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Kajian meta-analisis dari peptida antimikrobial (PAM) terhadap performa pertumbuhan broiler

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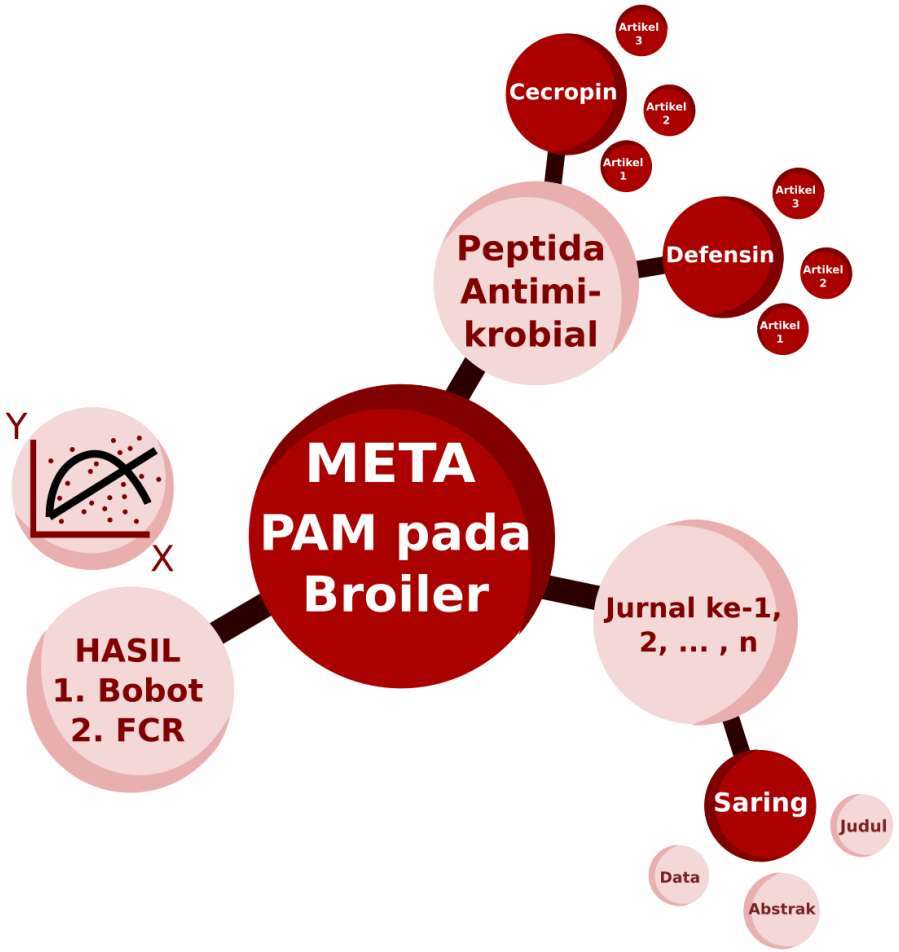

Biodata

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Pusat Riset Peternakan, Organisasi Riset Pertanian dan Pangan, Badan Riset dan Inovasi Nasional

S1-3 Institut Pertanian Bogor “Ilmu Nutrisi dan Pakan”

Pengertian meta-analisis

Meta-analisis adalah **metodologi statistik** untuk **mensintesis** hasil penelitian di berbagai **studi independent** (Koricheva *et al*. 2013).

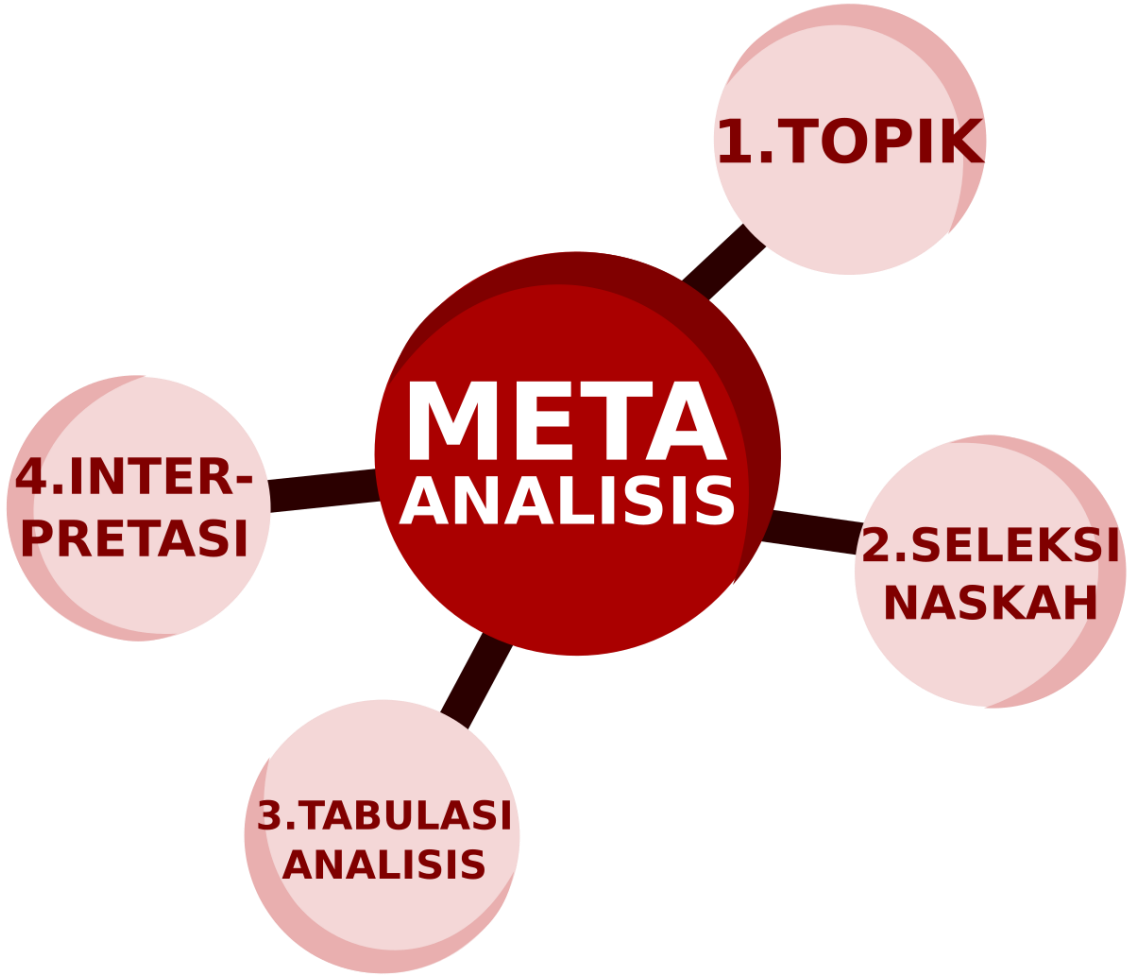
- Karya tulis ilmiah / **KTI**
- **Data penelitian** yang belum dipublikasikan

