

## **LAMPIRAN**

## Lampiran 1. Hasil analisis statistik

IL-1 Beta

Descriptive Statistics				
Dependent Variable:IL				
umur	Seligi	Mean	Std. Deviation	N
45	0	81.4000	7.92465	5
	2	1.7940E2	22.70022	5
	4	2.0400E2	30.29026	5
	6	2.7540E2	9.55510	5
	8	2.4080E2	51.94901	5
	Total	1.9620E2	72.47471	25
75	0	82.2000	7.39594	5
	2	1.7940E2	22.70022	5
	4	3.0620E2	18.21263	5
	6	3.9120E2	12.51799	5
	8	2.9080E2	19.44736	5
	Total	2.4996E2	110.91569	25
Total	0	81.8000	7.23878	10
	2	1.7940E2	21.40197	10
	4	2.5510E2	58.79238	10
	6	3.3330E2	61.92836	10
	8	2.6580E2	45.40876	10
	Total	2.2308E2	96.62083	50

Post Hoc

### Multiple Comparisons

IL

Tukey HSD

(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	2	-97.6000 <sup>*</sup>	15.46989	.000	-141.5980	-53.6020
	4	-173.3000 <sup>*</sup>	15.46989	.000	-217.2980	-129.3020
	6	-251.5000 <sup>*</sup>	15.46989	.000	-295.4980	-207.5020

	8	-184.0000*	15.46989	.000	-227.9980	-140.0020
2	0	97.6000*	15.46989	.000	53.6020	141.5980
	4	-75.7000*	15.46989	.000	-119.6980	-31.7020
	6	-153.9000*	15.46989	.000	-197.8980	-109.9020
	8	-86.4000*	15.46989	.000	-130.3980	-42.4020
4	0	173.3000*	15.46989	.000	129.3020	217.2980
	2	75.7000*	15.46989	.000	31.7020	119.6980
	6	-78.2000*	15.46989	.000	-122.1980	-34.2020
	8	-10.7000	15.46989	.957	-54.6980	33.2980
6	0	251.5000*	15.46989	.000	207.5020	295.4980
	2	153.9000*	15.46989	.000	109.9020	197.8980
	4	78.2000*	15.46989	.000	34.2020	122.1980
	8	67.5000*	15.46989	.001	23.5020	111.4980
8	0	184.0000*	15.46989	.000	140.0020	227.9980
	2	86.4000*	15.46989	.000	42.4020	130.3980
	4	10.7000	15.46989	.957	-33.2980	54.6980
	6	-67.5000*	15.46989	.001	-111.4980	-23.5020

Based on observed means.

The error term is Mean Square(Error) = 1196,588.

\*. The mean difference is significant at the ,05 level.

Tests of Between-Subjects Effects					
Dependent Variable:IL					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	404793.800 <sup>a</sup>	5	80958.760	67.658	.000
Intercept	2488234.320	1	2488234.320	2.079E3	.000
umur	36126.720	1	36126.720	30.191	.000
Seligi	368667.080	4	92166.770	77.025	.000
Error	52649.880	44	1196.588		
Total	2945678.000	50			
Corrected Total	457443.680	49			
a. R Squared = ,885 (Adjusted R Squared = ,872)					

## Homogeneous

### IL

Tukey HSD

Seligi	N	Subset			
		1	2	3	4
0	10	81.8000			
2	10		1.7940E2		
4	10			2.5510E2	
8	10			2.6580E2	
6	10				3.3330E2
Sig.		1.000	1.000	.957	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 1196,588.

## iNOS

### Descriptive Statistics

Dependent Variable:iNOS

umur	Seligi	Mean	Std. Deviation	N
45	0	6.15800	.279734	5
	2	4.97760	.169407	5
	4	4.49020	.289098	5
	6	4.37660	.182454	5
	8	4.17100	.170813	5
	Total		4.83468	.755945
75	0	5.60400	.454583	5
	2	3.57720	.161052	5
	4	2.51440	.055039	5
	6	2.30860	.187659	5
	8	4.07280	.523053	5
	Total		3.61540	1.251721
Total	0	5.88100	.460299	10
	2	4.27740	.754346	10
	4	3.50230	1.059659	10

6	3.34260	1.103811	10
8	4.12190	.370458	10
Total	4.22504	1.194385	50

**iNOS \* Seligi**

iNOS

Seligi	Mean	N	Std. Deviation
0	5.88100	10	.460299
2	4.27740	10	.754346
4	3.50230	10	1.059659
6	3.34260	10	1.103811
8	4.12190	10	.370458
Total	4.22504	50	1.194385

