Benefits of feed additives beyond growth related performance

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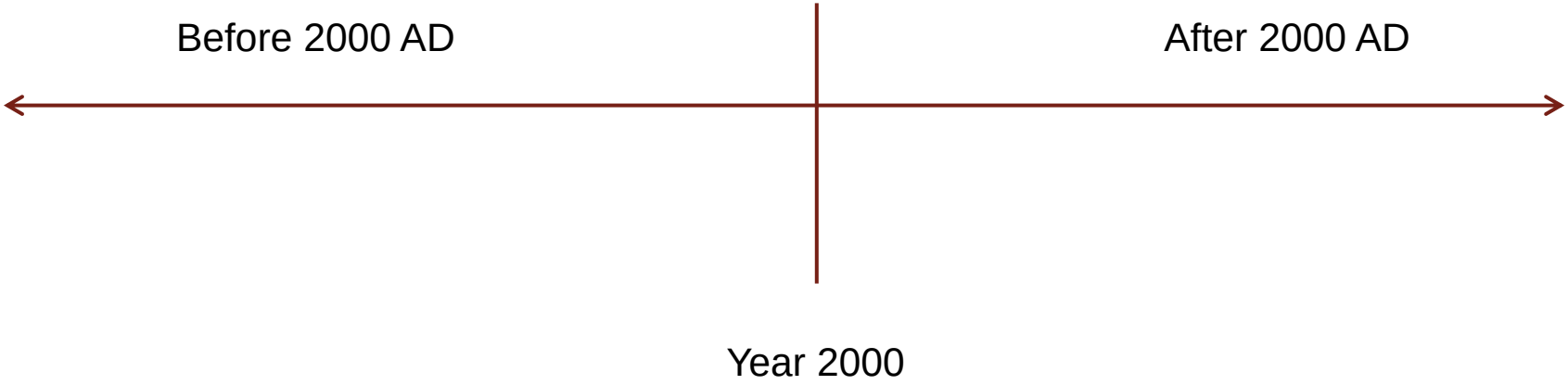
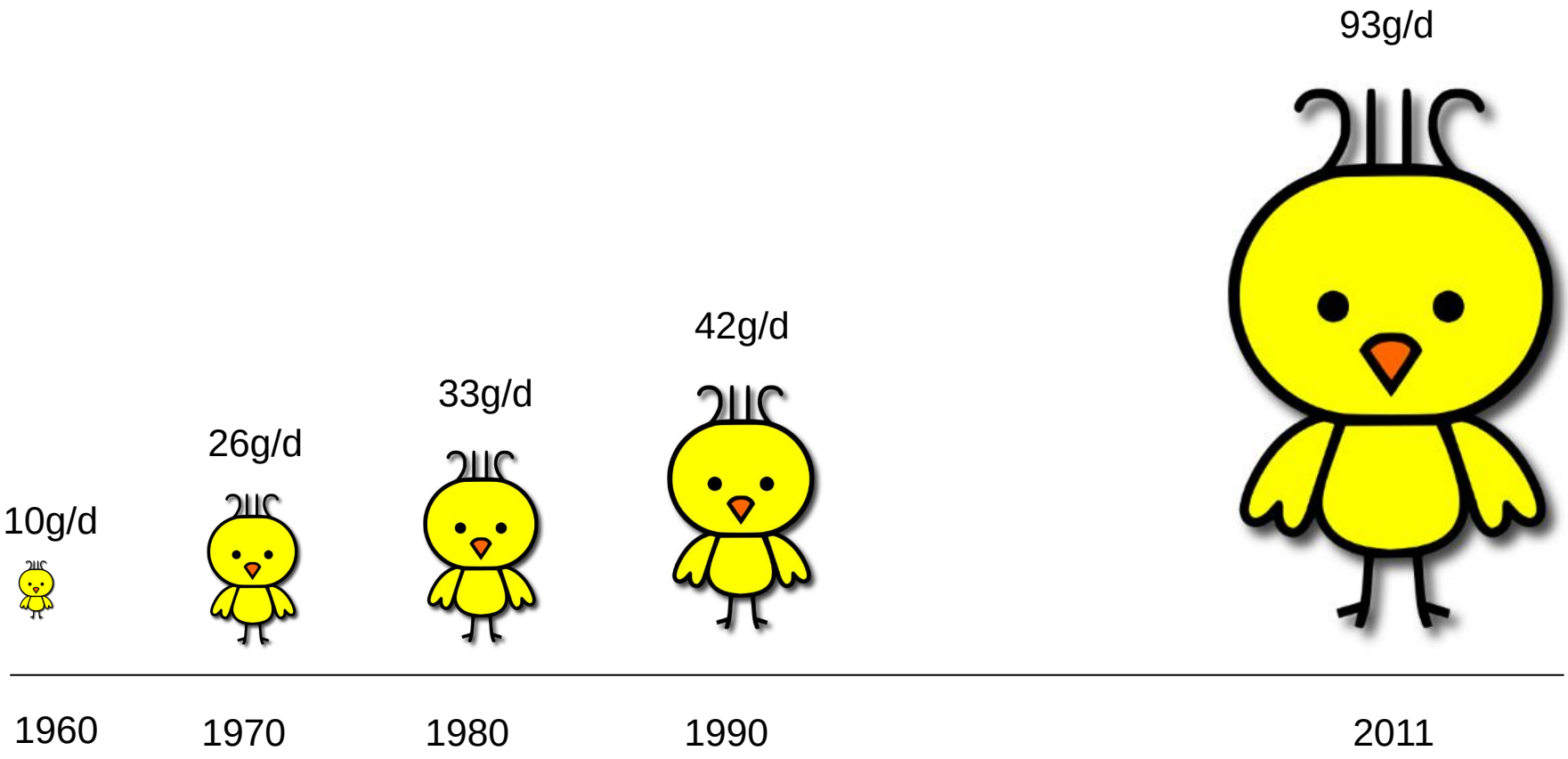
Success and Success criteria for Animal production:



Success criteria……..Before 2000AD

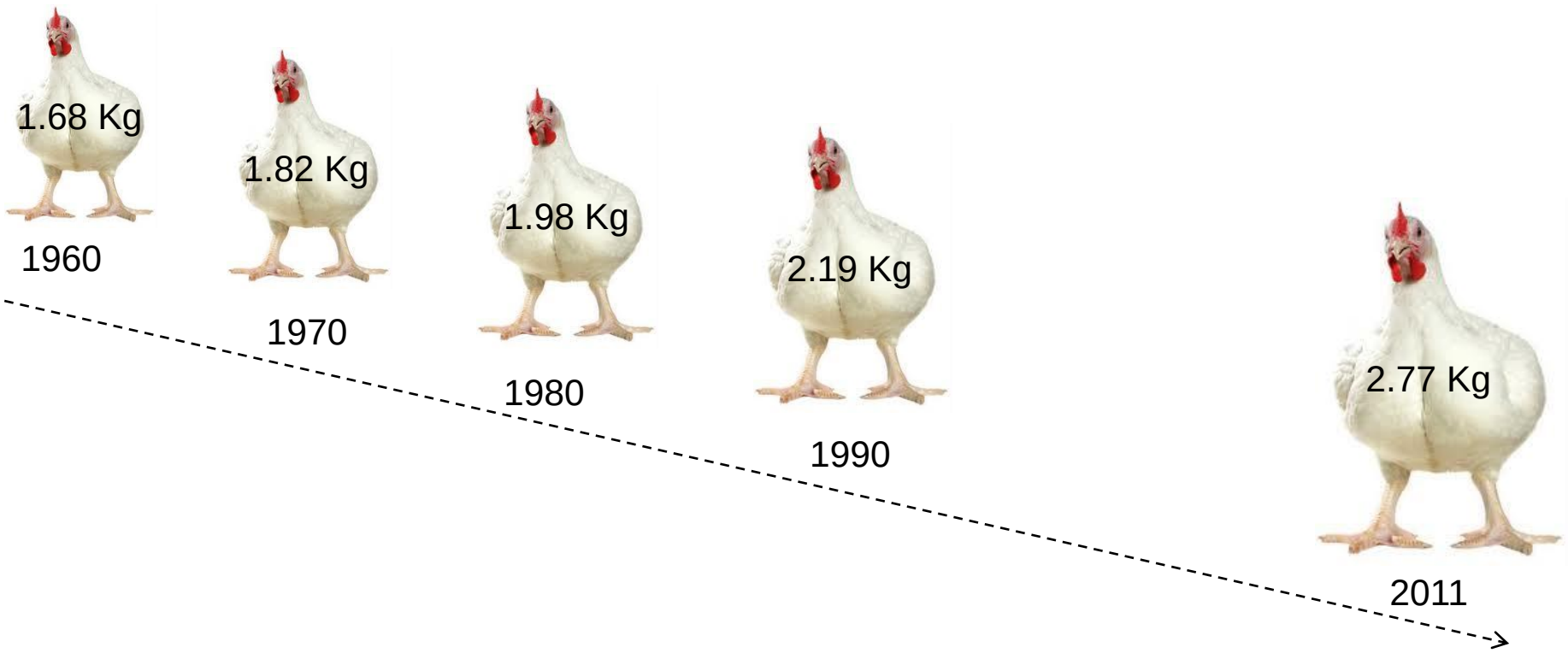
ADG: average daily gain g/d; SBW: Slaughter Body weight; FE: feed efficiency; FCR: feed conversion ratio

Improvement in growth rate



Based on Rauw 1998 and Ross info

Improvement in Slaughter weight



Based on Rauw 1998 and Ross info

Improvement in Feed Conversion Ratio

2.5 Kg

1960

2.1 Kg

1970

2.04 Kg

1980

1.92 Kg

1990

1.72 Kg

2011

Amount of feed required for 1Kg weight gain

Based on Rauw 1998 and Ross info

Animal production: before and after 2000AD

Changes in global human population, pig and poultry inventories, and production and international trade of pig and poultry meat between 1996 and 2005.