- **Pengetahuan**
- **Gambaran umum** dari fenomena

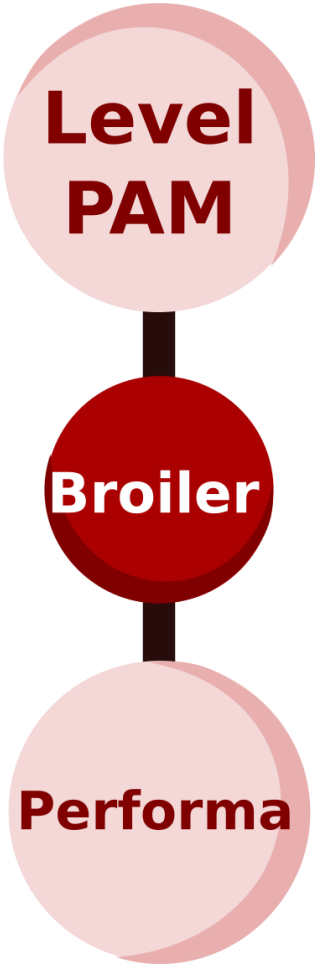
Langkah meta-analisis

Poin penting dalam meta-analisis:

1. Menentukan **topik**
2. Mengumpulkan dan **menyeleksi** naskah/jurnal yang dirujuk
3. Data dari naskah/jurnal terpilih **ditabulasi** dan **dianalisis**
4. Hasil analisis dirangkum dan **diinterpretasi**



1. Membuat topik meta-analisis (Yanza 2020)

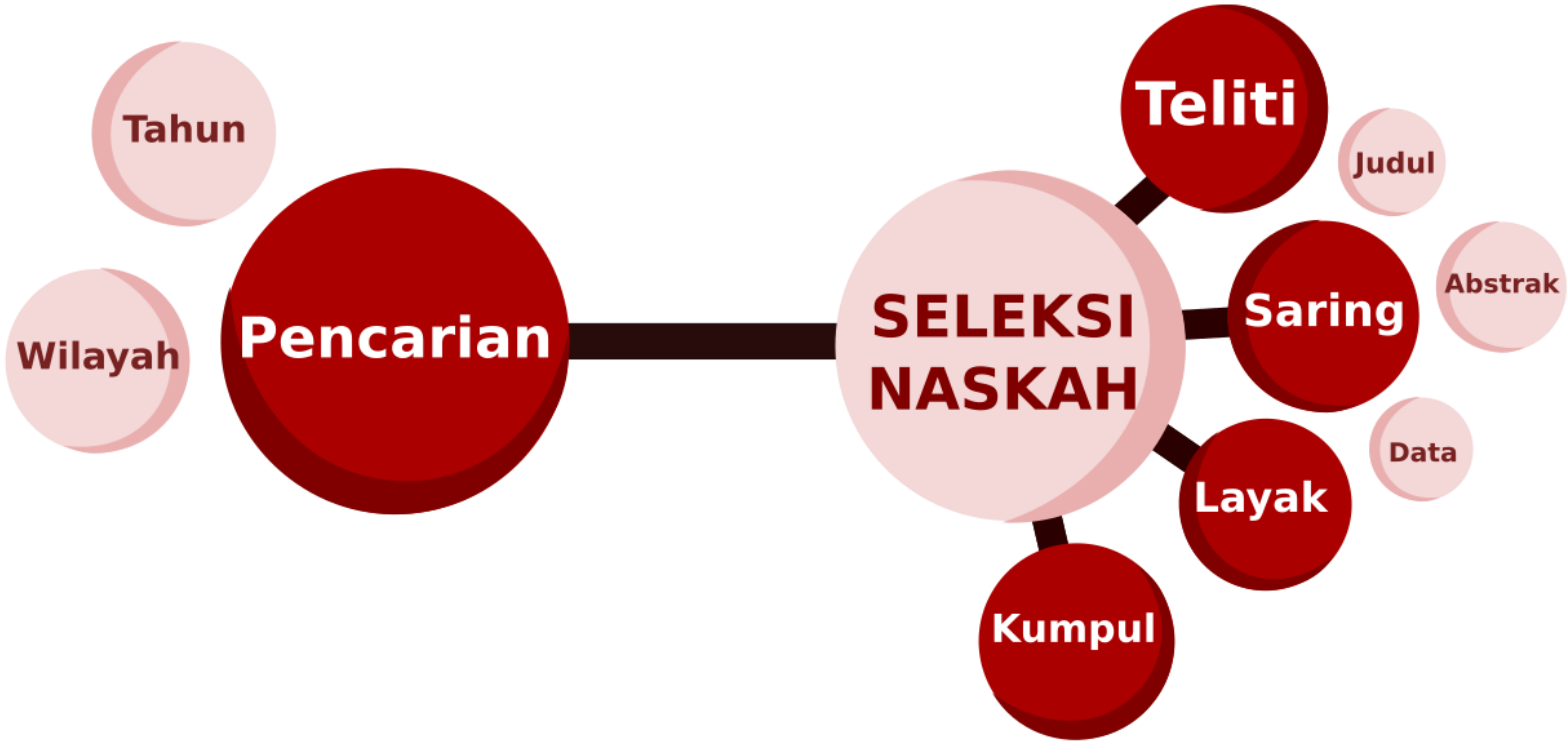


i **Independen (Y)**: Dosis aditif (mg/Kg as fed) dan level pemberian pakan (% as fed)

ii **Subyek**: Ruminansia (kambing dan domba) dan monogastrik (ayam pedaging/broiler dan babi)

iii **Dependen (X)**: Parameter performa (bobot badan (bb, g), pertambahan bobot badan harian (pbbh, g/hari), konsumsi pakan harian (kph, g/hari), dan konversi pakan (fcr))

