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Approaches in the AGP free era of poultry farming

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Jakarta, 4 – 6 Juli 2017



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Lecturer, Faculty of Animal Science UGM 1990-Now

Executive Director, Small and Medium Enterprises Development Centre
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General Secretary of South East Asia Network of Animal Science
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Consultant in Feed mill and Feedlot, Jakarta, 2000 – Now

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Agenda

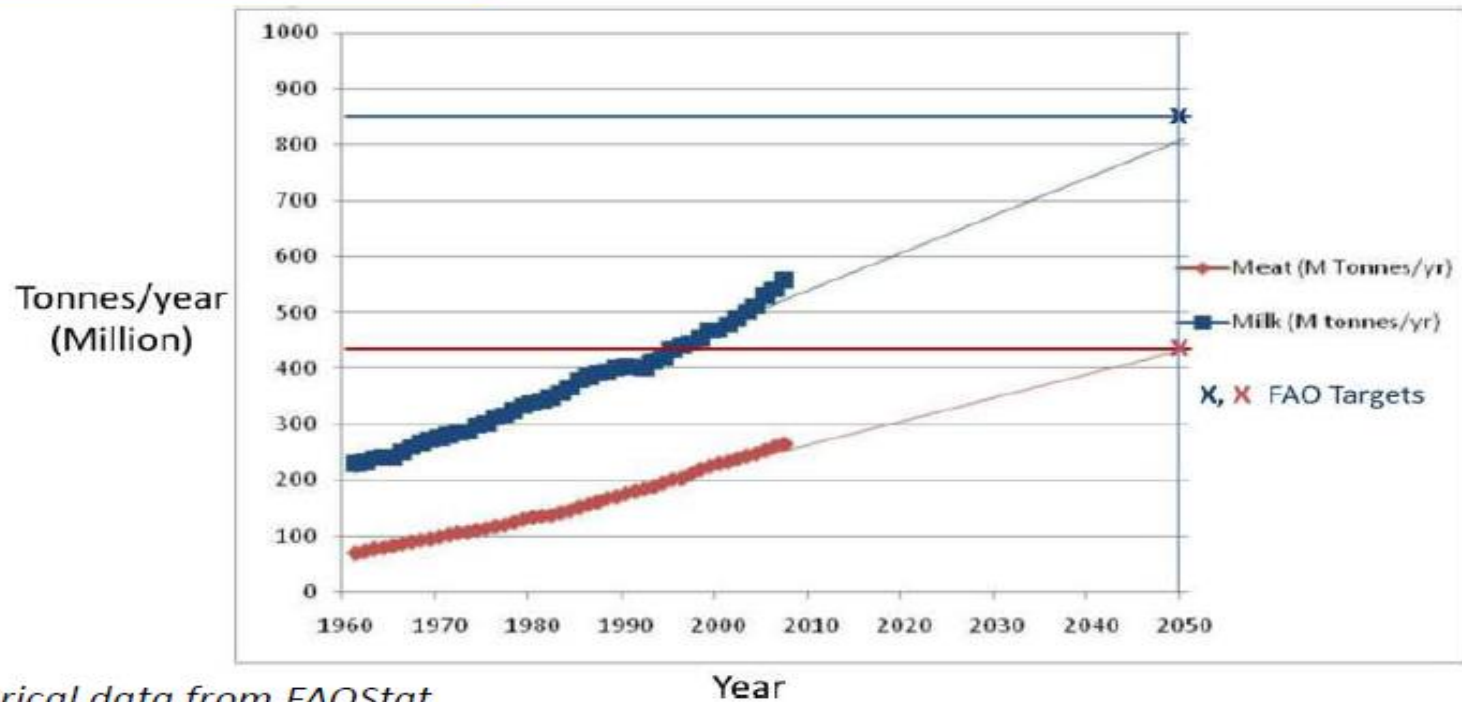
- Introduction
- Current issue in Animal Production
- Approach & Alternative of AGP
- Remarks

INTRODUCTION



Predictions are in line with past growth

Global milk demand 2050 : 850 MioT/year
Global meat demand 2050 : 450 MioT/Year



Historical data from FAOStat



Eating can be hazardous

but

Not eating is fatal



FOOD PARADOX

less or no food to eat

vs

too much food to eat



Food & Health



Unhealthy food related to the consumer health

- Hearth disease
- High blood pressure
- Diabetes
- Cholesterol
- Uric Acid
- Arthritis
- Cancer
- Obesity



Stroke
is a leading cause of serious, long-term disability.

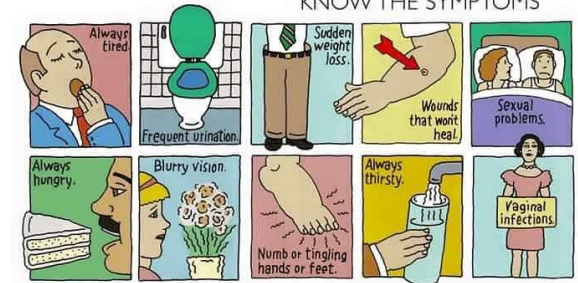


Hipertensi



DIABETES

KNOW THE SYMPTOMS





Current Issue in Animal Production

Consumers Want Their Meat “Free” Across the Globe! And They Want Adjectives Added and Not Additives Added!

- Antibiotic-free
- Hormone-free
- Additive-free
- Campylobacter-free
- Salmonella-free
- E.coli-free
- GMO-free
- Free-range
- Gluten-free



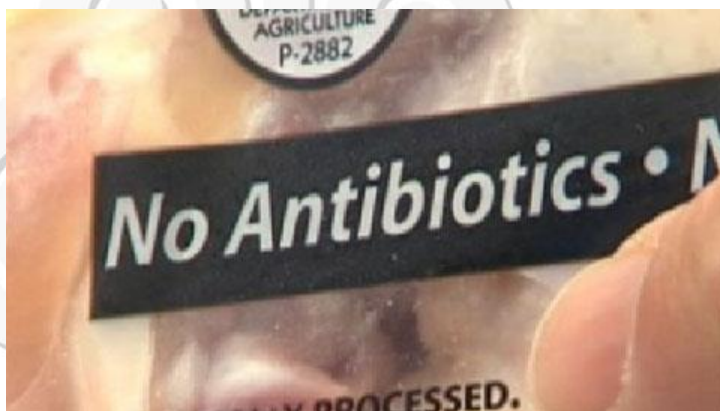
No Antibiotics
ever
No Preservatives
*ever***
No Added Hormones
ever

antibioticfree
chicken

GLUTEN-FREE
CHICKEN NUGGETS

NO ANTIBIOTICS USED**
HUMANELY RAISED*** • GLUTEN & CASEIN FREE

Contact a Salmonella Lawyer Now
Free Case Evaluation
1-888-377-8900



Excessive utilization of **Antibiotic and Growth Promotor (AGP)** in animal farming stimulate bacterial resistance, and AGP residue in the animal products (meat, milk, egg) is harmful for the human health because bacteria resistance.

Data O'Neill Commission (2016), **700.000 people** died because microbial resistant.

Food and Agriculture Organization (FAO), agriculture uses **antibiotic 63.000 – 240.000 ton per year.**

EU has banned the utilization of AGP in animal farming since 2006 (Indonesia start from 2018).