**Tests of Between-Subjects Effects**

Dependent Variable: iNOS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	59.149 <sup>a</sup>	5	11.830	48.412	.000
Intercept	892.548	1	892.548	3.653E3	.000
Umur	18.583	1	18.583	76.048	.000
Seligi	40.566	4	10.142	41.503	.000
Error	10.752	44	.244		
Total	962.449	50			
Corrected Total	69.901	49			

a. R Squared = ,846 (Adjusted R Squared = ,829)

**Post Hoc**

**Multiple Comparisons**

iNOS

Tukey HSD

(I) Seligi	(J) Seligi	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	2	1.60360 <sup>*</sup>	.221070	.000	.97485	2.23235
	4	2.37870 <sup>*</sup>	.221070	.000	1.74995	3.00745
	6	2.53840 <sup>*</sup>	.221070	.000	1.90965	3.16715

	8	1.75910 <sup>*</sup>	.221070	.000	1.13035	2.38785
2	0	-1.60360 <sup>*</sup>	.221070	.000	-2.23235	-.97485
	4	.77510 <sup>*</sup>	.221070	.009	.14635	1.40385
	6	.93480 <sup>*</sup>	.221070	.001	.30605	1.56355
	8	.15550	.221070	.955	-.47325	.78425
4	0	-2.37870 <sup>*</sup>	.221070	.000	-3.00745	-1.74995
	2	-.77510 <sup>*</sup>	.221070	.009	-1.40385	-.14635
	6	.15970	.221070	.950	-.46905	.78845
	8	-.61960	.221070	.055	-1.24835	.00915
6	0	-2.53840 <sup>*</sup>	.221070	.000	-3.16715	-1.90965
	2	-.93480 <sup>*</sup>	.221070	.001	-1.56355	-.30605
	4	-.15970	.221070	.950	-.78845	.46905
	8	-.77930 <sup>*</sup>	.221070	.008	-1.40805	-.15055
8	0	-1.75910 <sup>*</sup>	.221070	.000	-2.38785	-1.13035
	2	-.15550	.221070	.955	-.78425	.47325
	4	.61960	.221070	.055	-.00915	1.24835
	6	.77930 <sup>*</sup>	.221070	.008	.15055	1.40805

Based on observed means.

The error term is Mean Square(Error) = ,244.

\*. The mean difference is significant at the 0,05 level.

## Homogeneous

### iNOS

#### Tukey HSD

Seligi	N	Subset			
		1	2	3	4
6	10	3.34260			
4	10	3.50230	3.50230		
8	10		4.12190	4.12190	
2	10			4.27740	
0	10				5.88100
Sig.		.950	.055	.955	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = ,244.

# IPT

## Descriptive Statistics

Dependent Variable: IPT

Kelompok	ulangan	Mean	Std. Deviation	N
45	1	7.46440	1.180960	5
	2	7.62120	1.046315	5
	3	7.62000	1.046305	5
	Total	7.56853	1.014823	15
60	1	8.19160	.760612	5
	2	8.49680	.513935	5
	3	8.50140	.505433	5
	Total	8.39660	.579885	15
75	1	1.09028E1	1.771414	5
	2	1.09010E1	1.773386	5
	3	1.09076E1	1.771138	5
	Total	1.09038E1	1.640537	15
Total	1	8.85293	1.950845	15
	2	9.00633	1.829424	15
	3	9.00967	1.830435	15
	Total	8.95631	1.829578	45

## Tests of Between-Subjects Effects

Dependent Variable: IPT

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	117.566 <sup>a</sup>	6	19.594	25.055	.000
Intercept	3609.698	1	3609.698	4.616E3	.000
Seligi	27.087	4	6.772	8.659	.000
Kelompok	90.479	2	45.239	57.847	.000
Error	29.718	38	.782		
Total	3756.982	45			
Corrected Total	147.284	44			

a. R Squared = ,798 (Adjusted R Squared = ,766)