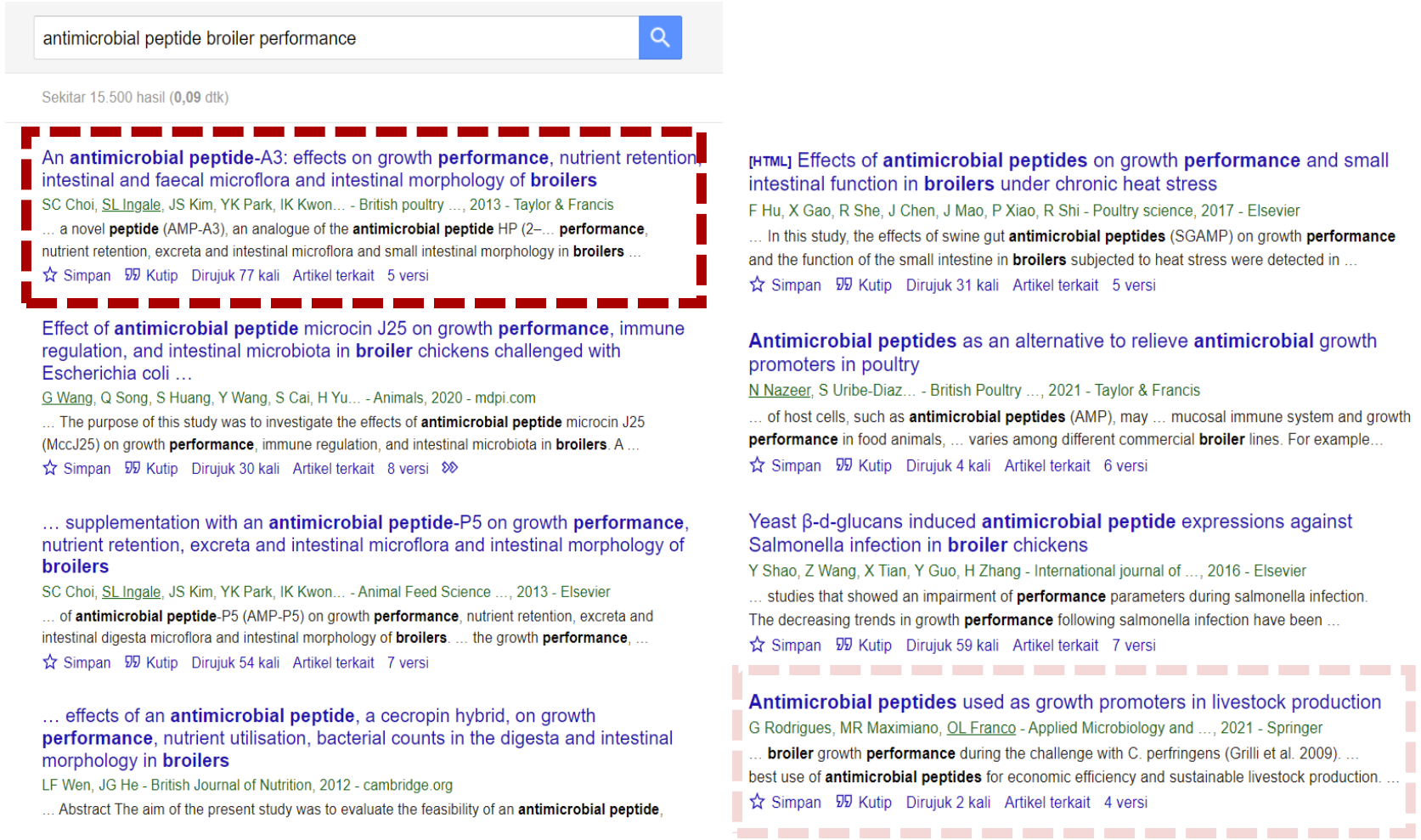
2. Pencarian dan seleksi sumber KTI



i **Sumber**: Basis data **scopus** → google **scholar** dan **science direct**

ii **Seleksi**: **satuan** level/dosis tertera, **ternak** (ayam pedaging/broiler), dan parameter performa