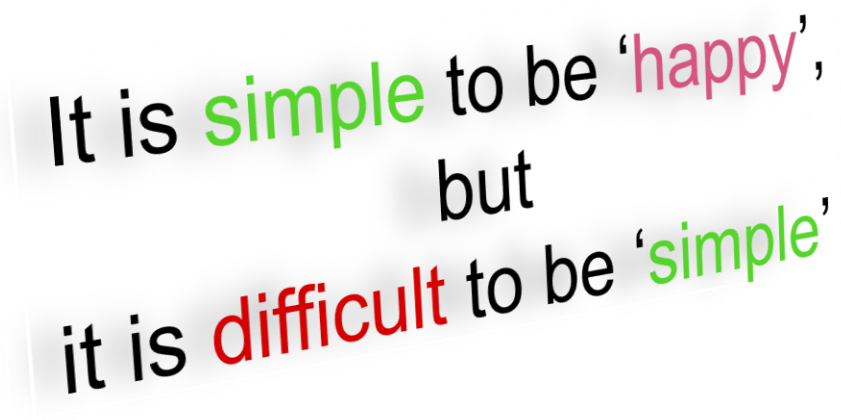
	1996	2005	Annual growth (%)
Human population	5,762	6,451	1.1
Inventory			
Pigs (million)	859	963	1.1
Poultry (million)	14,949	18,428	2.1
Production			
Pig meat (thousand tons)	79,375	103,226	2.6
Poultry meat (thousand tons)	56,408	81,856	3.7
International trade			
Pig meat (thousand tons)	6,398	9,557	4.0
Poultry meat (thousand tons)	5,359	9,234	5.3

Source: FAOSTAT

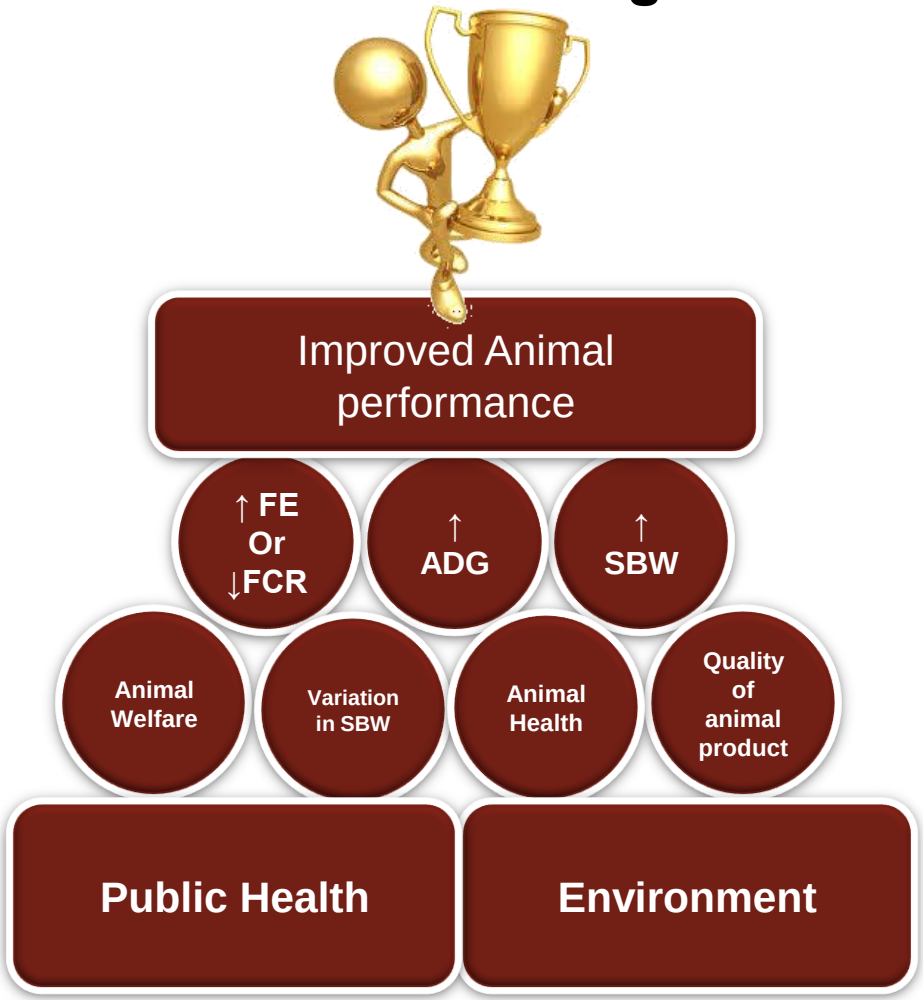
Otte *et al*., 2007

Was Animal production successful before 2000AD?

Yes …..positively very successful!!



Success criteria for animal farming……..Now



Good news is we understand and we can do something about it nutritionally

Compromised Gut health affects animal performance

X Decreased nutrient digestibility in chickens with microbial overgrowth in small intestine(Smits 1996)

X Non specific stimulation of immune response

- IgA secreted across the GIT accounts for >70% of total antibody production (Macpherson and Uhr, 2004)

X Increased absorptive cell turnover and mucus production

- In chickens, gut metabolism accounts for 20-36% of the whole body energy expenditure, which is mainly due to cell turnover (Cant et al 1996)

Animal Health and Public Health

Gastro-intestinal Pathogens
e.g. E.coli, Clostridia, Salmonella

In feed antibiotics

Increased antibiotic resistance

Ban in EU and some other countries

Further increase in therapeutic antibiotics use

Threat to public health

Quality of animal products and public health

Campylobacter infection

Commensal in poultry

↓

Does not cause any infection,
But serious threat to human health

Salmonella infection

E.coli infection

Animal Welfare

Gastrointestinal microbes

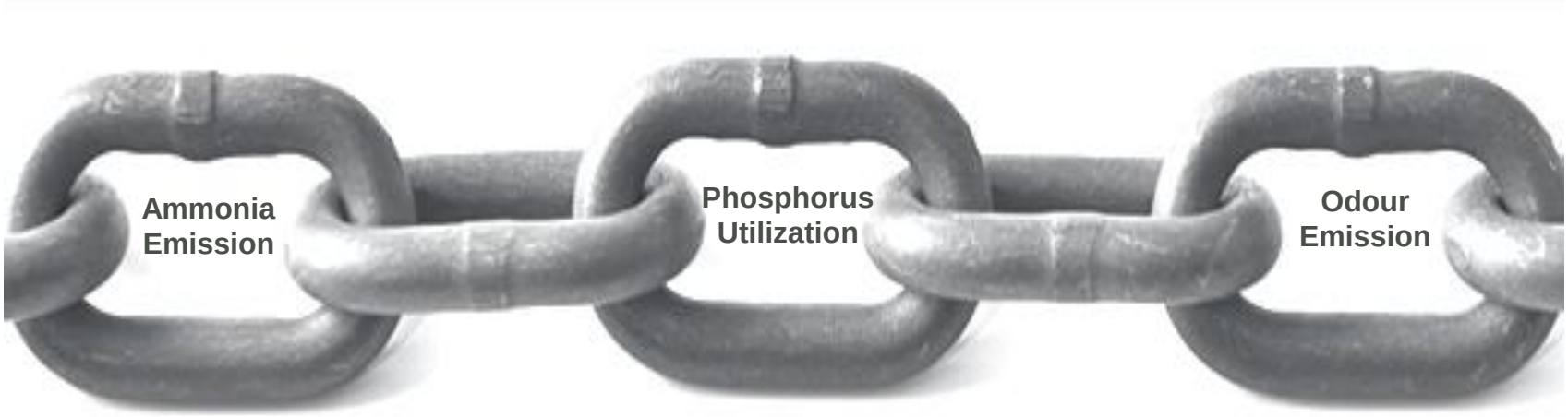
e.g. *Staphylococcus spp.*
Clostridium spp.