Post Hoc

Multiple Comparisons						
IPT						
Tukey HSD						
(I) Seligi	(J) Seligi	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	2	-.37367	.416879	.896	-1.56722	.81988
	4	-.23500	.416879	.980	-1.42855	.95855
	6	.29067	.416879	.956	-.90288	1.48422
	8	1.77644*	.416879	.001	.58289	2.96999
2	0	.37367	.416879	.896	-.81988	1.56722
	4	.13867	.416879	.997	-1.05488	1.33222
	6	.66433	.416879	.511	-.52922	1.85788
	8	2.15011*	.416879	.000	.95656	3.34366
4	0	.23500	.416879	.980	-.95855	1.42855
	2	-.13867	.416879	.997	-1.33222	1.05488
	6	.52567	.416879	.716	-.66788	1.71922
	8	2.01144*	.416879	.000	.81789	3.20499
6	0	-.29067	.416879	.956	-1.48422	.90288
	2	-.66433	.416879	.511	-1.85788	.52922
	4	-.52567	.416879	.716	-1.71922	.66788
	8	1.48578*	.416879	.008	.29223	2.67933
8	0	-1.77644*	.416879	.001	-2.96999	-.58289
	2	-2.15011*	.416879	.000	-3.34366	-.95656
	4	-2.01144*	.416879	.000	-3.20499	-.81789
	6	-1.48578*	.416879	.008	-2.67933	-.29223

Based on observed means.  
 The error term is Mean Square(Error) = ,782.  
 \*. The mean difference is significant at the ,05 level.



### Homogenous

IPT			
Tukey HSD			
Seligi	N	Subset	
		1	2
8	9	7.47156	
6	9		8.95733
0	9		9.24800
4	9		9.48300
2	9		9.62167
Sig.		1.000	.511

Means for groups in homogeneous subsets are displayed.  
Based on observed means.  
The error term is Mean Square(Error) = ,782.

### Kelompok

Multiple Comparisons						
IPT						
Tukey HSD						
(I) Kelompok	(J) Kelompok	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
45	60	-.82807 <sup>*</sup>	.322913	.037	-1.61560	-.04054
	75	-3.33527 <sup>*</sup>	.322913	.000	-4.12280	-2.54774
60	45	.82807 <sup>*</sup>	.322913	.037	.04054	1.61560
	75	-2.50720 <sup>*</sup>	.322913	.000	-3.29473	-1.71967
75	45	3.33527 <sup>*</sup>	.322913	.000	2.54774	4.12280
	60	2.50720 <sup>*</sup>	.322913	.000	1.71967	3.29473

Based on observed means.  
The error term is Mean Square(Error) = ,782.  
\*. The mean difference is significant at the ,05 level.

## Homogenous

IPT				
Tukey HSD				
Kelompok	N	Subset		
		1	2	3
45	15	7.56853		
60	15		8.39660	
75	15			1.09038E1
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.  
Based on observed means.  
The error term is Mean Square(Error) = ,782.

## IKT

Descriptive Statistics				
Dependent Variable: IKT				
Kelompok	ulangan	Mean	Std. Deviation	N
45	1	.44760	.018690	5
	2	.44560	.018257	5
	3	.44980	.019305	5
	Total	.44767	.017455	15
60	1	.49040	.015534	5
	2	.48500	.012510	5
	3	.49440	.018501	5
	Total	.48993	.015078	15
75	1	.53600	.026627	5
	2	.53060	.027889	5
	3	.54100	.025807	5
	Total	.53587	.025187	15
Total	1	.49133	.042039	15
	2	.48707	.040677	15
	3	.49507	.043360	15
	Total	.49116	.041206	45

Tests of Between-Subjects Effects					
Dependent Variable:IKT					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.065 <sup>a</sup>	6	.011	40.205	.000
Intercept	10.856	1	10.856	4.057E4	.000
Seligi	.006	4	.002	5.759	.001
Kelompok	.058	2	.029	109.096	.000
Error	.010	38	.000		
Total	10.930	45			
Corrected Total	.075	44			

a. R Squared = ,864 (Adjusted R Squared = ,842)

Post Hoc  
Seligi

Multiple Comparisons

IKT

Tukey HSD

(I) Seligi	(J) Seligi	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	2	-.01567	.007711	.271	-.03774	.00641
	4	.00700	.007711	.892	-.01508	.02908
	6	.02033	.007711	.084	-.00174	.04241
	8	-.00078	.007711	1.000	-.02285	.02130
2	0	.01567	.007711	.271	-.00641	.03774
	4	.02267 <sup>*</sup>	.007711	.042	.00059	.04474
	6	.03600 <sup>*</sup>	.007711	.000	.01392	.05808
	8	.01489	.007711	.319	-.00719	.03697
4	0	-.00700	.007711	.892	-.02908	.01508
	2	-.02267 <sup>*</sup>	.007711	.042	-.04474	-.00059
	6	.01333	.007711	.429	-.00874	.03541
	8	-.00778	.007711	.850	-.02985	.01430
6	0	-.02033	.007711	.084	-.04241	.00174
	2	-.03600 <sup>*</sup>	.007711	.000	-.05808	-.01392
	4	-.01333	.007711	.429	-.03541	.00874

	8		-.02111	.007711	.067	-.04319	.00097
8	0		.00078	.007711	1.000	-.02130	.02285
	2		-.01489	.007711	.319	-.03697	.00719
	4		.00778	.007711	.850	-.01430	.02985
	6		.02111	.007711	.067	-.00097	.04319

Based on observed means.