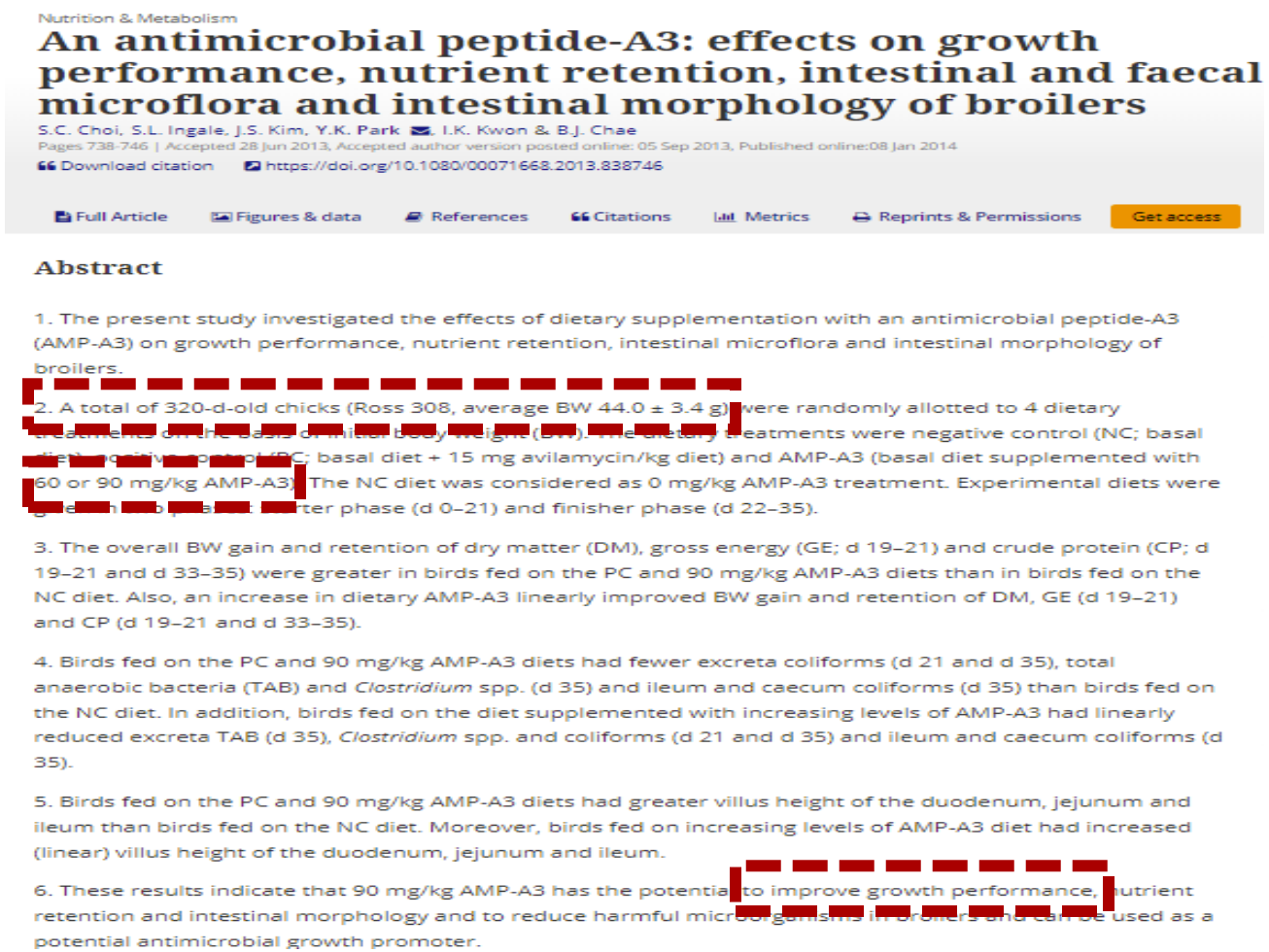
2. **Contoh:** Pencarian sumber KTI



Judul

Sumber: Basis data **scopus** → google **scholar** dan **science direct**

2. **Contoh:** Seleksi KTI (Choi 2013)



Nutrition & Metabolism

An antimicrobial peptide-A3: effects on growth performance, nutrient retention, intestinal and faecal microflora and intestinal morphology of broilers

S.C. Choi, S.L. Ingale, J.S. Kim, Y.K. Park, I.K. Kwon & B.J. Chae

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Abstract

1. The present study investigated the effects of dietary supplementation with an antimicrobial peptide-A3 (AMP-A3) on growth performance, nutrient retention, intestinal microflora and intestinal morphology of broilers.

2. A total of 320-d-old chicks (Ross 308, average BW 44.0 ± 3.4 g) were randomly allotted to 4 dietary treatments on the basis of initial body weight (BW). The dietary treatments were negative control (NC; basal diet), positive control (PC; basal diet + 15 mg avilamycin/kg diet) and AMP-A3 (basal diet supplemented with 60 or 90 mg/kg AMP-A3). The NC diet was considered as 0 mg/kg AMP-A3 treatment. Experimental diets were given to birds in starter phase (d 0–21) and finisher phase (d 22–35).

3. The overall BW gain and retention of dry matter (DM), gross energy (GE; d 19–21) and crude protein (CP; d 19–21 and d 33–35) were greater in birds fed on the PC and 90 mg/kg AMP-A3 diets than in birds fed on the NC diet. Also, an increase in dietary AMP-A3 linearly improved BW gain and retention of DM, GE (d 19–21) and CP (d 19–21 and d 33–35).

4. Birds fed on the PC and 90 mg/kg AMP-A3 diets had fewer excreta coliforms (d 21 and d 35), total anaerobic bacteria (TAB) and *Clostridium* spp. (d 35) and ileum and caecum coliforms (d 35) than birds fed on the NC diet. In addition, birds fed on the diet supplemented with increasing levels of AMP-A3 had linearly reduced excreta TAB (d 35), *Clostridium* spp. and coliforms (d 21 and d 35) and ileum and caecum coliforms (d 35).