Foot pad lesions in broilers

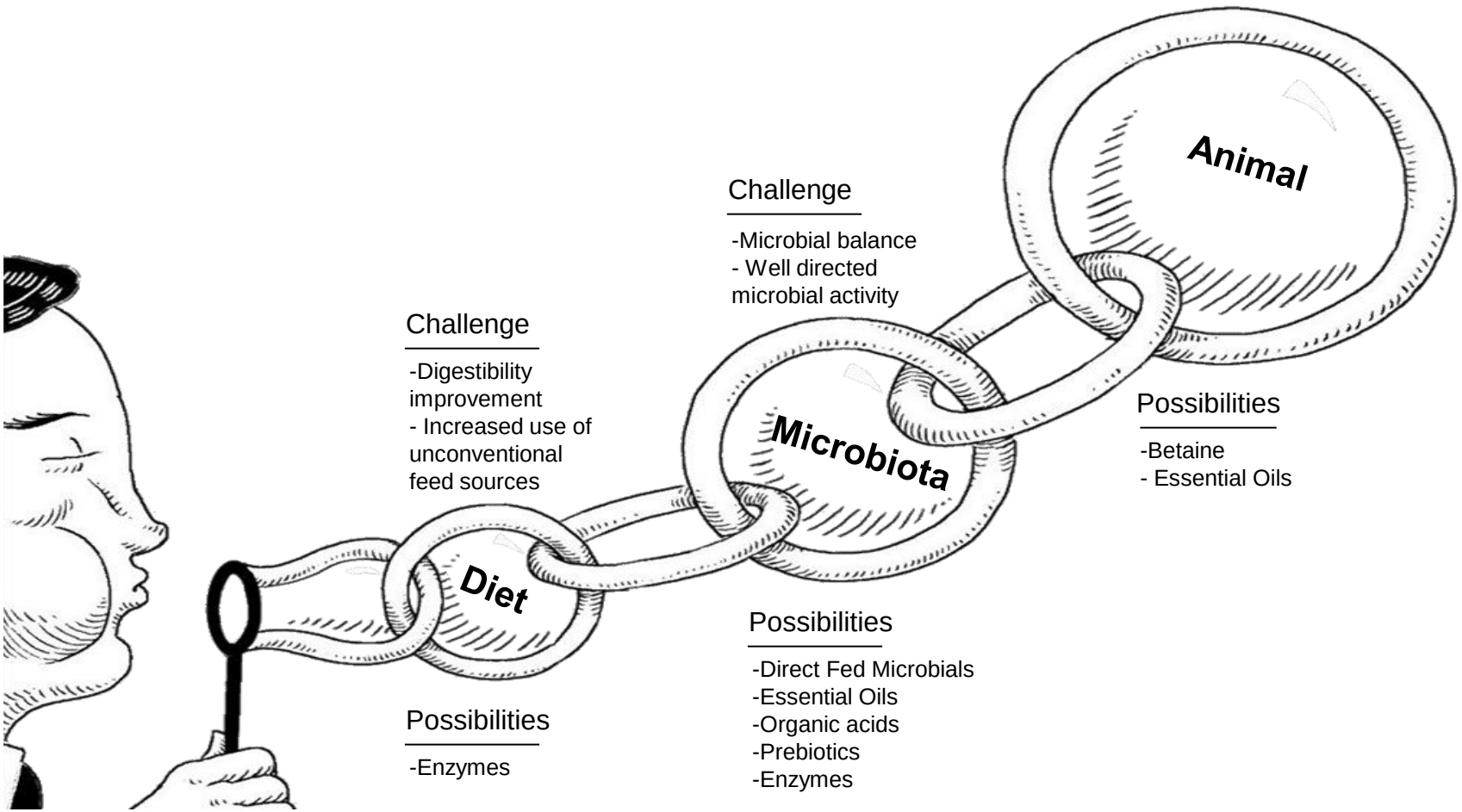
Microbial activity

Higher protein fermentation -leading to higher ammonia in excreta

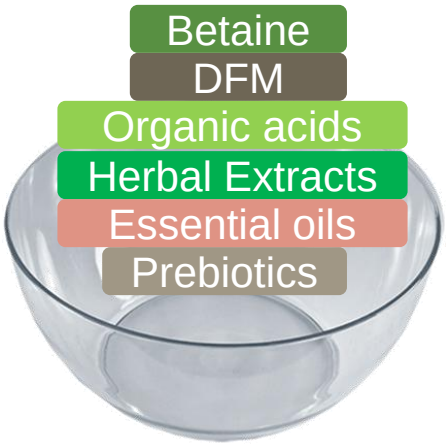
Environment



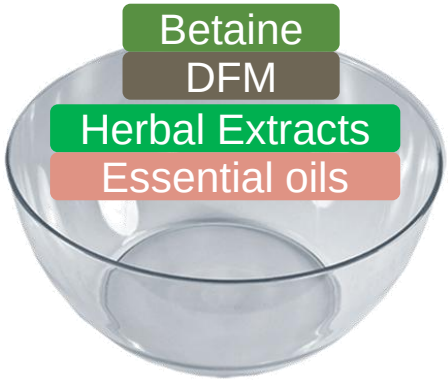
What can we do about it?



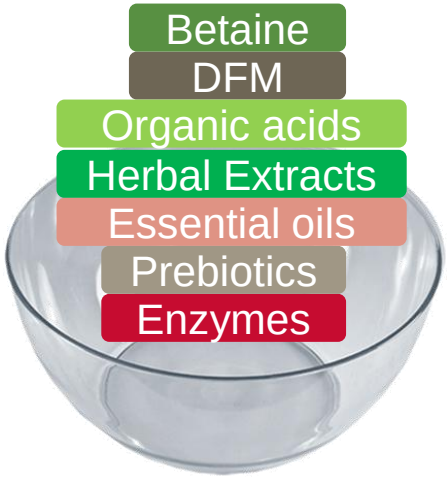
How about feed additives and challenges?



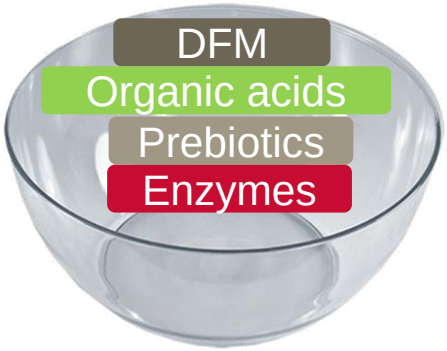
Animal Health & Welfare



Quality of animal products



Public Health (AMGP alternative)