More consumer has aware on the issue of **food quality and food safety.**



Without ANTIBIOTIC

- a. Food-borne zoonotic diseases
 - b. Economic impact
-

With ANTIBIOTIC

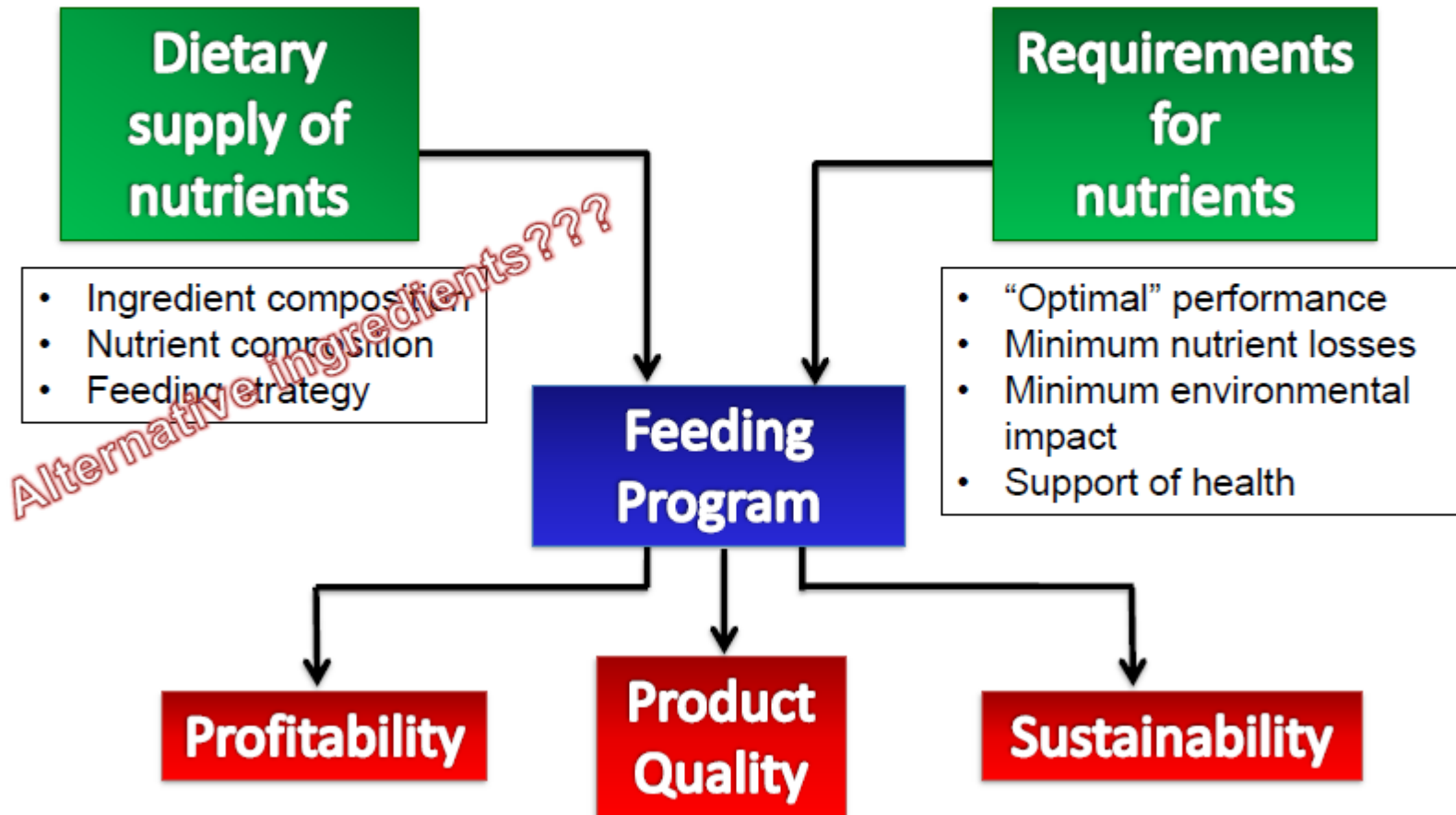
- a. Bioresistance
- b. Higher medical cost
- c. Increased mortality





Approach & Alternative of AGP

Goal of animal nutrition



Three Main Areas of Nutrition

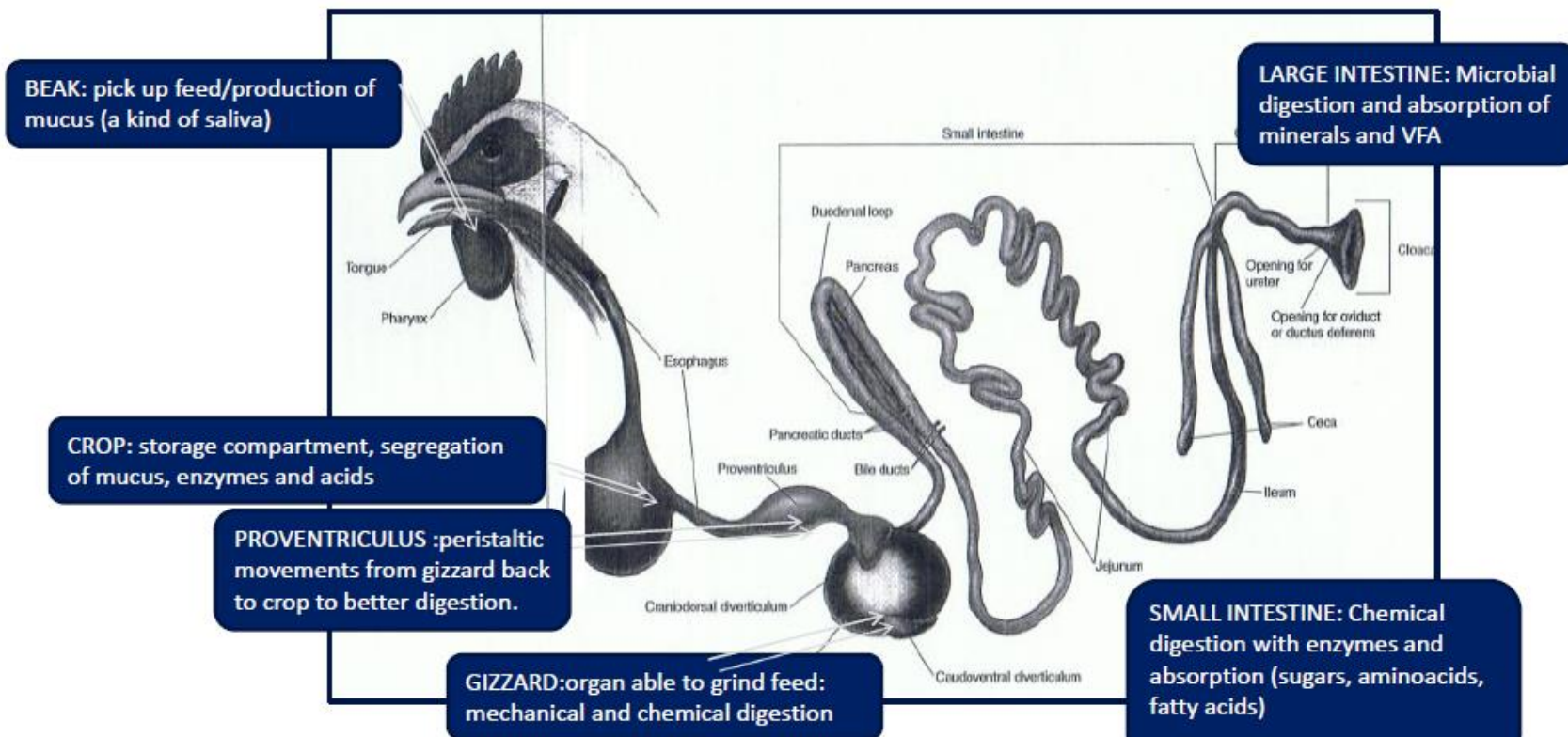


- What we feed to the animals
 - Nutrient composition of ingredients
- What happens in the GI-tract
 - Digestion, absorption, excretion
- What happens in the rest of the body
 - metabolism, synthesis, deposition, and excretion of excesses





The chicken flowsheet!