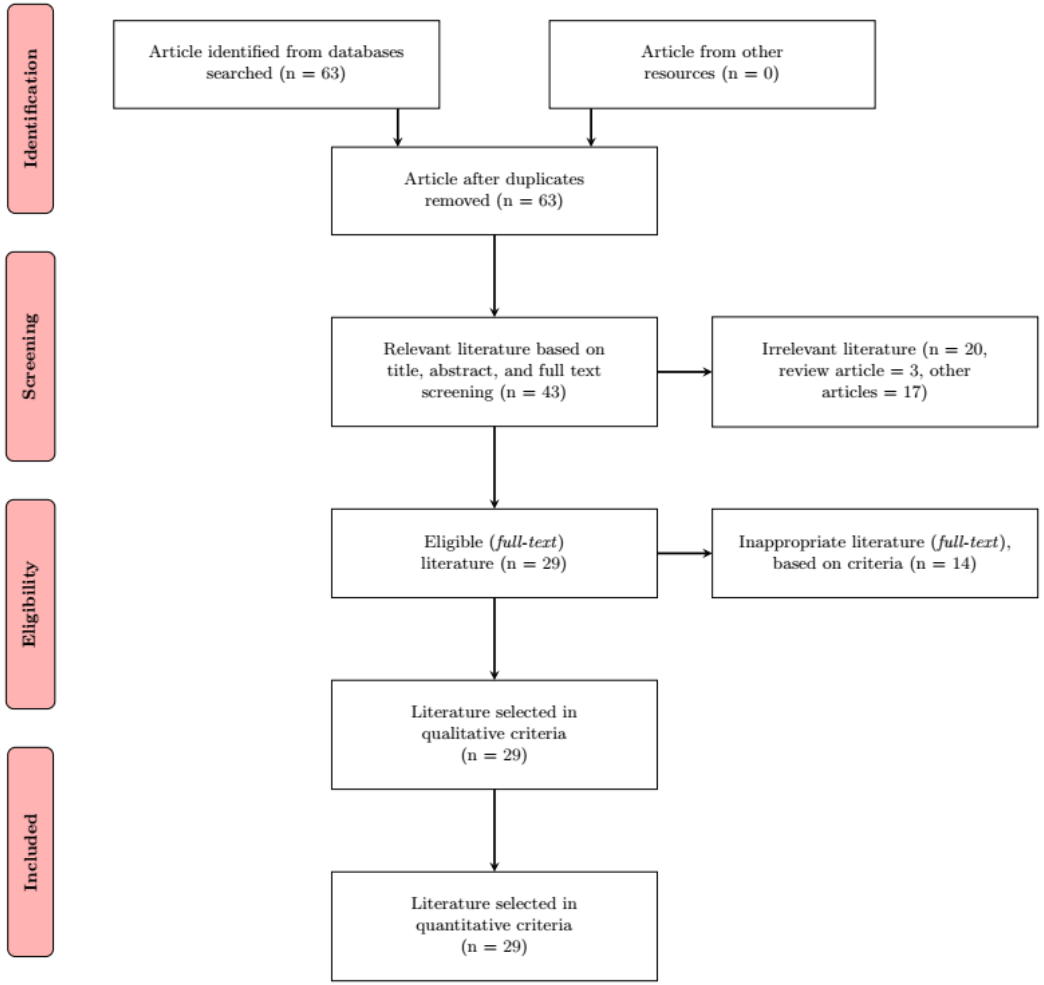
5. Birds fed on the PC and 90 mg/kg AMP-A3 diets had greater villus height of the duodenum, jejunum and ileum than birds fed on the NC diet. Moreover, birds fed on increasing levels of AMP-A3 diet had increased (linear) villus height of the duodenum, jejunum and ileum.

6. These results indicate that 90 mg/kg AMP-A3 has the potential to improve growth performance, nutrient retention and intestinal morphology and to reduce harmful microorganisms in broilers and can be used as a potential antimicrobial growth promoter.

Abstrak

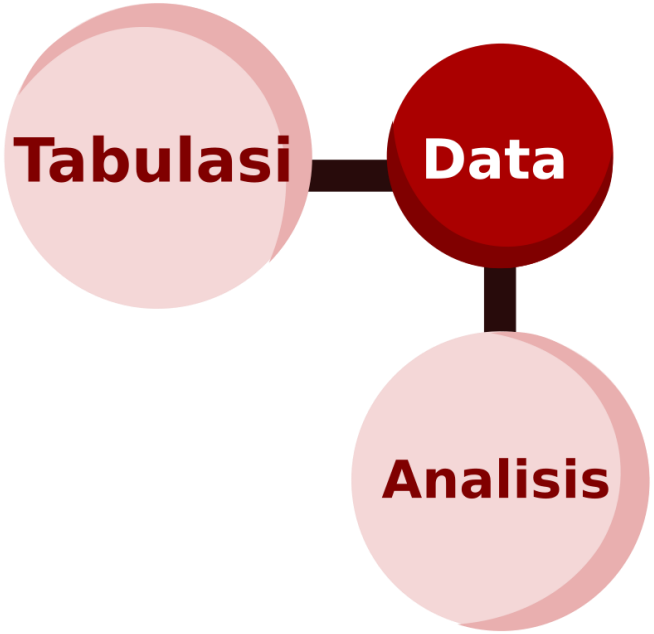
ii **Seleksi**: **satuan** level/dosis tertera, **ternak** (ayam pedaging/broiler), dan parameter performa

2. **Contoh:** Alur Seleksi KTI



3. Tabulasi data dan analisis

i Pengumpulan data dari KTI ke dalam *spreadsheet*



$$Y_{ij} = B_0 + B_1X_{ij} + s_i + e_{ij}$$

Y_{ij} = variabel dependen (fcr)
B_0 = titik potong (intercept)
B_1 = koefisien regresi linier (slope)
X_{ij} = variabel independen (level PAM)
s_i = efek acak dari perbedaan studi
e_{ij} = kesalahan yang tidak dapat dijelaskan

ii Analisis data menggunakan *linear mixed model* (St-Pierre 2001) pada aplikasi R. Validasi menggunakan R^2

3. Contoh: Tabulasi data (Choi 2013)

Table 2. *Effect of dietary supplementation of antimicrobial peptide-A3 (AMP-A3) on growth performance of broilers*[1,2]

		AMP-A3, mg/kg				*P*-values[3]		
Item	PC	0 (NC)	60	90	SEM	T	L	Q
Starter (d 0–21)								
Body weight gain, g	732[a]	693[b]	704[b]	722[a]	4.48	0.010	0.002	0.525
Feed intake, g	1143	1114	1123	1136	4.68	0.126	0.140	0.902
FCR[4]	1.56	1.61	1.60	1.57	0.01	0.080	0.119	0.680
Finisher (d 22–35)								
Body weight gain, g	1153[a]	1077[c]	1088[c]	1121[b]	10.21	0.016	0.043	0.543
Feed intake, g	2075	2013	2010	2048	15.63	0.439	0.326	0.500
FCR	1.80	1.87	1.85	1.83	0.01	0.098	0.085	0.904
Overall (d 0–35)								
Body weight gain, g	1885[a]	1769[c]	1792[bc]	1843[ab]	13.50	0.001	0.004	0.341
Feed intake, g	3218	3127	3134	3184	17.84	0.217	0.158	0.510
FCR	1.71[b]	1.77[a]	1.75[ab]	1.73[ab]	0.01	0.034	0.056	0.935

[a,b,c]Mean values within the same row sharing a common superscript letter are not statistically different at $P < 0.05$.