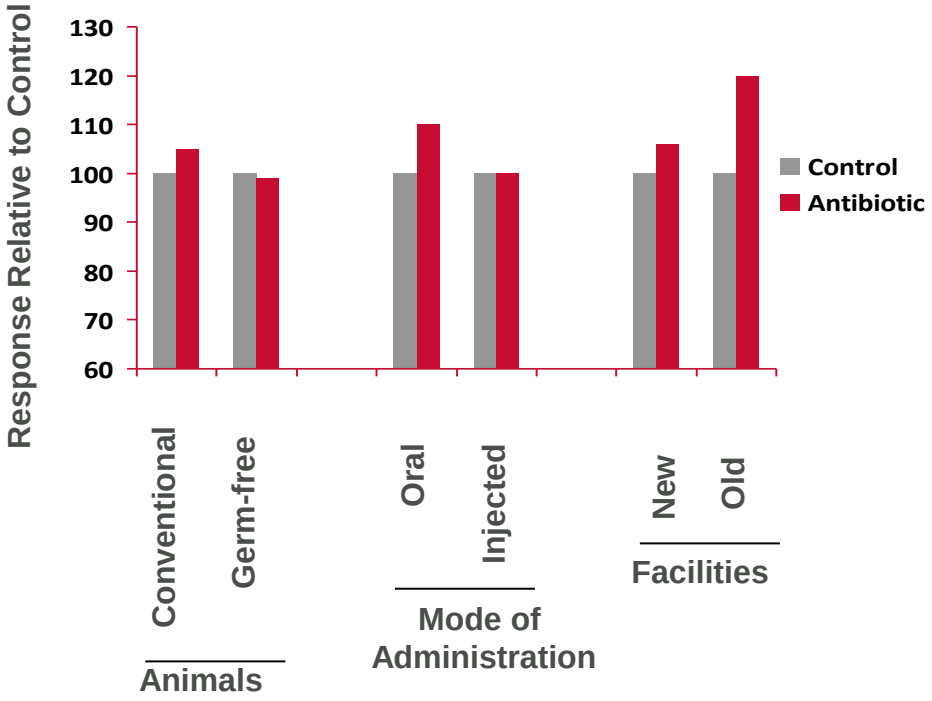
Environment

Interesting stories for today

- Enzymes: Alternative to AMGPs
- DFM: Quality of animal products

Enzymes as an alternative to AMGP

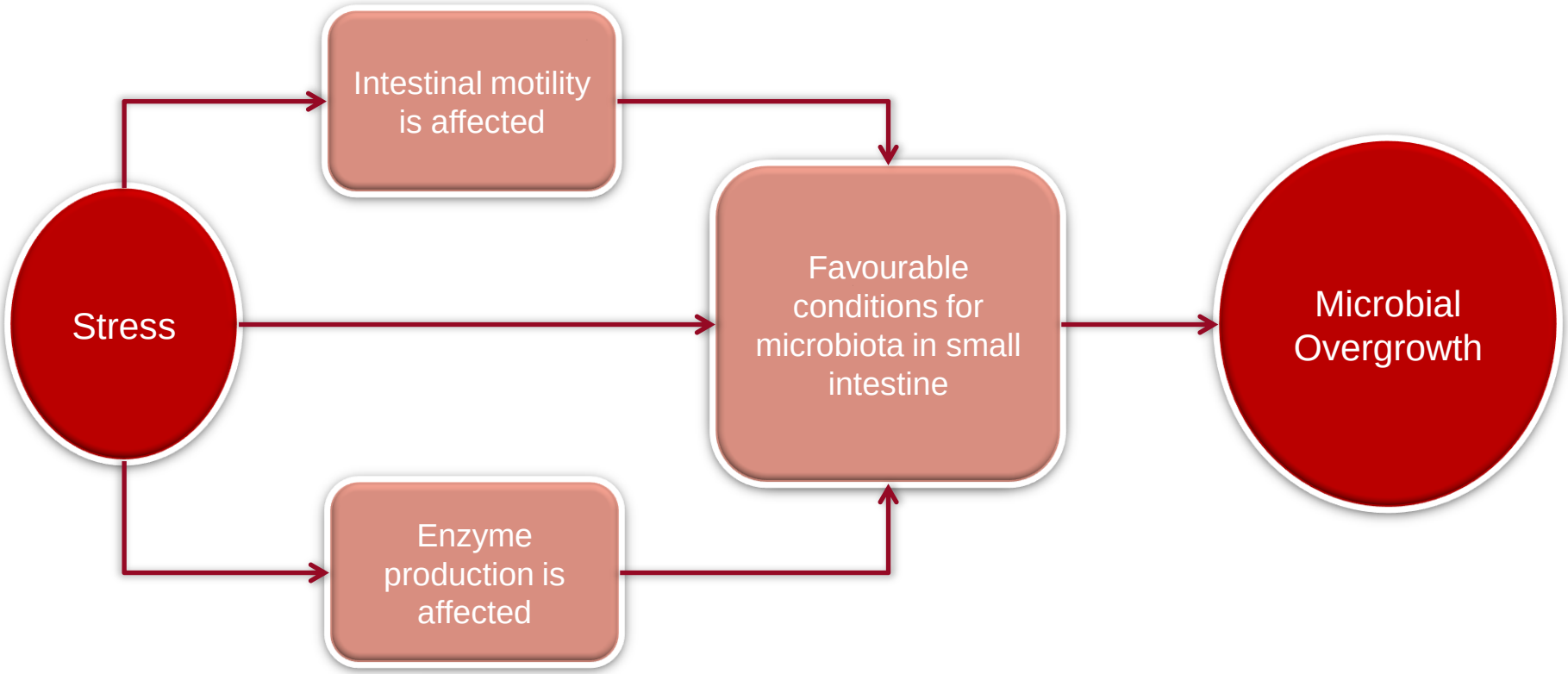
When, how and why AMGPs work?



- AMGPs work more effectively in **gut**
- AMGPs work more effectively under **stress**

