	+

+/- = presence/absence of *Salmonella*

Conclusions

- After 45 days MOS at inclusion level of 2 kg/t was able to stop *Salmonella* Eteritidis shedding in artificially contaminated broilers.
- Lower inclusion level of MOS was not sufficient in preventing the shedding of *Salmonella*.
- Even the higher inclusion level of FOS was not able to stop *Salmonella* shedding in artificially contaminated broilers.
- This might be attributed to superior properties of MOS in pathogen control compared to FOS.

Thank you for your attention!

Questions?

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