[1]The dietary treatments were the following: NC: negative control (basal diet without any antimicrobials); PC: positive control (basal diet + 15 mg avilamycin/kg diet) and AMP-A3 (basal diet supplemented with 60 and 90 mg/kg AMP-A3). The NC (diet without antimicrobials) was considered as 0 mg/kg AMP-A3.

[2]Data are means of 4 pens of 20 birds each.

[3]T: overall effect of treatments; L: linear effect of increasing AMP-A3; Q: quadratic effect of increasing AMP-A3 (0, 60 and 90 mg/kg of diet).

[4]FCR, feed conversion ratio.

i Pengumpulan data dari KTI ke dalam *spreadsheet*

3. **Contoh:** Tabulasi data

studi	pengarang	tahun	PAM	Level (mg/Kg as fed)	breed	periode starter	periode finisher	total periode	starter bb, Kg	starter pbbh, g/hari	starter kph, g/hari	starter fcr
1	Choi et al.	2013	Kontrol	0.0000	ROSS 308	1-21	22-35	1-35	737.0000	33.0000	53.0500	1.6100
1	Choi et al.	2013	PAM A3	60.0000	ROSS 308	1-21	22-35	1-35	747.9200	33.5200	53.4800	1.6000
1	Choi et al.	2013	PAM A3	90.0000	ROSS 308	1-21	22-35	1-35	765.9800	34.3800	54.1000	1.5700
2	Choi et al.	2013	Kontrol	0.0000	ROSS 308	1-21	22-35	1-35	803.9900	36.1900	55.9500	1.5500
2	Choi et al.	2013	PAM P5	40.0000	ROSS 308	1-21	22-35	1-35	821.0000	37.0000	56.5200	1.5300
2	Choi et al.	2013	PAM P5	60.0000	ROSS 308	1-21	22-35	1-35	836.9600	37.7600	56.7100	1.5000
3	Wen and He	2012	Kontrol	0.0000	Lingnan	14-28	29-42	14-42	542.0000	21.4000	41.3000	1.9300
3	Wen and He	2012	Cecropin A	2.0000	Lingnan	14-28	29-42	14-42	545.5000	21.5000	39.4000	1.8300
3	Wen and He	2012	Cecropin A	4.0000	Lingnan	14-28	29-42	14-42	551.5000	21.9000	38.9000	1.7800
3	Wen and He	2012	Cecropin A	6.0000	Lingnan	14-28	29-42	14-42	545.0000	21.6000	34.7000	1.6100

$$Y_{ij} = B_0 + B_1 X_{ij} + s_i + e_{ij}$$

3. **Contoh:** Analisis

```
# Plugin
library(readxl)
library(xlsx)
library(nlme)
library(sjstats)

## Input data
data_metal = read_excel("nama_file_data.xlsx", sheet="nama_sheet_data")

# Analisis
contoh_lmm <- lme(fcr ~ level, random=list(~1|studi), na.action=na.exclude, data=contoh_data)

# Hasil
# Koefisien lmm
summary(contoh_lmm)
# R kuadrat
performance::r2(contoh_lmm)
```

$$Y_{ij} = B_0 + B_1 X_{ij} + s_i + e_{ij}$$

ii Analisis data menggunakan *linear mixed model* (St-Pierre 2001) pada aplikasi R

3. **Contoh:** Analisis

```
# Hasil
# Koefisien lmm
summary(contoh_lmm)
```

```
Linear mixed-effects model fit by REML
  Data: contoh_data
       AIC       BIC   logLik
  -90.92603 -81.39792 49.46301

Random effects:
 Formula: ~1 | studi
        (Intercept)   Residual
StdDev:   0.1876368 0.07334596

Fixed effects:  fcr ~ level
                Value  Std.Error DF  t-value p-value
(Intercept)  1.5080402 0.03910927 56 38.55966  0.0000
level       -0.0001291 0.00006764 56 -1.90878  0.0614
 Correlation:
      (Intr)
level -0.18

Standardized Within-Group Residuals:
        Min          Q1         Med          Q3         Max
-2.07180482 -0.29537929 -0.03428949  0.38162920  2.92419158

Number of Observations: 82
Number of Groups: 25
```

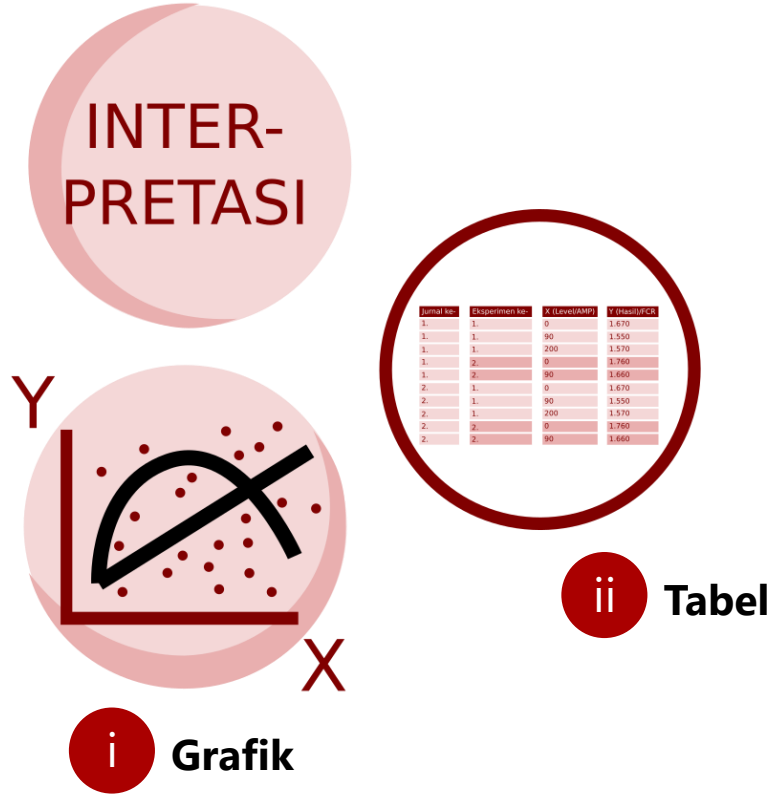
```
# R kuadrat
performance::r2(contoh_lmm)
```

```
      # R2 for Mixed Models

Conditional R2: 0.869
   Marginal R2: 0.010
```