Anderson, 1999

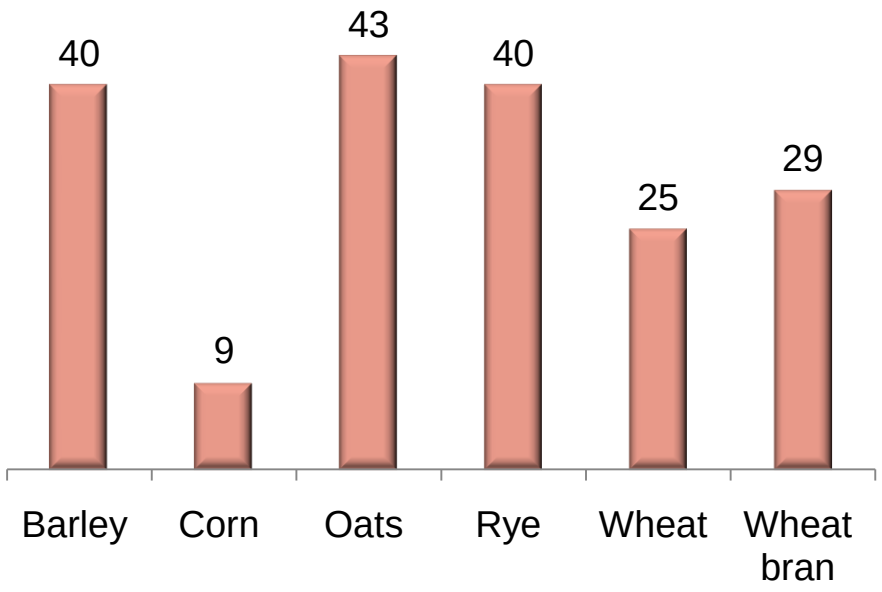
Stress and gut microflora



NSP contents in diet contribute further to the problem

Animal diets contain Cereals

unconventional cheap ingredients with high NSP contents

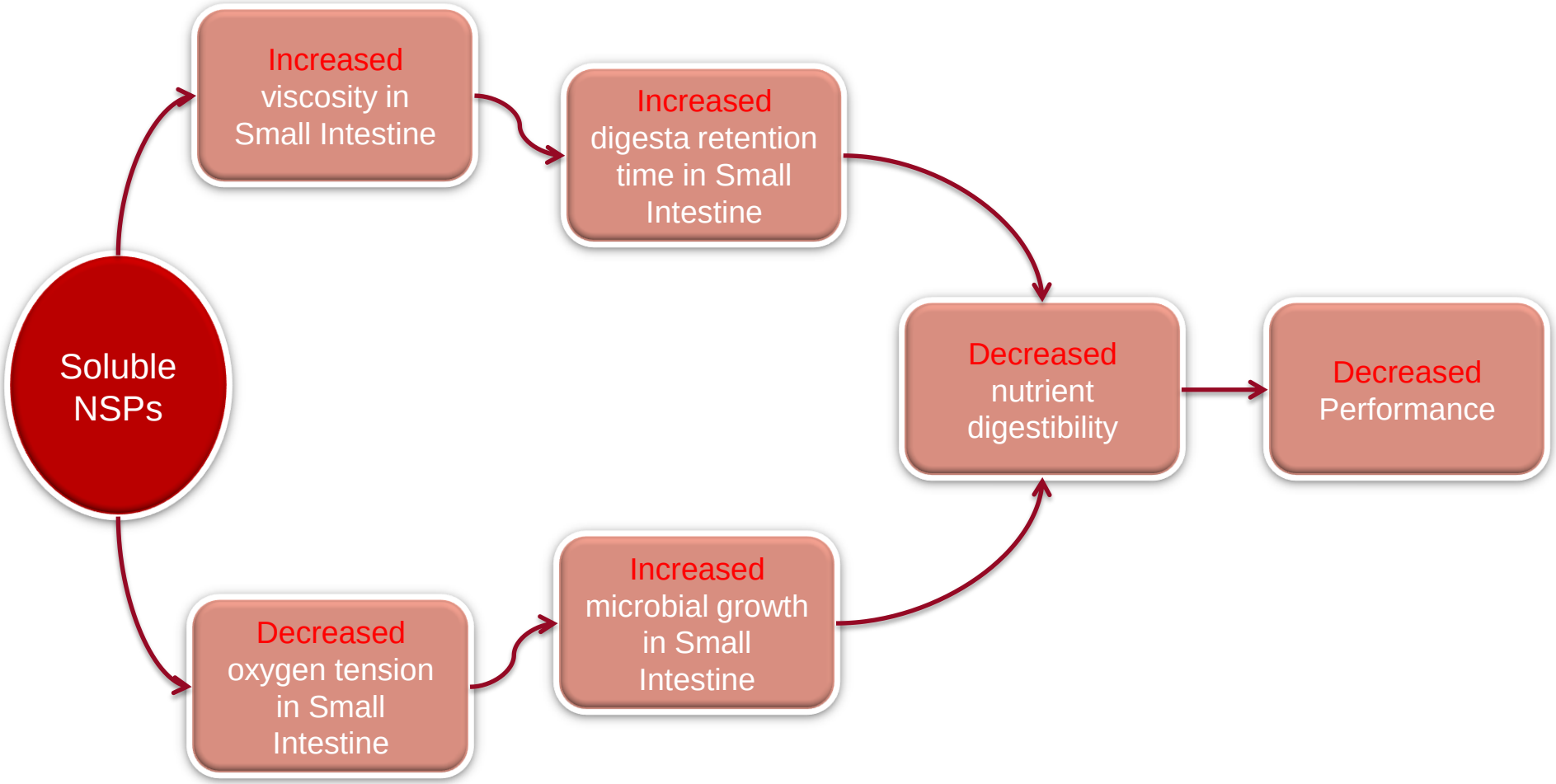


Concentration of soluble NSPs g/Kg DM

Soluble NSP levels are high

Bach Knudsen, Anim. Feed Sci. Technol. 67:319-338

Soluble NSPs in diet and gut health



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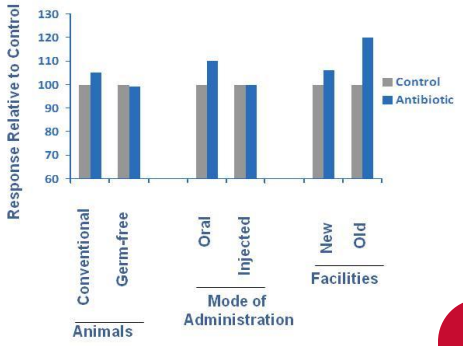

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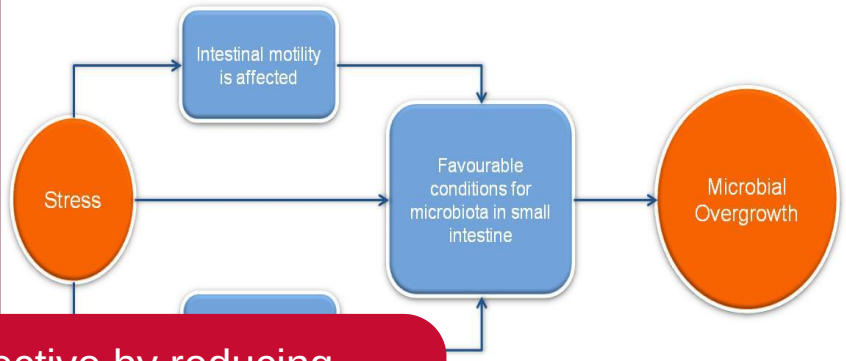
Stress and gut microflora

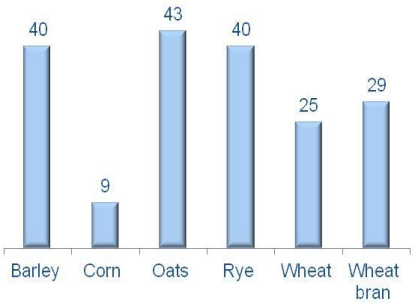


AMGPs were effective by reducing microbial overgrowth in the small intestine caused by stress & soluble NSP content of the diet.

NSP contents in diet contribut

Animal diets contain Cereals

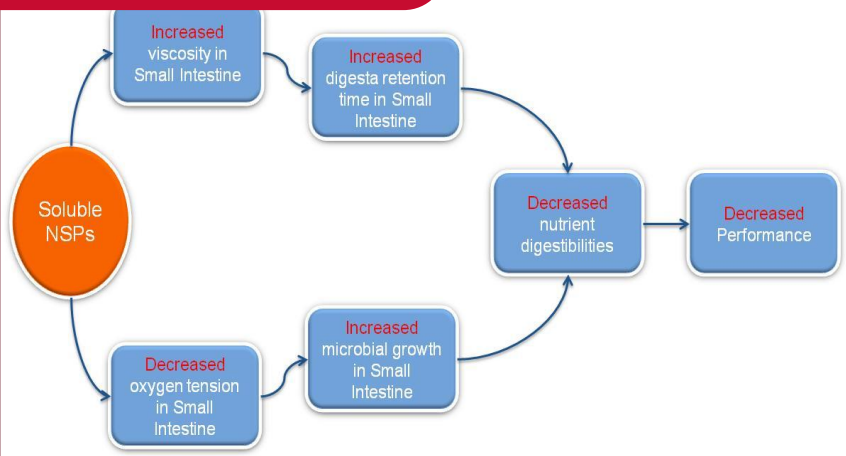
unconventional cheap ingredients with high NSP contents



Concentration of soluble NSPs g/Kg DM

Soluble NSP levels are high

ealth



Enzymes can be part of the solution

Small Intestine

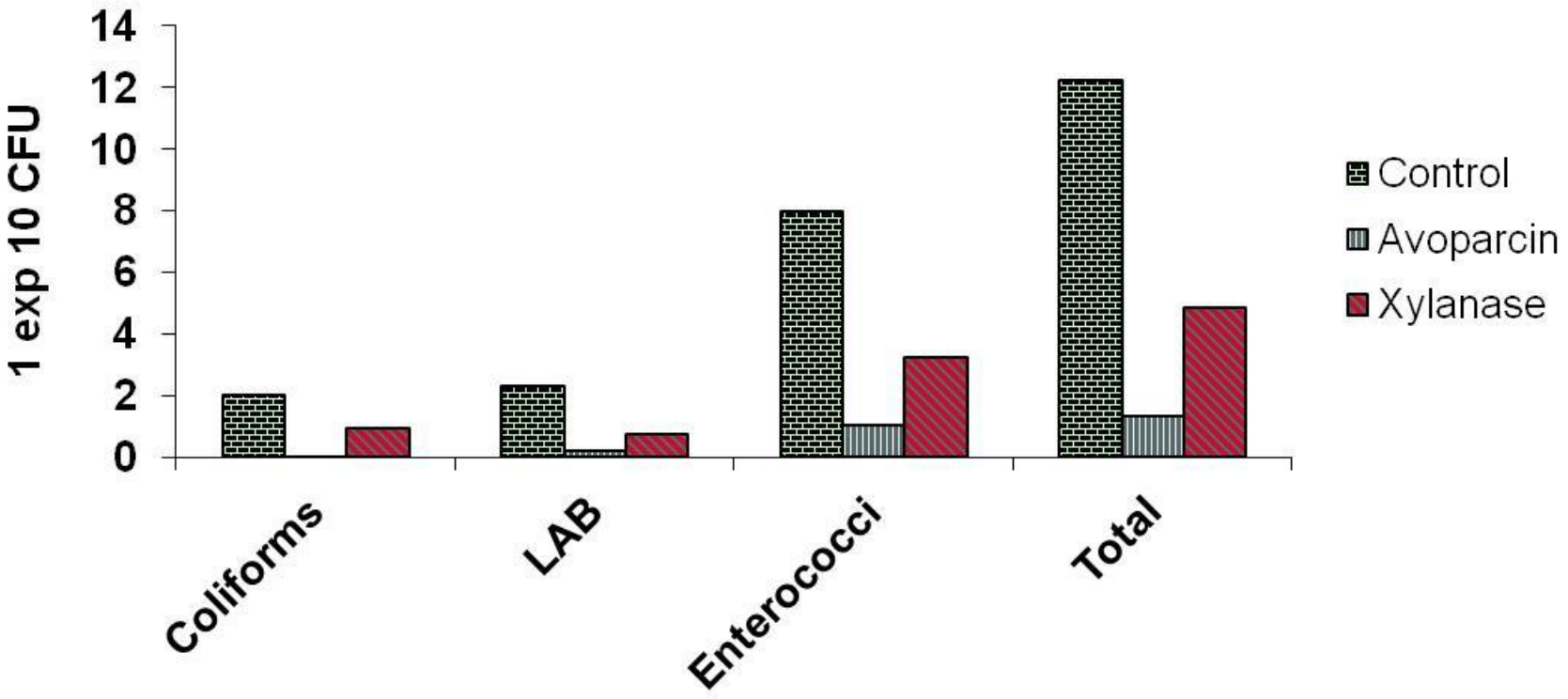
-De-polymerisation of soluble NSPs
-Reduction in viscosity
-Increased nutrient digestibility
-Digesta transit time is better regulated
-Lesser microbial overgrowth
-Better nutrient absorption