1

Feed Technology

- 1. Increase Feed intake***
- 2. Improve Digestibility***
- 3. Improve Nutrients Absorption***
- 4. Balance nutrients***
- 5. Supplement & Additive***



Particle size reduction (Grinding)

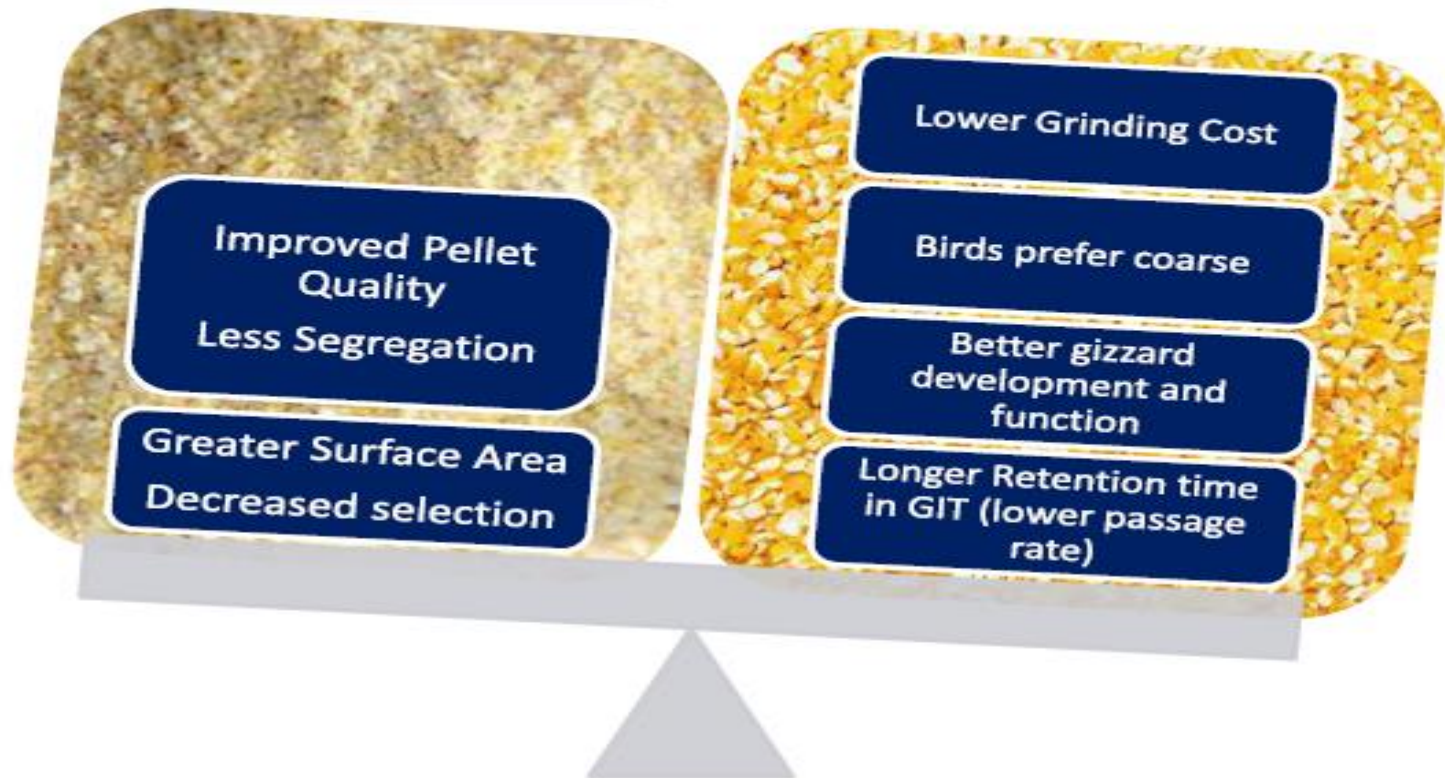




Effect of Grinding : Particle Size

fine

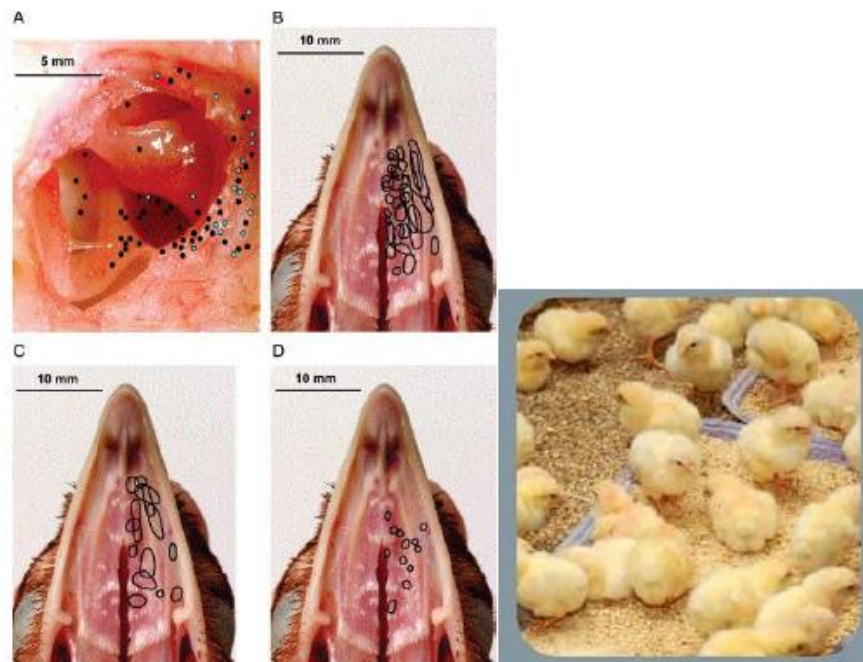
coarse





Which particle size do birds prefer when they are feed as meal (= non-pelleted)?

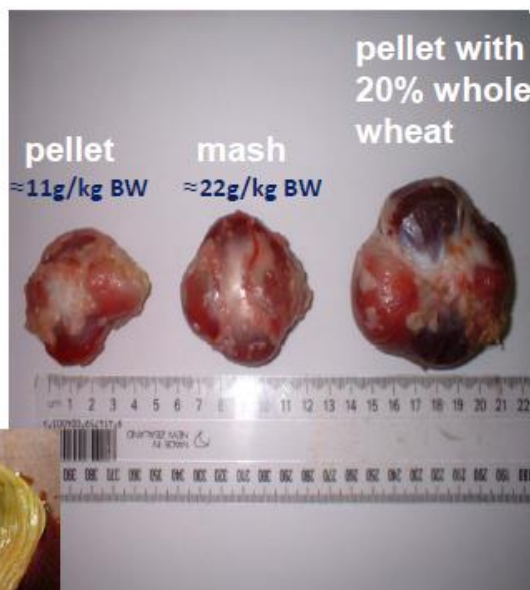
- **Feed consumption in broilers is related directly to particle size and only weak correlation with nutrient composition (Portella, 1988)**
- **Birds can discriminate differences in feed particle size by mechanoreceptors located in the beak (Gentle, 1979)**
- **Chickens prefer larger feed particles observed at all ages and fine particles are the ones remaining in the feeder (Schiffman, 1968; Allen & Perry, 1977)**
- **A more uniform diet will reduce the time spent searching for and selecting larger particles better performance**
- **Selection implies suboptimal nutrients intake**



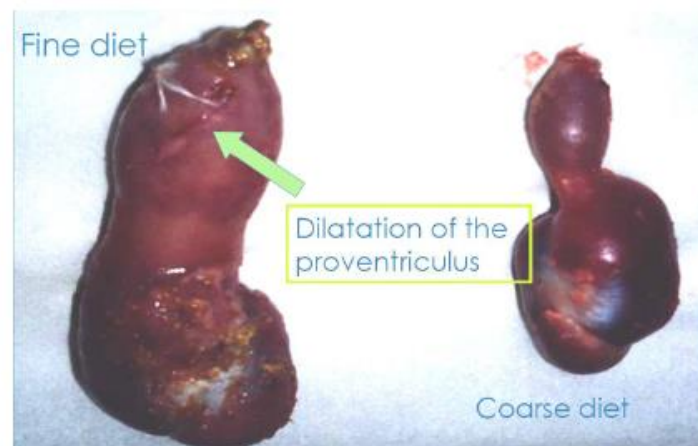
Source: Gentle, 1979; Schiffman, 1968; Portabella et al., 1988