$$Y_{ij} = B_0 + B_1 X_{ij} + s_i + e_{ij}$$

4. Hasil analisis dan interpretasinya



4. Contoh: Tabel

Parameter (Periode starter)	Satuan	N	Parameter estimates				Model estimates		
			Intercept	SE Intercept	Slope	SE Slope	P-Value	R-Seq	RMSE
Bobot badan (bb)	g	82	919	43.4	**0.0683**	0.0345	**0.05**	0.972	1.75
Pertambahan bobot badan harian (pbbh)	g/hari	82	38.8	1.87	0.00318	0.00172	0.07		1.9
Konsumsi pakan harian (kph)	g/hari	82	57.1	2.67	0.00039	0.00148	0.792		1.75
Konversi pakan (fcr)		82	1.51	0.0388	**-0.00013**	0.00007	**0.063**	0.869	1.63

$$Y_{ij} = B_0 + B_1 X_{ij} + s_i + e_{ij}$$

$$Y_{ij} = 1.51 - 0.00013X + s_i + e_{ij}$$

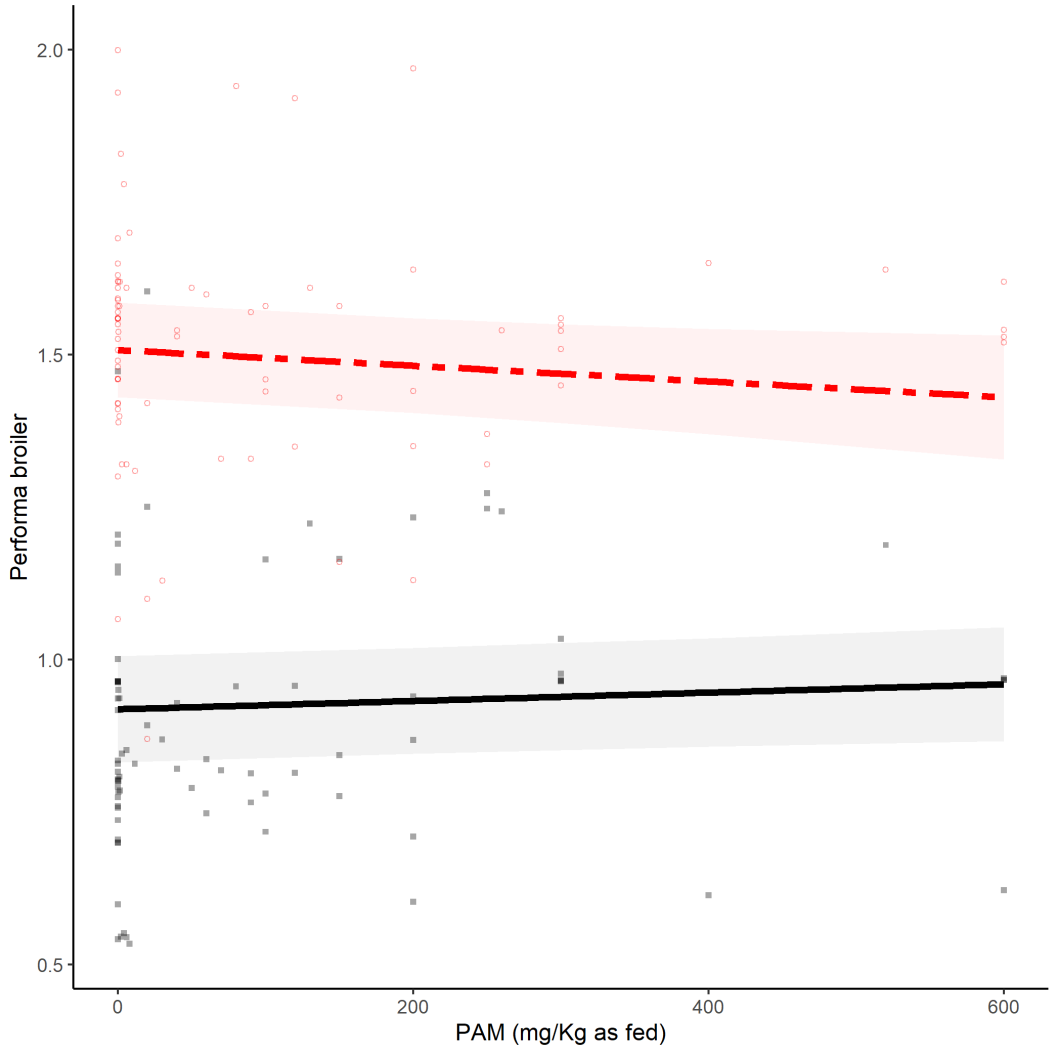
4. Contoh: Tabel

Parameter (Periode starter)	Satuan	N	Parameter estimates				Model estimates		
			Intercept	SE Intercept	Slope	SE Slope	P-Value	R-Seq	RMSE
Bobot badan (bb)	g	82	919	43.4	**0.0683**	0.0345	**0.05**	0.972	1.75
Konversi pakan (fcr)		82	1.51	0.0388	**-0.00013**	0.00007	**0.063**	0.869	1.63

i **bb**: Pemberian PAM signifikan meningkatkan bobot badan broiler periode starter

ii **fcr**: Pemberian PAM tidak nyata menurunkan konversi pakan broiler periode starter