Large Intestine

-De-polymerisation of soluble NSPs produce smaller oligomers which utilized by healthy microflora
-Increased energy availability by higher VFA production
-Lower pathogen pressure

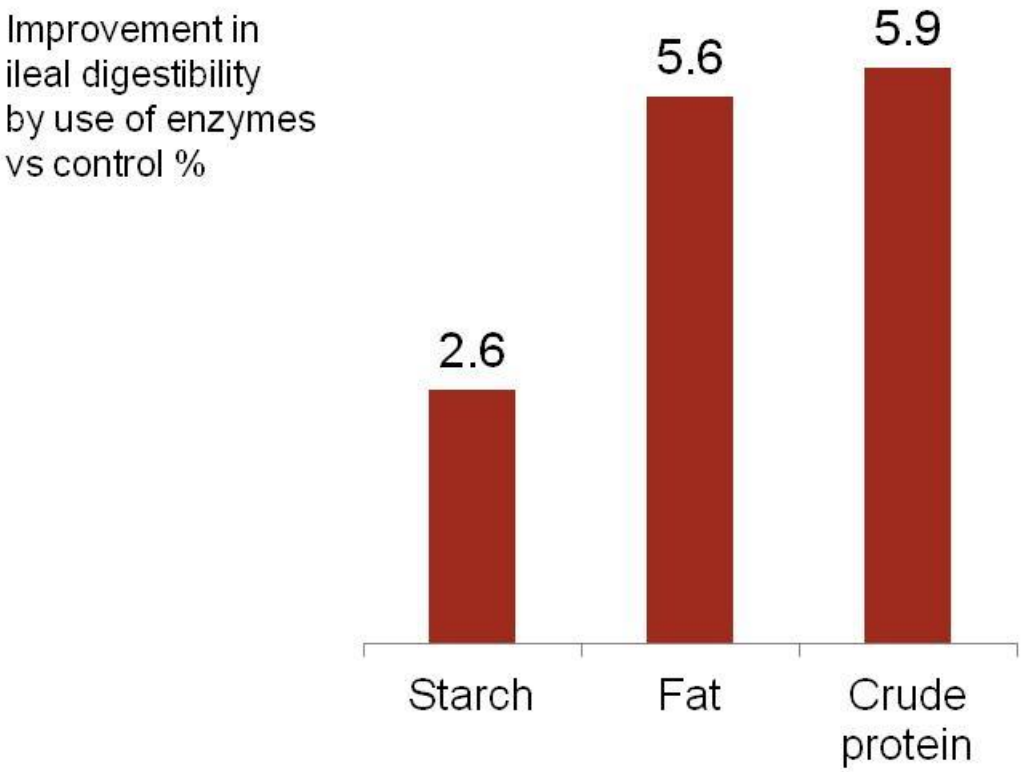
Choct 1997

Enzymes: Small Intestine



Apajalahti and Bedford1998

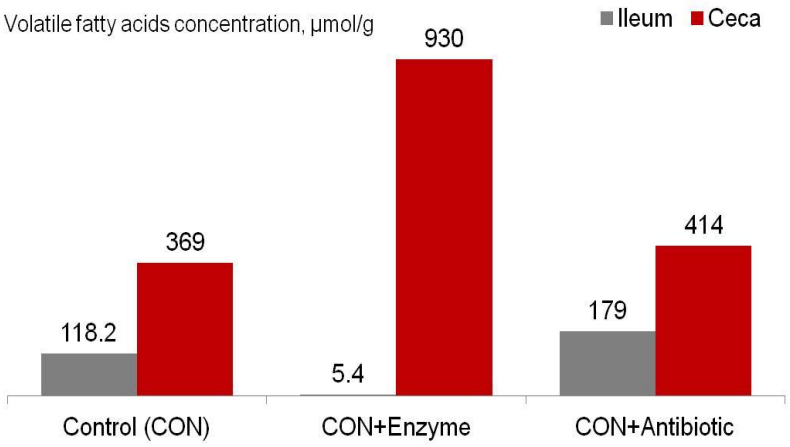
Enzymes: Small Intestine



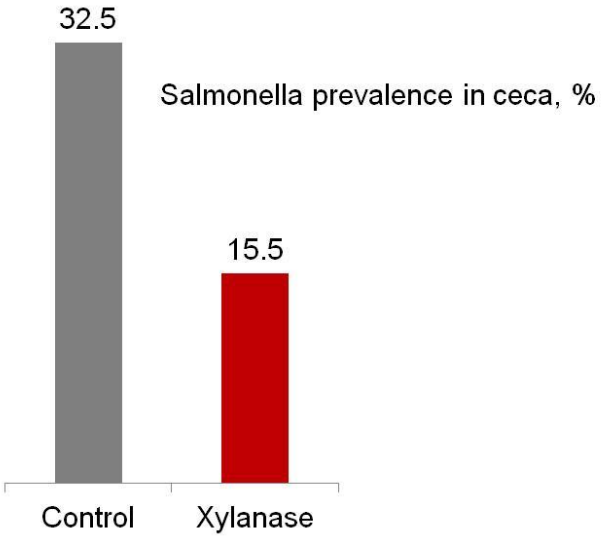
Enzyme source: Combination XAP

Romero et al. 2011

Enzymes: Large Intestine



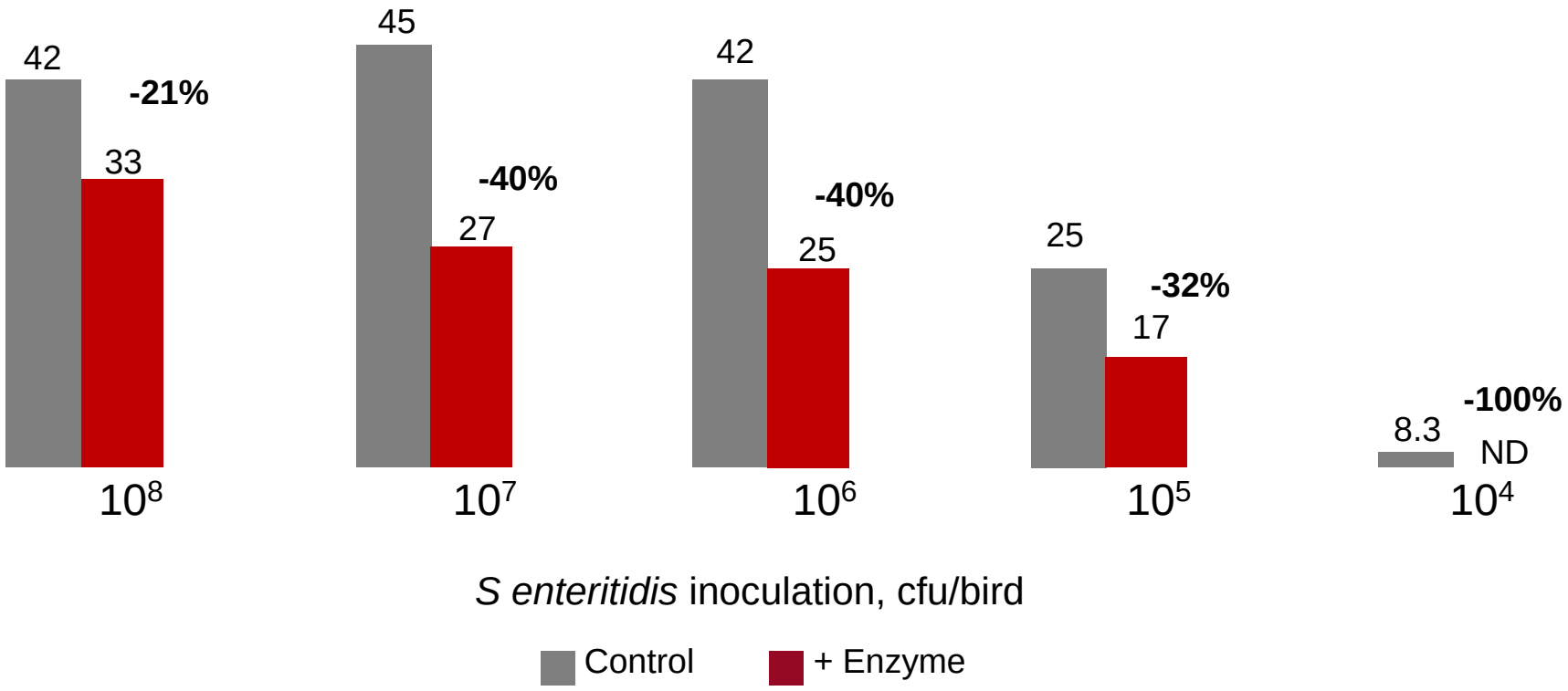
Choct et al. Brit. Poult. Sci. 37: 609-621