Gizzard development affected by particle size and feed treatment



Source: Amerah et al., (2008)

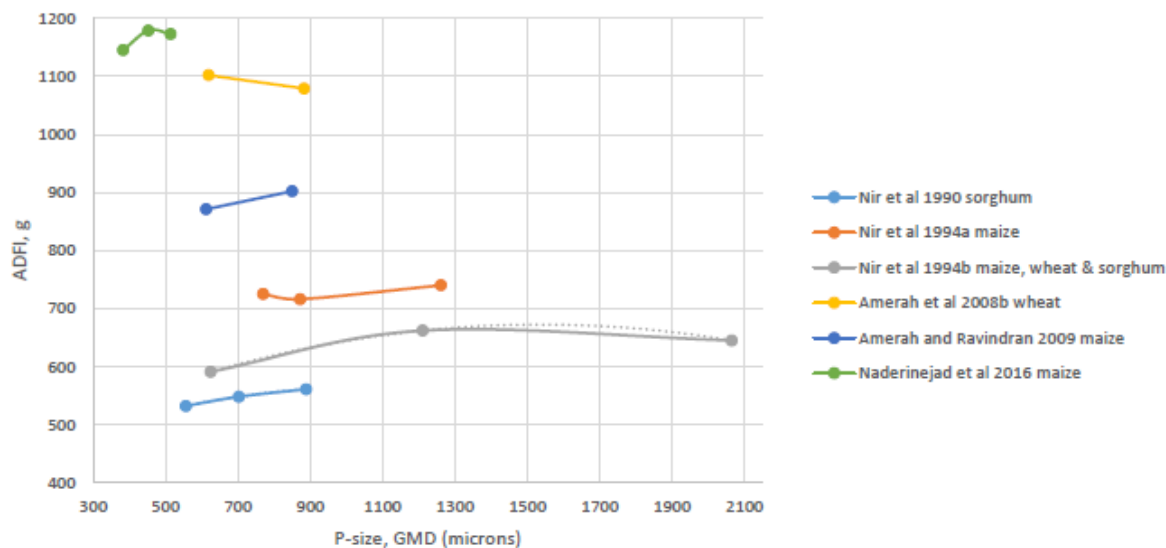


Source: Kwakkel (2009)



Feed intake (FI) response to particle size in broilers fed mash diets

FI response to p-size (GMD, microns) in broilers d1-21 or d7-21



Discrepancies related to:

- Type and cultivar of grain?
- Grain hardness?
- **Particle uniformity and distribution?**
- Particle shape/ area?
- Type of grinding?
- Age of birds
- ❖ **Limited studies on p-size of SBM.**

Extracted from Abdollahi 2018 REVIEW



Optimal particle size in broilers

Age (days)	GMD (μm)
1-7	900 - 1100
7-21	1100 - 1300
21-market	1300 - 1500

GMD =geometric mean diameter

In Amerah et al., 2007, after Nir and Ptichi, 2001.



Some key messages on particle size in broiler

- Particle size improve upper gut (mainly gizzard) development and function
- Particle size is not the only factor to consider but particle size distribution which gives indications on uniformity
- Too course in very young animals may compromise performance by high energy expenditure for gizzard function



2

***Livestock farming system based on the nature
for healthier animal products and human health***

Multifunctional Feed Additive & Essential oils



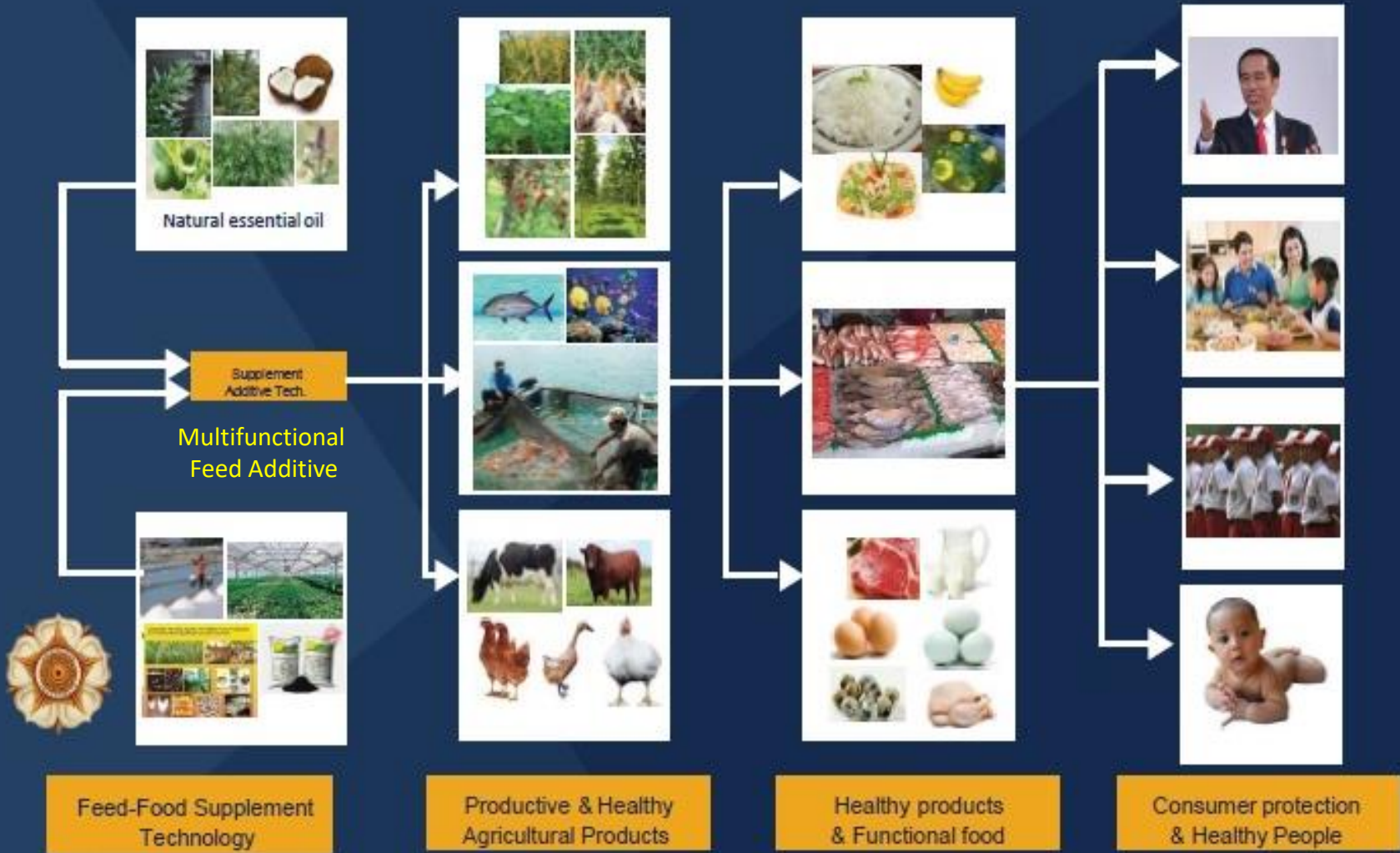
Livestock farming system based on the nature for healthier animal products and human health



Indonesia is megabiodiversity country and rich in natural resources including herbs
Exploring **herbs** and other plants for its naturally **essential oil** is much of interest as
feed additive for livestock farming

Research Roadmap

(Ali Agus, 2016 - 2021)



Multifunctional Feed Additive



Definition :

Feed additive consisting of several ingredients or active substances mixture, required essentially by the animal for better health and optimal production (trace mineral, vitamin, amino acid, probiotic, prebiotic, phytobiotic, essential fatty acids,...)