The error term is Mean Square(Error) = ,000.

\*. The mean difference is significant at the ,05 level.

Homogenous

**IKT**

Tukey HSD

Seligi	N	Subset	
		1	2
6	9	.47300	
4	9	.48633	
0	9	.49333	.49333
8	9	.49411	.49411
2	9		.50900
Sig.		.067	.271

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = ,000.

**Multiple Comparisons**

IKT

Tukey HSD

(I) Kelompok	(J) Kelompok	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
45	60	-.04227 <sup>*</sup>	.005973	.000	-.05683	-.02770
	75	-.08820 <sup>*</sup>	.005973	.000	-.10277	-.07363
60	45	.04227 <sup>*</sup>	.005973	.000	.02770	.05683
	75	-.04593 <sup>*</sup>	.005973	.000	-.06050	-.03137

75	45	.08820*	.005973	.000	.07363	.10277
	60	.04593*	.005973	.000	.03137	.06050

Based on observed means.

The error term is Mean Square(Error) = ,000.

\*. The mean difference is significant at the ,05 level.

Homogenous  
Seligi

### IKT

Tukey HSD

Kelompok	N	Subset		
		1	2	3
45	15	.44767		
60	15		.48993	
75	15			.53587
Sig.		1.000	1.000	1.000

Kolesterol

### Descriptive Statistics

Dependent Variable:Kolesterol

Umur	Seligi	Mean	Std. Deviation	N
45	0	1.7086E2	6.75300	5
	2	1.5500E2	4.14669	5
	4	1.2828E2	3.93535	5
	6	1.2050E2	1.31719	5
	8	1.1442E2	2.51137	5
	Total		1.3781E2	22.33462
60	0	1.8288E2	1.39893	5
	2	1.7044E2	.81425	5
	4	1.6706E2	.83845	5
	6	1.6256E2	1.49599	5
	8	1.5596E2	1.24619	5
	Total		1.6778E2	9.22244
75	0	2.0880E2	14.11435	5

	2	1.7988E2	7.01548	5
	4	1.6920E2	2.53969	5
	6	1.8226E2	2.31905	5
	8	1.8006E2	.81117	5
	Total	1.8404E2	14.98841	25
Total	0	1.8751E2	18.41334	15
	2	1.6844E2	11.48240	15
	4	1.5485E2	19.63127	15
	6	1.5511E2	26.71248	15
	8	1.5015E2	28.10574	15
	Total	1.6321E2	25.17528	75

### Tests of Between-Subjects Effects

Dependent Variable:Kolesterol

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	45483.355 <sup>a</sup>	14	3248.811	137.522	.000
Intercept	1997829.129	1	1997829.129	8.457E4	.000
Umur	27495.805	2	13747.903	581.948	.000
Seligi	13863.974	4	3465.994	146.715	.000
umur * Seligi	4123.576	8	515.447	21.819	.000
Error	1417.436	60	23.624		
Total	2044729.920	75			
Corrected Total	46900.791	74			

a. R Squared = ,970 (Adjusted R Squared = ,963)

### 1. umur

Dependent Variable:Kolesterol

umur	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
45	137.812	.972	135.868	139.756
60	167.780	.972	165.836	169.724
75	184.040	.972	182.096	185.984

## 2. Seligi

Dependent Variable:Kolesterol

Seligi	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
0	187.513	1.255	185.003	190.024
2	168.440	1.255	165.930	170.950
4	154.847	1.255	152.336	157.357
6	155.107	1.255	152.596	157.617
8	150.147	1.255	147.636	152.657