Amerah et al. 2012

Enzymes and Salmonella challenge

S. enteritidis-positive birds (birds with >10^5 cfu/g), %



Study done at Bristol University, UK

Enzymes in post AMGP era

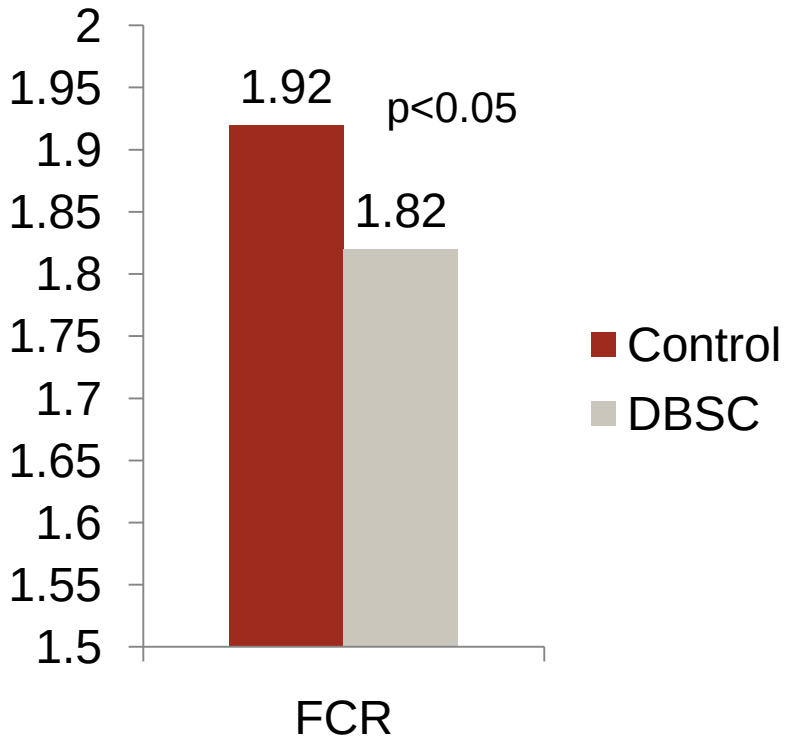
AMGPs prevent microbial overgrowth in small intestine by antimicrobial activity

Enzymes prevent microbial overgrowth in small intestine by substrate reduction

Appropriate use of either single or combinations of enzymes can play a vital role in sustainable animal production in post AMGP era