Role :

- Source of mineral and trace minerals
- Source of vitamins
- Antioxidant
- Immuno-stimulator
- Balance microbe in the gut



Essential oils as feed additives

- 1. Improve growth performance of broiler and immune response (Kang and Kim, 2016)**
- 2. Improve feed efficiency in beef cattle (Rivaroli et al, 2017)**
- 3. Improve animal performances (Simitzis, 2017)**
- 4. Antimicrobial properties (Faleiro, 2011; Akthar, 2014; Cui et al., 2015; Oh et al., 2016; Benbelaid et al., 2016;**

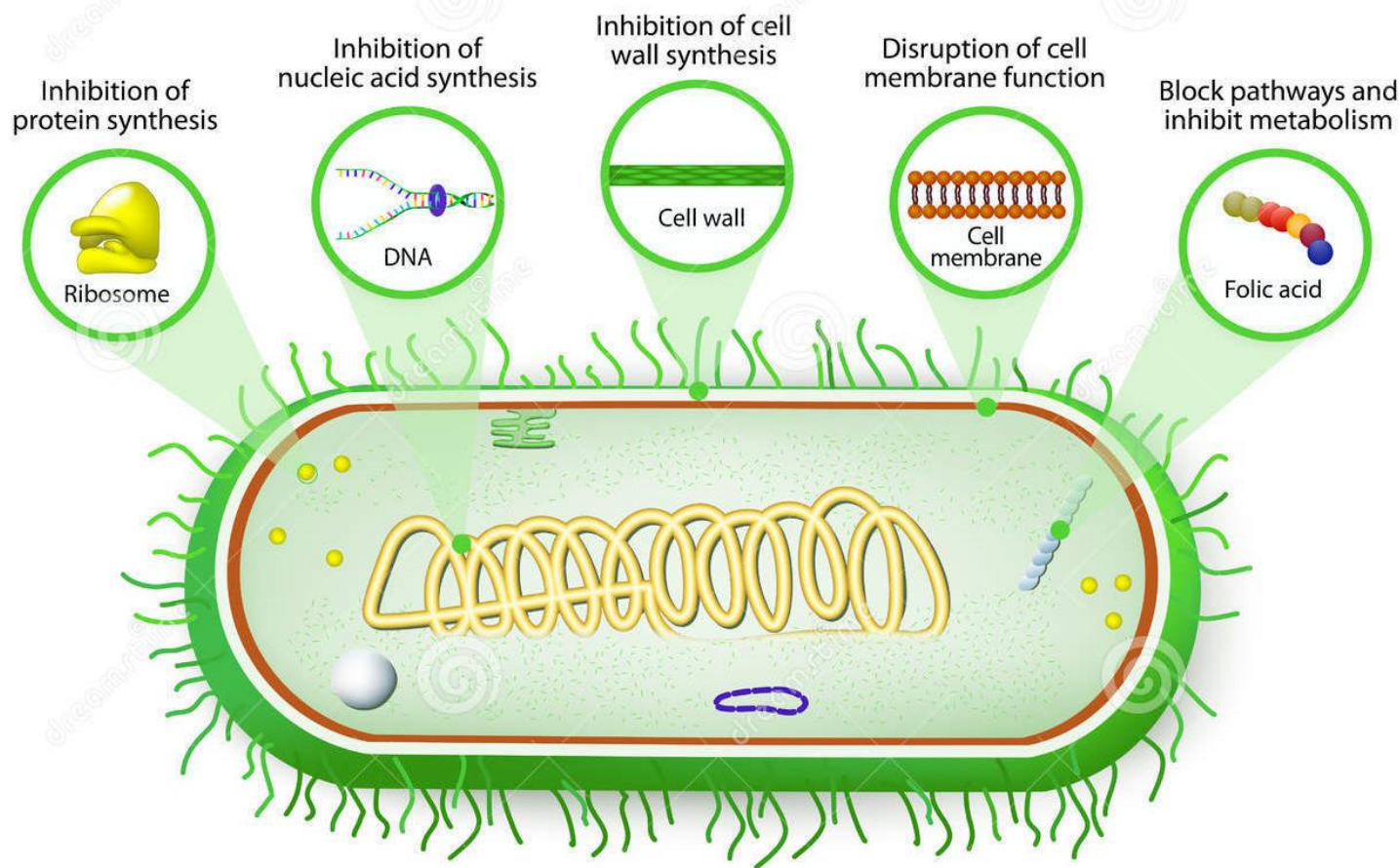


Table 1. Effects of essential oils or their components on gut microflora, morphology, enzyme activity and growth performance parameters in monogastric animals.

Essential Oil or Component	Level	Animal	Effects	Reference
Artemisinin	17 ppm	Broilers	Reduction of oocyst output and lesion scores attributable to <i>Eimeria tenella</i> .	[27]
BEO (thymol, eugenol and piperine)	100–200 mg/kg	Broilers	No effect on intestinal numbers of <i>C. perfringens</i> , GP and FCR. Reduction of FBW.	[28]
BEO (thymol, eugenol and piperine)	100 mg/kg	Broilers	No effect on FI, BWG, FCR, CT and ileal bacterial count (<i>C. perfringens</i> and Gram ⁺ bacilli). Increase of ileum length and ileal villi height.	[29,30]
BEO (carvacrol, thymol, eucalyptol, lemon)	125–500 mg/kg	Broilers	Improvement of BWG and FCR (125 or 250 mg/kg). Reduction of <i>Salmonella</i> Heidelberg colonization in crops (500 mg/kg). No effect on <i>Salmonella</i> Heidelberg caecal or faecal counts.	[31]
BEO (cinnamaldehyde and thymol)	100 mg/kg	Broilers	No effect on ADG, FI, gut morphology and ileal bacterial count. Improvement of FCR and apparent ileal nitrogen digestibility.	[32]
BEO (cinnamaldehyde and thymol)	100 mg/kg	Broilers	No effect on FI. Improvement of BWG and FCR. Reduction of <i>Salmonella</i> -positive caecal samples.	[33]
BEO (garlic, sage, echinacea, thyme, oregano)	1 g/kg	Broilers	No effect on BWG, FI, FCR, CT and lesion score. Reduction of oocyst counts 6–14 days post infection.	[34]
BEO (oregano, laurel leaf and lavender)	50 mg/kg	Broilers	No effect on BWG, FI, FCR, intestinal length and caecal weight. Reduction of faecal <i>Eimeria</i> oocyst output.	[35]
BEO (oregano, cinnamaldehyde, carvacrol, yucca extract)	250 mg/kg	Broilers	No effect on BWG and FI. Improvement of FCR, ATTD of DM and gross energy. Reduction of lesion score and <i>C. perfringens</i> and <i>E. coli</i> intestinal counts.	[36]
BEO (<i>Agrimonia eupatoria</i> , <i>Echinacea angustifolia</i> , <i>Ribes nigrum</i> and <i>Cinchona succirubra</i> extracts)	0.5–1.0 g/kg	Broilers	No effect on caecal lesion score. Improvement of BWG and FCR. Reduction of <i>Eimeria tenella</i> oocysts count and bloody diarrhea intensity.	[37]
BEO (oregano, anis and citrus peel)	125 mg/kg	Broilers	No effect on BWG, FI, intestinal pH values, caecal TVFA levels and total ileum microbiota counts. Improvement of FCR. Reduction of ileum ammonia concentration.	[38]
BEO (clove and cinnamon)	100 mg/kg	Broilers	No effect on FBW, ADG, FCR and CT.	[39]
BEO (capsaicin, cinnamaldehyde, carvacrol)	150–300 mg/kg	Broilers	No effect on FBW, ADG, FCR, CT and ileal ND. Reduction of rectal <i>E. coli</i> and <i>Clostridium perfringens</i> counts.	[40]
BEO (capsaicin, cinnamaldehyde, carvacrol)	100 mg/kg	Broilers	No effect on FBW, CT and ileal ND. Improvement of FCR. Increase of LAB counts and lipase activity in pancreas and intestine wall. Reduction of intestinal <i>E. coli</i> and <i>Clostridium perfringens</i> counts.	[22]
BEO (capsicum oleoresin, cinnamaldehyde, carvacrol)	100 mg/kg	Broilers	No effect on FBW. Improvement of FCR. Increase of mucus secretion intensity and accumulation inside cells of the gastrointestinal mucosa. Reduction of intestinal <i>E. coli</i> and <i>Clostridium perfringens</i> counts.	[19]
BEO (thymol, eugenol and piperine)	50 mg/kg	Broilers	No effect on FBW, ADG, FI, FCR and LAB counts. Increase of pancreatic trypsin, pancreatic alpha-amylase and intestinal maltase activity. Reduction of <i>E. coli</i> counts in ileo-caecal digesta.	[21]