4. **Contoh:** Grafik



i **fcr**: Pemberian PAM tidak nyata menurunkan konversi pakan broiler periode starter (merah)

ii **bb (dalam Kg)**: Pemberian PAM signifikan meningkatkan bobot badan broiler periode starter (hitam)

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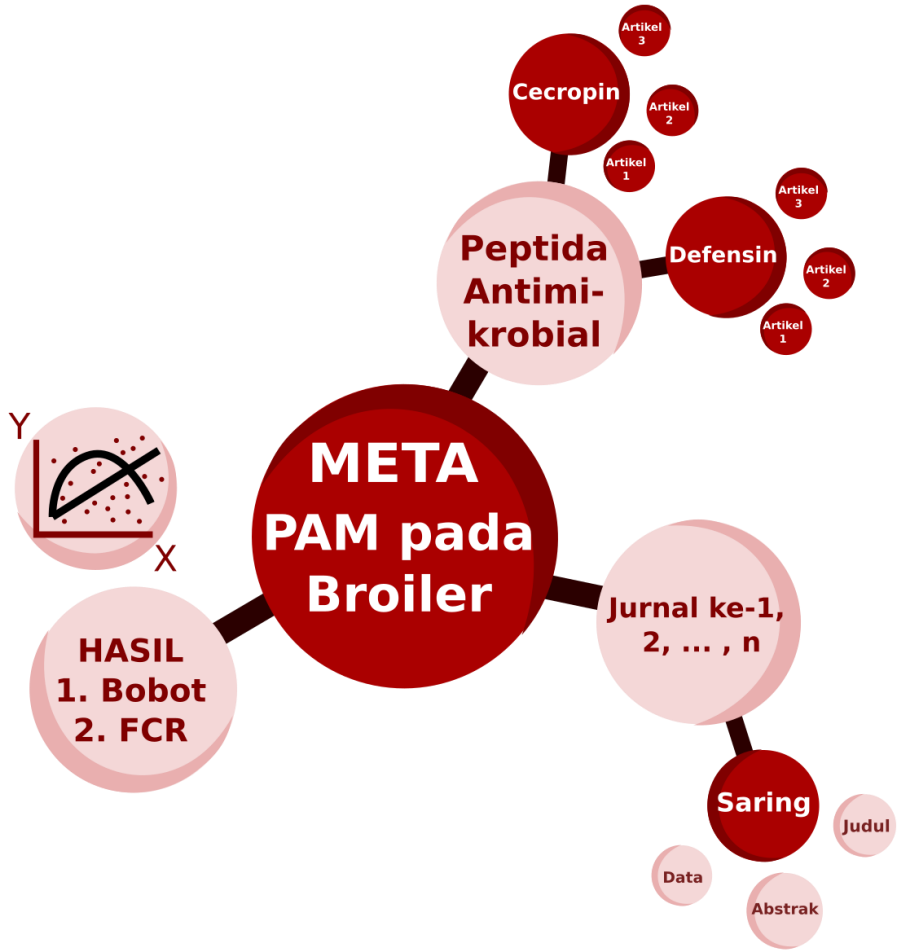
Selesai
Terima kasih



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Referensi

Choi S.C., Ingale S.L., Kim J.S., Park Y.K., Kwon I.K., Chae B.J., 2013. An antimicrobial peptide-A3: effects on growth performance, nutrient retention, intestinal and faecal microflora and intestinal morphology of broilers. Br. Poult. Sci. 54, 738–746, https://doi.org/10.1080/00071668.2013.838746

Sauvant D., Schmidely P., Daudin J.J., St-Pierre N.R., 2008. Meta-analyses of experimental data in animal nutrition. Animal 2, 1203–1214, https://doi.org/10.1017/s1751731108002280

St-Pierre N.R., 2001. Invited review: integrating quantitative findings from multiple studies using mixed model methodology. J. Dairy Sci. 84, 741–755, https://doi.org/10.3168/jds.S0022-0302(01)74530-4

Yanza, Y.R. *et al*., 2020. The effects of dietary medium-chain fatty acids on ruminal methanogenesis and fermentation in vitro and in vivo: A meta-analysis. Bahan Presentasi

Artikel

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The Kielanowski Institute of Animal Physiology and Nutrition, Polish Academy of Sciences, Jabłonna

Antimicrobial peptides as an additive in broiler chicken nutrition: a meta-analysis of bird performance, nutrient digestibility and serum metabolites

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KEY WORDS: antimicrobial peptide, broiler chickens, growth performance, meta-analysis

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ABSTRACT. The present meta-analysis evaluated the effect of the level of antimicrobial peptides (AMPs) on broiler chicken growth performance, digestibility, small intestine morphology and blood serum parameters. The database was developed from 29 articles comprising 36 experiments. Data were analyzed using a mixed model methodology considering the levels of AMPs as fixed effects and different studies as random effects. It was shown that an increased AMPs addition level quadratically influenced body weight (BW), average daily gain (ADG) and feed conversion ratio (FCR) ($P < 0.05$). Simultaneously, it linearly reduced mortality ($P < 0.05$) both in the starter and finisher periods. There was a linear increase in metabolizable energy ($P < 0.05$). Small intestine morphology in the duodenum, as indicated by villus height and villus height to crypt depth ratio linearly increased, while the crypt depth was linearly decreased ($P < 0.05$). The mucosa thickness was quadratically affected in the jejunum, while the crypt depth linearly decreased ($P < 0.05$). Categorical analysis showed that AMPs had a comparable effect with antibiotics on broiler performance (BW, ADG, FCR) ($P > 0.05$); however the improvement in comparasion with the non-supplemented group was stated ($P < 0.01$). In conclusion, it is evidenced that AMPs can be used as an effective replacer of antibiotic growth promoters (AGP) because they can improve growth performance, digestibility, small intestine morphology and blood serum parameters of broiler in all rearing periods. Also, the optimal doses of dietary AMPs addition at 337 and 359 mg/kg of diet for the starter and finisher phases, respectively are suggested.