DFM and improvement of quality and production of animal products

DFM and Growth performance

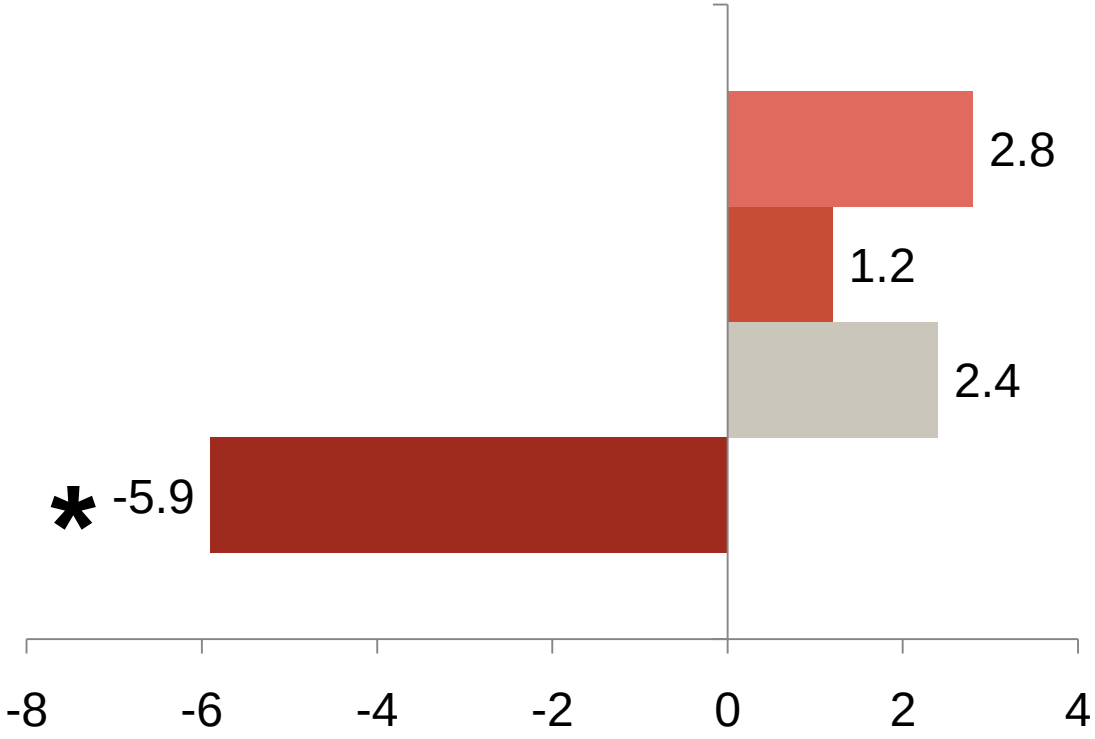


Animal: Broilers
DFM: *Dried bacillus subtilis culture*

Production Performance

Santoso *et al* 1999

DFM and Egg production

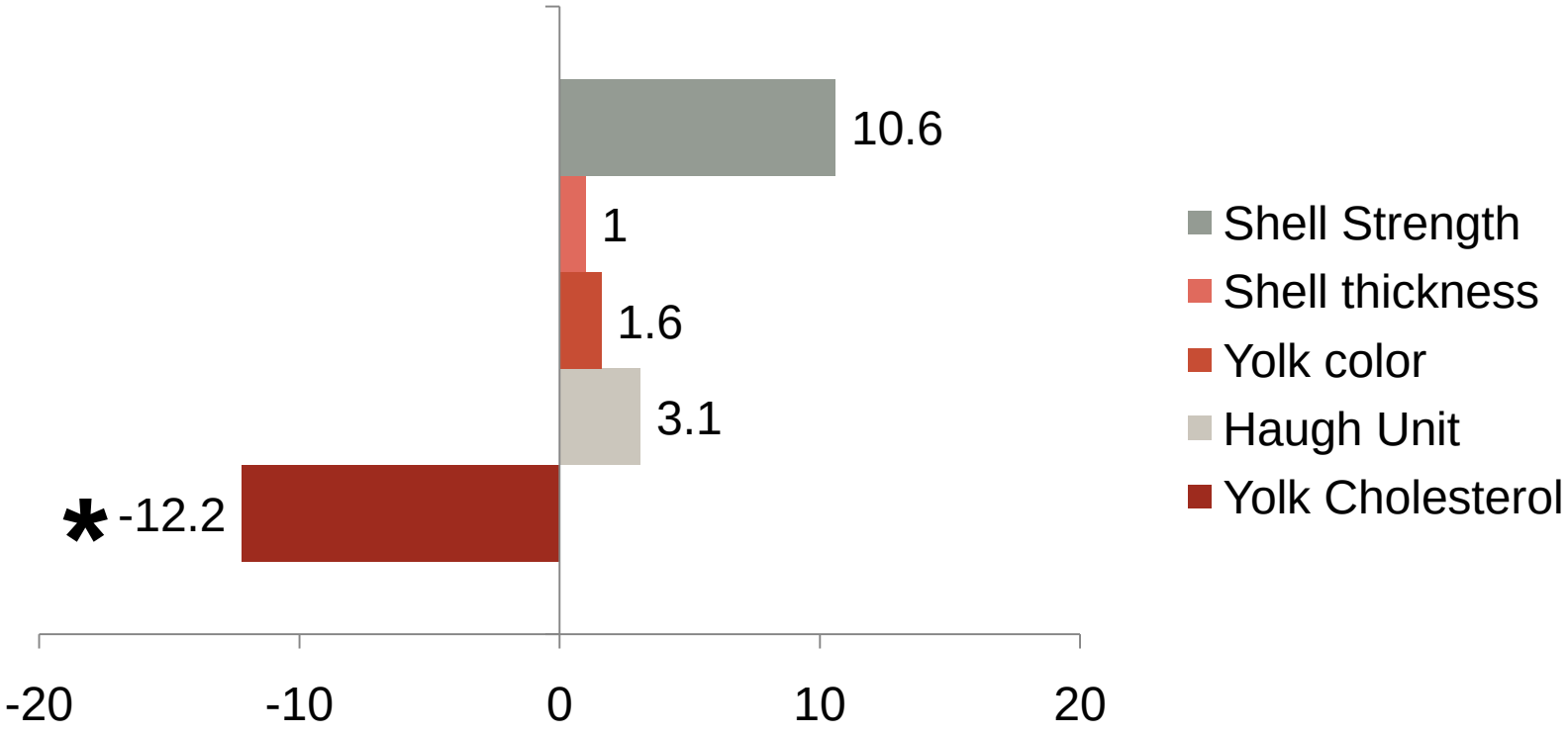


Production Performance

Animal: Laying hens
DFM: *Dried bacillus subtilis culture*

Xu *et al* 2006

DFM and egg quality

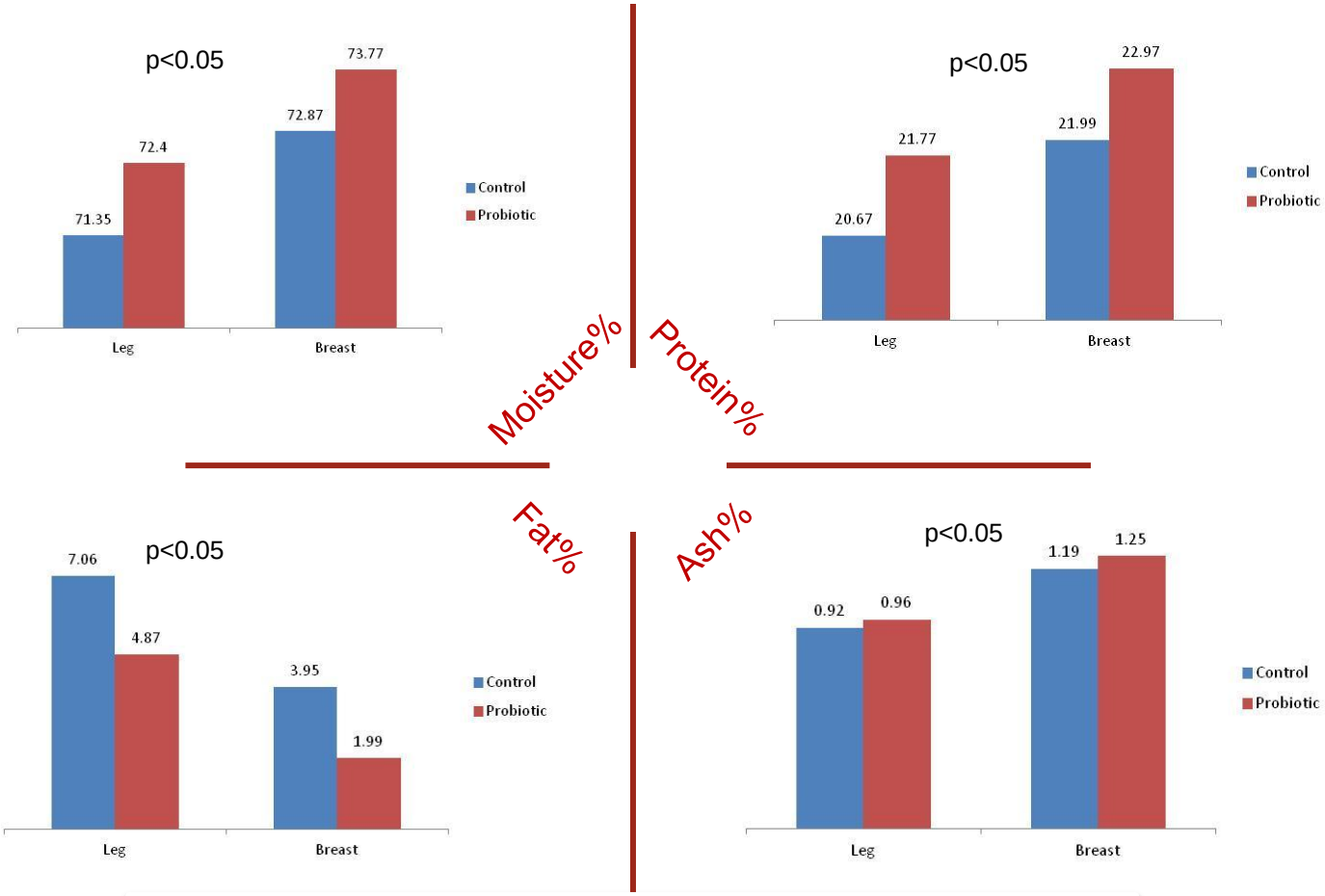


Animal: Laying hens
DFM: *Dried bacillus subtilis culture*

Quality of Animal Products

Xu *et al* 2006

DFM and meat quality (Proximate composition)



Animal: Broilers
DFM: *Mixture of lactobacilli and bifidobacterium*

Khaksefidi and Rahimi 2005

Quality of Animal Products

DFM and meat quality

Effect of probiotic on microbial status of carcasses meat

Measurement	Control	Probiotic	Pooled SEM
Salmonella (number positive/total)	40/40[a]	16/40[b]	
Log CFU/ml campylobacter	3.04[a]	2.67[b]	0.09
Log CFU/ml coliforms	2.52[a]	1.55[b]	0.11

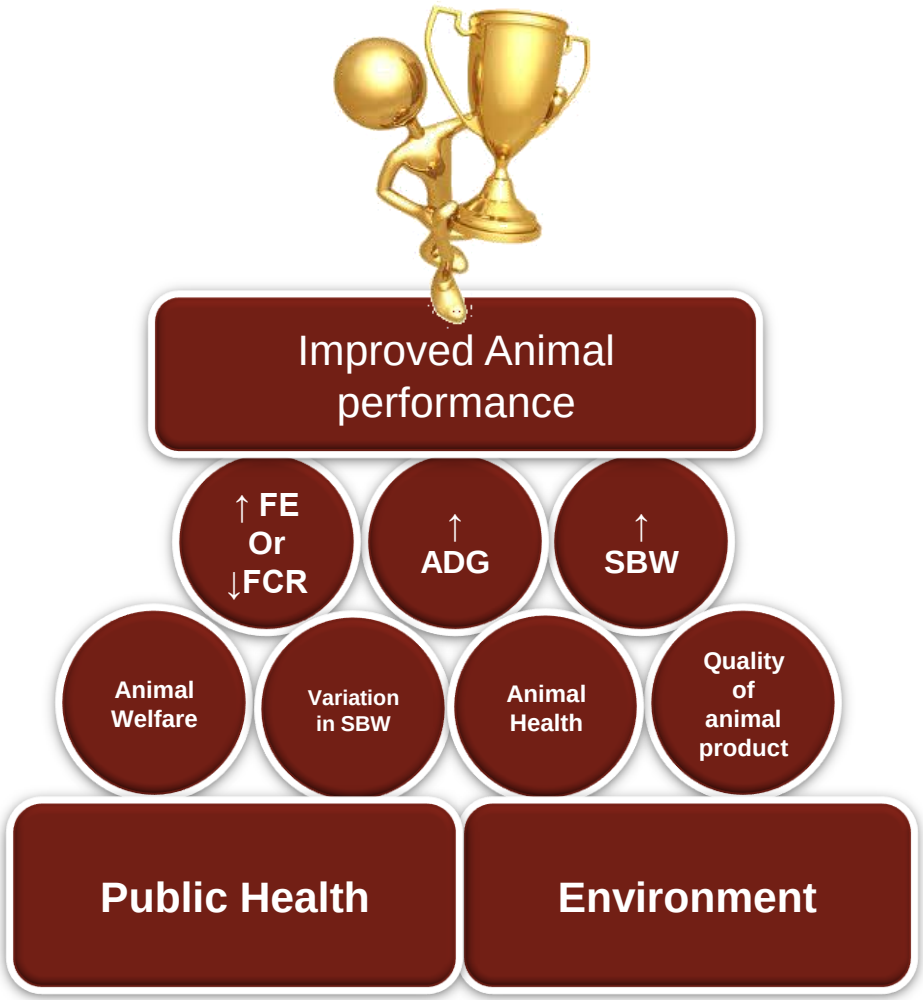
Means in the same row with no common superscript differ significantly ($p<0.05$).

Public health concern

Animal: Broilers
DFM: *Mixture of lactobacilli and bifidobacterium*

Khaksefidi and Rahimi 2005

Conclusion



Can we be successful based on these new criteria?

With a conscious effort in developing feed additives for more than growth performance effect

Yes we can!!

Thank you for your attention

Image courtesy: Google Images

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