Seligi

### Multiple Comparisons

Kolesterol

Tukey HSD

(I) Seligi	(J) Seligi	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	2	19.0733*	1.77478	.000	14.0818	24.0648
	4	32.6667*	1.77478	.000	27.6752	37.6582
	6	32.4067*	1.77478	.000	27.4152	37.3982
	8	37.3667*	1.77478	.000	32.3752	42.3582
2	0	-19.0733*	1.77478	.000	-24.0648	-14.0818
	4	13.5933*	1.77478	.000	8.6018	18.5848
	6	13.3333*	1.77478	.000	8.3418	18.3248
	8	18.2933*	1.77478	.000	13.3018	23.2848
4	0	-32.6667*	1.77478	.000	-37.6582	-27.6752
	2	-13.5933*	1.77478	.000	-18.5848	-8.6018
	6	-.2600	1.77478	1.000	-5.2515	4.7315
	8	4.7000	1.77478	.074	-.2915	9.6915
6	0	-32.4067*	1.77478	.000	-37.3982	-27.4152
	2	-13.3333*	1.77478	.000	-18.3248	-8.3418
	4	.2600	1.77478	1.000	-4.7315	5.2515
	8	4.9600	1.77478	.052	-.0315	9.9515
8	0	-37.3667*	1.77478	.000	-42.3582	-32.3752

2	-18.2933*	1.77478	.000	-23.2848	-13.3018
4	-4.7000	1.77478	.074	-9.6915	.2915
6	-4.9600	1.77478	.052	-9.9515	.0315

Based on observed means.

The error term is Mean Square(Error) = 23,624.

\*. The mean difference is significant at the .05 level.

## Homogeneous

### Kolesterol

Tukey HSD

Seligi	N	Subset		
		1	2	3
8	15	1.5015E2		
4	15	1.5485E2		
6	15	1.5511E2		
2	15		1.6844E2	
0	15			1.8751E2
Sig.		.052	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 23,624.

## HDL

### Descriptive Statistics

Dependent Variable:HDL

Umur	Seligi	Mean	Std. Deviation	N
45	0	88.8600	5.08951	5
	2	94.1440	.19450	5
	4	99.7540	1.75065	5
	6	90.4500	3.15030	5
	8	80.9760	.79992	5
	Total		90.8368	6.82219
60	0	87.3980	.84390	5
	2	97.6180	1.25866	5



	4	1.0294E2	1.31298	5
	6	95.6220	1.82653	5
	8	90.6520	1.04342	5
	Total	94.8456	5.65658	25
75	0	88.0240	.70408	5
	2	98.1060	1.36280	5
	4	1.0844E2	1.45963	5
	6	1.0233E2	.79881	5
	8	93.9940	.75029	5
	Total	98.1784	7.18316	25
Total	0	88.0940	2.85137	15
	2	96.6227	2.08037	15
	4	1.0371E2	3.97021	15
	6	96.1340	5.41425	15
	8	88.5407	5.77105	15
	Total	94.6203	7.16497	75

#### Tests of Between-Subjects Effects

Dependent Variable:HDL

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3584.129 <sup>a</sup>	14	256.009	71.511	.000
Intercept	671474.615	1	671474.615	1.876E5	.000
Umur	675.643	2	337.821	94.364	.000
Seligi	2527.169	4	631.792	176.479	.000
umur * Seligi	381.317	8	47.665	13.314	.000
Error	214.799	60	3.580		
Total	675273.543	75			
Corrected Total	3798.928	74			

a. R Squared = ,943 (Adjusted R Squared = ,930)

## Estimated Marginal

### 1. umur

Dependent Variable:HDL

Umur	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
45	90.837	.378	90.080	91.594
60	94.846	.378	94.089	95.603
75	98.178	.378	97.421	98.935

### 2. Seligi

Dependent Variable:HDL

Seligi	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
0	88.094	.489	87.117	89.071
2	96.623	.489	95.645	97.600
4	103.710	.489	102.733	104.687
6	96.134	.489	95.157	97.111
8	88.541	.489	87.563	89.518

### 3. umur \* Seligi

Dependent Variable:HDL

Umur	Seligi	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
45	0	88.860	.846	87.167	90.553
	2	94.144	.846	92.451	95.837
	4	99.754	.846	98.061	101.447
	6	90.450	.846	88.757	92.143
	8	80.976	.846	79.283	82.669
60	0	87.398	.846	85.705	89.091
	2	97.618	.846	95.925	99.311
	4	102.938	.846	101.245	104.631
	6	95.622	.846	93.929	97.315
	8	90.652	.846	88.959	92.345

75	0	88.024	.846	86.331	89.717
	2	98.106	.846	96.413	99.799
	4	108.438	.846	106.745	110.131
	6	102.330	.846	100.637	104.023
	8	93.994	.846	92.301	95.687

Homogeneous

### HDL

Tukey HSD

Umur	N	Subset		
		1	2	3
45	25	90.8368		
60	25		94.8456	
75	25			98.1784
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 3,580.