Antibacterial action mode of essential oils





Some preliminary results :

Multifunctional Feed Additive (Vimmune Salt)

Vimmune Salt : Minerals (Na, Cl, trace elements) + **Essential oils** *
Mixed in the concentrate/feed at 2 kg/ton

Trial in :

1. Piglet
2. Broiler
3. Laying hen
4. Calve
5. Dairy cattle

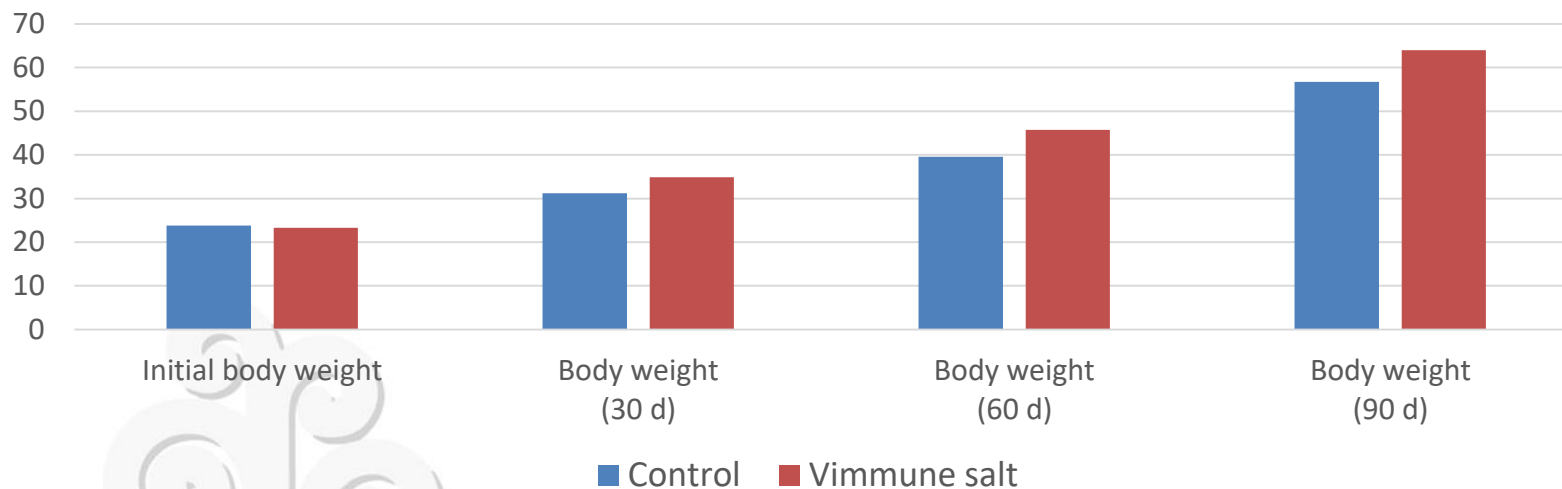
* the blend of natural essential oils consists of essential oils derived from 9 various herbs: Pine oil, *Gardenia jasminoides*, *Cocos nucifera*, *Eucalyptus globules*, *Herba Origani*, *Gummi myrrha*, *Gummi boswellii*, *Cymbopogon citrates* and Carrot seed oil (PT. CPP Jakarta)



1. Piglet



Body Weight (kg)



number of animal: 80 head

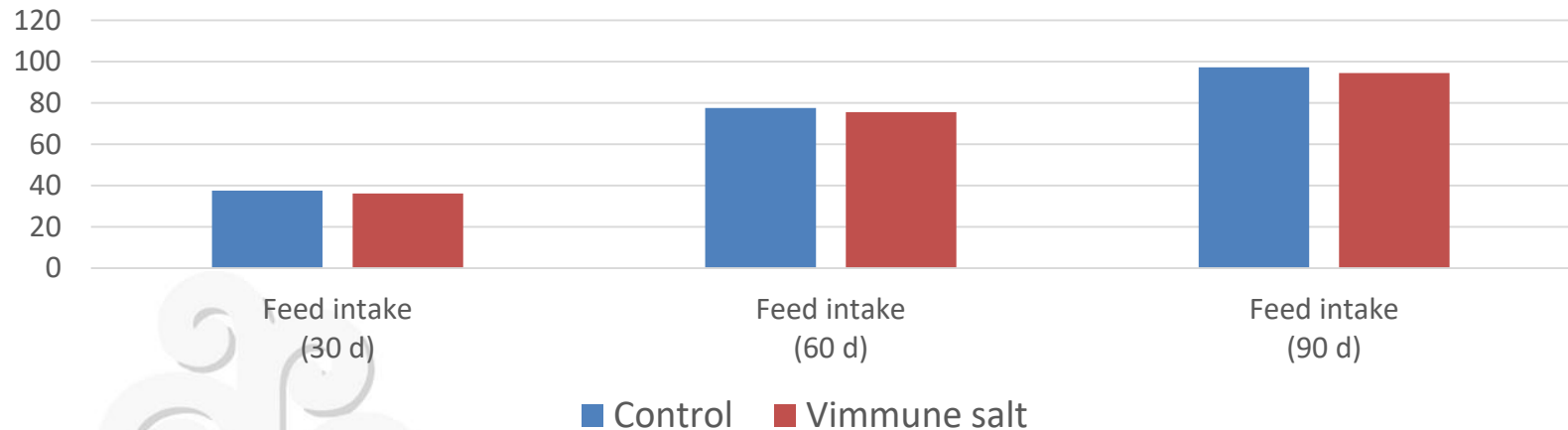
Treatment	Initial body weight	Body weight (30 d)	Body weight (60 d)	Body weight (90 d)
Control	24	31	40	57
Vimmune salt	23	35	46	64

Result and conclusion:

Utilization of Vimmune Salt (2 kg/ton) improve body weight gain 7 Kg of piglet swine in 90 d.



Feed Intake



number of animal: 80 head

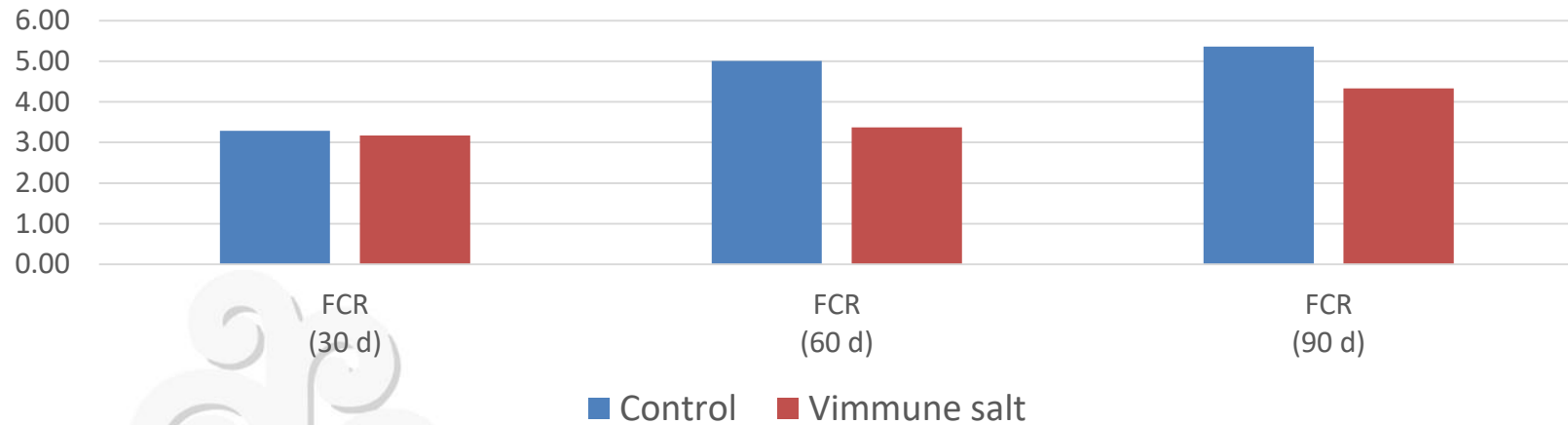
Treatment	Feed Intake (30 d)	Feed Intake (60 d)	Feed Intake (90 d)
Control	38	78	97
Vimmune salt	36	76	94

Result and conclusion:

Utilization of Vimmune Salt (2 kg/ton) decrease total feed intake of piglet swine until 3 kg in 90 d.



Feed Conversion Ratio



number of animal: 80 head

Treatment	FCR (30 d)	FCR (60 d)	FCR (90 d)
Control	3.29	5.01	5.36
Vimmune salt	3.17	3.37	4.33

Result and conclusion:

Utilization of Vimmune Salt (2 kg/ton) had lower value of feed conversion ratio (FCR) in 60 d and 90 d.



2. Broiler



Effect of *Vimmune salt* on growth and performance index of broilers at 21 d age (*Research 1*)

Number of animal: 3000 birds

Feeding Treatment	Body Weight (g)	Feed Intake (g)	FCR	Mortality (%)	Indeks Performance
A	1019.50	1217.30 ^{ab}	1.20	0.80	403.70
B	1023.10	1245.60 ^c	1.22	0.60	398.03
C	1022.10	1231.40 ^{bc}	1.21	0.80	401.14
D	1008.40	1233.10 ^{bc}	1.22	0.80	389.59
E	1012.70	1235.03 ^c	1.22	0.60	389.59
Vimmune salt	1035.10	1212.30^a	1.17	0.40	419.28

Result and conclusion:

Utilization of Vimmune Salt (2kg/ton feed) had lower value of feed intake, feed conversion ratio (FCR), and mortality in 21 d of broiler. Vimmune salt group had higher value of indeks performance than the other groups.



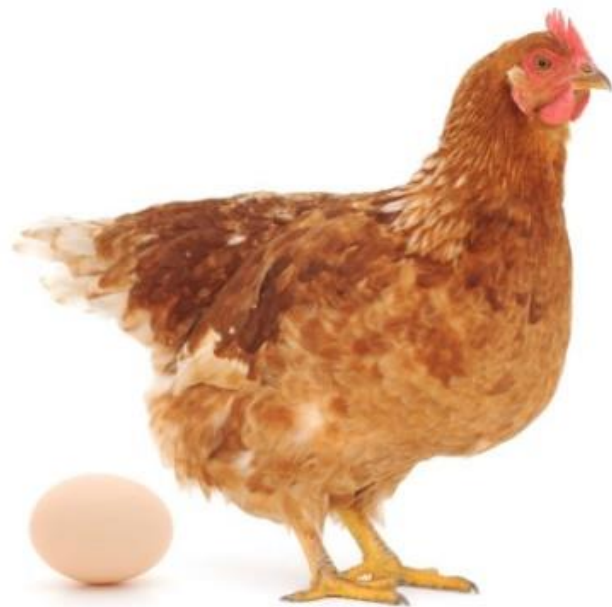
Effect of *Vimmune salt* on growth and performance index of broilers at 28 d age (Research 1)

Number of animal: 3000 birds

Feeding Treatment	Body Weight (g)	Feed Intake (g)	FCR	Mortality (%)	Indeks Performance
A	1610.50	2252.20 ^{ab}	1.40	0.46	406.37
B	1566.80	2280.60 ^c	1.46	0.80	383.24
C	1591.00	2266.40 ^{bc}	1.43	0.65	395.78
D	1618.70	2268.10 ^{bc}	1.40	1.13	406.07
E	1596.60	2270.00 ^c	1.43	0.40	399.37
Vimmune salt	1596.90	2247.30^a	1.41	0.76	400.12

Result and conclusion:

Utilization of Vimmune Salt (20kg/ton feed) had lower value of feed intake, than B, C, D, and E feed conversion ratio (FCR) than B, C, and E, and mortality than B and D. Vimmune salt group had higher value of indeks performance than the B, C, and E groups.



3. Laying Hen



Effect of *Vimmune salt* on egg quality (Research 1: Faculty of Animal Science, UGM)

Egg Parameter	Control	Vimmune Salt
	(n: 24 birds)	(n: 24 birds)
Egg mass (g)	55.855	55.843
Length (cm)	6.195	4.191
Wide (cm)	4.374	4.395
Albumen height (cm)	0.877	0.895
Albumen wide (cm)	8.461	8.191
Yolk height (cm)	1.673	1.803
Yolk wide (cm)	3.953	3.917
Yolk color (cm)	8.759	8.508
Thick shell (cm)	0.455	0.450
Shell mass (g)	8.180	8.248
Haugh Unit	81.374	82.740

Result and conclusion:

Utilization of Vimmune Salt (2kg/ton feed) tend to improve the egg quality.



Effect of *Vimmune salt* on egg quality (Research 2 Faculty of Animal Science, UGM)

Egg Parameter	Control	Vimmune Salt
	(n: 15 birds)	(n: 15 birds)
Egg mass (g)	63.322	63.800
Lenght (cm)	5.717	5.698
Wide (cm)	4.428	4.420
Albumen hight (cm)	0.755	0.771
Albumen wide (cm)	7.389	7.539
Yolk hight (cm)	1.633	1.671
Yolk wide (cm)	3.933	3.965
Yolk color(cm)	7.656	8.278
Thick shell (cm)	0.290	0.297
Shell mass (g)	6.533	6.500
Haugh Unit	85.496	86.079

Result and conclusion:

Utilization of Vimmune Salt (2kg/ton feed) tent to improve the egg quality. .



Effect of *Vimmune salt* on egg quality (Research 3: Bromo, East Java)

Parameter	Control	Vimmune Salt
	(n: 1642 birds)	(n: 2358 birds)
Egg mass (g)	63.548	67.143
Length (cm)	5.781	5.781
Wide (cm)	4.470	4.495
Shell color	7.738	7.095
Albumen height (cm)	8.123	7.495
Albumen wide (cm)	7.337	7.683
Yolk height (cm)	1.773	1.792
Yolk wide (cm)	4.046	4.164
Yolk color	11.167	10.714
Thin shell (cm)	0.338	0.326
Shell mass (g)	6	6
Haugh Unit	88.4	83.0

Result and conclusion:

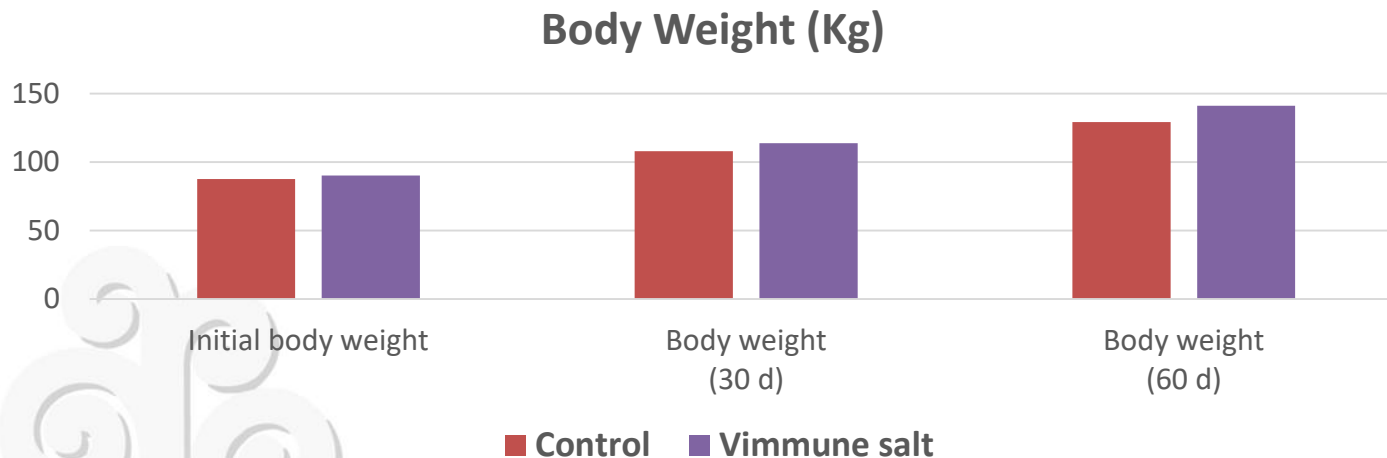
When the management practice of laying hen is excellent and antibiotic still use, there is no clear effect of vimmune salt on egg quality, but egg mass is 3.59 g higher than the control.



4. Calves



Research 1: Growing Periode



Treatment	Initial body weight	Body weight (30 d)	Body weight (60 d)
Control	88	108	129
Vimmune salt	90	114	141

Result and conclusion:

Utilization of Vimmune Salt improve daily body weight gain 0.17 kg higher than control (0.85 kg vs 0.68 Kg)



Picture

Before



After

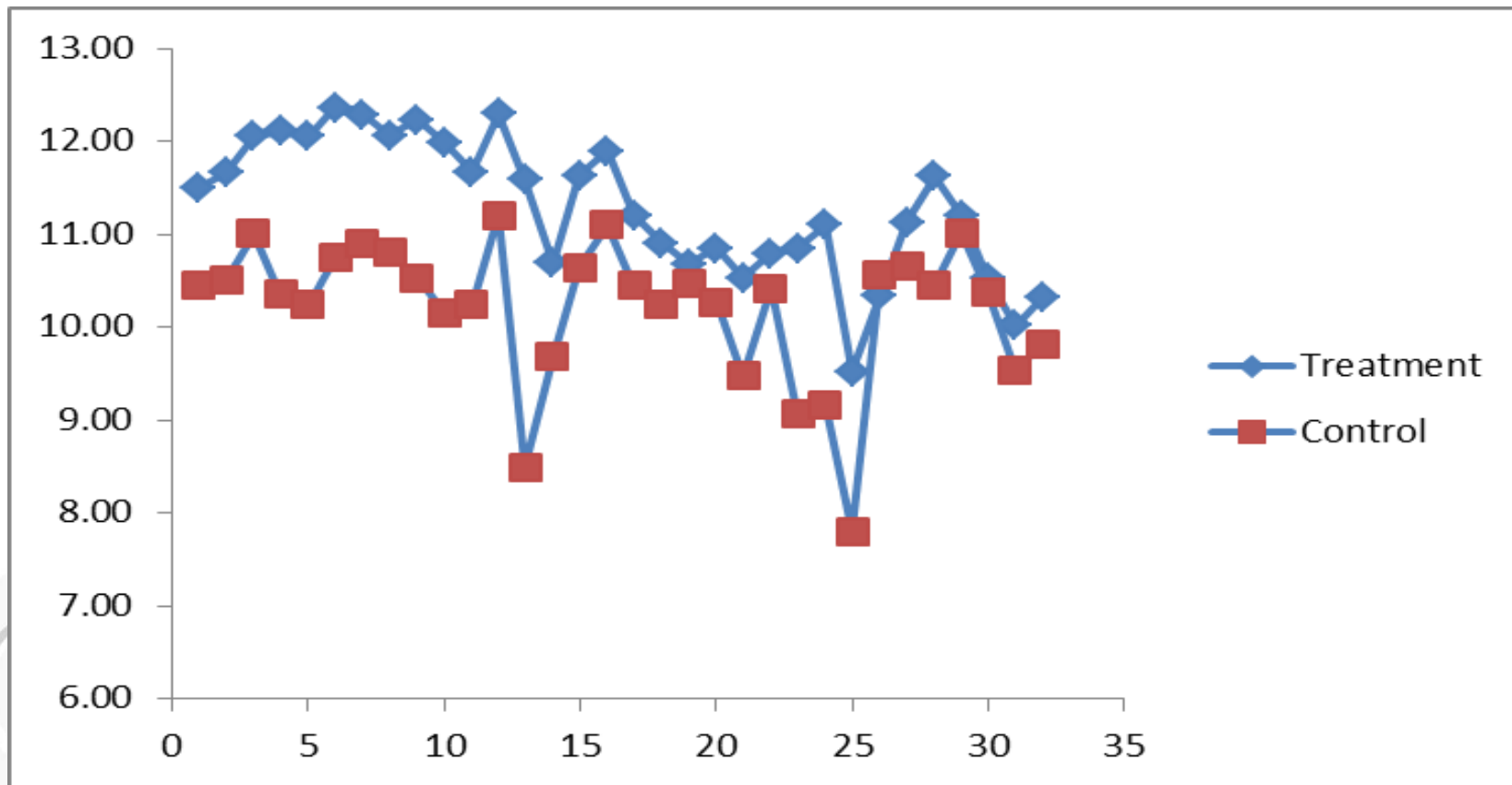




5. Dairy Cattle

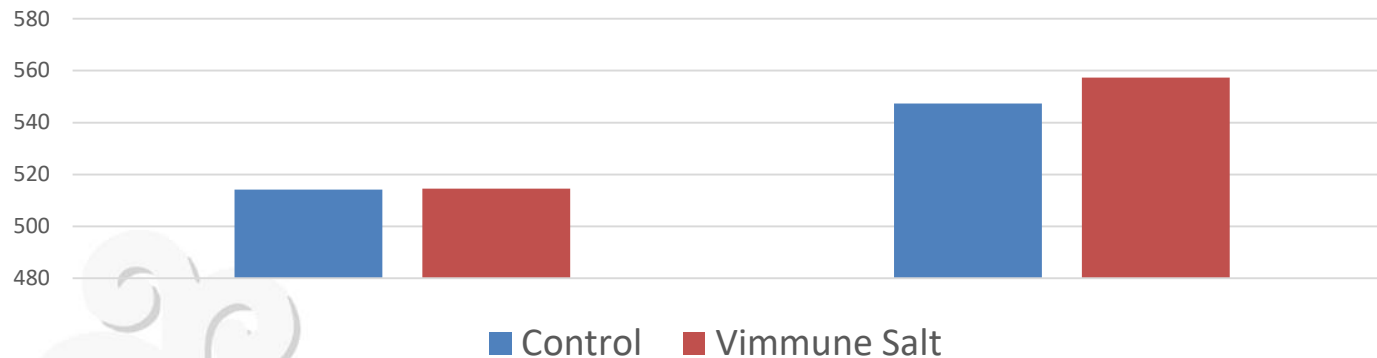


Milk Production





Body Weight (Kg)



number of animal: 28 head

Treatment	Initial body weight	Body weight (60 d)	Gain (kg)
Control	522	556	34
Vimmune salt	530	575	45

Result and conclusion:

Utilization of Vimmune Salt (50g/head/day) improve body weight gain 0.18 Kg of lactating dairy cattle (0.75 kg vs 0.57 Kg).



CONCLUDING REMARKS

1. Animal production face the problem on the productivity, **safety** and sustainability
2. Alternative of **AGP replacer** should be developed urgently
3. Animal nutrition and feed scientist should be more active and creative to participate in the problem solving
4. Development of **multifunctional feed additive** based on local resources has the opportunities and challenges, and it seems to be **promising**



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THANK YOU