Seligi

### Multiple Comparisons

HDL

Tukey HSD

(I) Seligi	(J) Seligi	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	2	-8.5287 <sup>*</sup>	.69089	.000	-10.4718	-6.5856
	4	-15.6160 <sup>*</sup>	.69089	.000	-17.5591	-13.6729
	6	-8.0400 <sup>*</sup>	.69089	.000	-9.9831	-6.0969
	8	-.4467	.69089	.967	-2.3898	1.4964
2	0	8.5287 <sup>*</sup>	.69089	.000	6.5856	10.4718
	4	-7.0873 <sup>*</sup>	.69089	.000	-9.0304	-5.1442
	6	.4887	.69089	.954	-1.4544	2.4318
	8	8.0820 <sup>*</sup>	.69089	.000	6.1389	10.0251
4	0	15.6160 <sup>*</sup>	.69089	.000	13.6729	17.5591
	2	7.0873 <sup>*</sup>	.69089	.000	5.1442	9.0304

	6	7.5760 <sup>*</sup>	.69089	.000	5.6329	9.5191
	8	15.1693 <sup>*</sup>	.69089	.000	13.2262	17.1124
6	0	8.0400 <sup>*</sup>	.69089	.000	6.0969	9.9831
	2	-.4887	.69089	.954	-2.4318	1.4544
	4	-7.5760 <sup>*</sup>	.69089	.000	-9.5191	-5.6329
	8	7.5933 <sup>*</sup>	.69089	.000	5.6502	9.5364
8	0	.4467	.69089	.967	-1.4964	2.3898
	2	-8.0820 <sup>*</sup>	.69089	.000	-10.0251	-6.1389
	4	-15.1693 <sup>*</sup>	.69089	.000	-17.1124	-13.2262
	6	-7.5933 <sup>*</sup>	.69089	.000	-9.5364	-5.6502

Based on observed means.

The error term is Mean Square(Error) = 3,580.

\*. The mean difference is significant at the ,05 level.

## Homogeneous

### HDL

Tukey HSD

Seligi	N	Subset		
		1	2	3
0	15	88.0940		
8	15	88.5407		
6	15		96.1340	
2	15		96.6227	
4	15			1.0371E2
Sig.		.967	.954	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 3,580.

## LDL

### Descriptive Statistics

Dependent Variable: LDL

umur	Seligi	Mean	Std. Deviation	N
45	0	49.1160	1.51064	5

	2	42.7700	.50532	5
	4	41.0500	.69390	5
	6	44.5020	1.02341	5
	8	43.1140	1.18143	5
	Total	44.1104	2.94868	25
60	0	58.4860	1.71017	5
	2	54.5680	.89452	5
	4	48.4420	.63373	5
	6	54.3400	1.22556	5
	8	51.3960	1.38580	5
	Total	53.4464	3.61540	25
75	0	62.9780	1.25715	5
	2	56.8160	1.05968	5
	4	45.7940	.47522	5
	6	54.0120	.70194	5
	8	52.6360	1.58552	5
	Total	54.4472	5.80018	25
Total	0	56.8600	6.13750	15
	2	51.3847	6.42507	15
	4	45.0953	3.21493	15
	6	50.9513	4.81361	15
	8	49.0487	4.56161	15
	Total	50.6680	6.31909	75

### Tests of Between-Subjects Effects

Dependent Variable:LDL

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2879.103 <sup>a</sup>	14	205.650	162.812	.000
Intercept	192543.467	1	192543.467	1.524E5	.000
umur	1625.099	2	812.550	643.291	.000
Seligi	1089.174	4	272.294	215.573	.000
umur * Seligi	164.829	8	20.604	16.312	.000
Error	75.787	60	1.263		

Total	195498.356	75		
Corrected Total	2954.889	74		

a. R Squared = ,974 (Adjusted R Squared = ,968)

### 3. umur \* Seligi

Dependent Variable:LDL

umur	Seligi	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
45	0	49.116	.503	48.111	50.121
	2	42.770	.503	41.765	43.775
	4	41.050	.503	40.045	42.055
	6	44.502	.503	43.497	45.507
	8	43.114	.503	42.109	44.119
60	0	58.486	.503	57.481	59.491
	2	54.568	.503	53.563	55.573
	4	48.442	.503	47.437	49.447
	6	54.340	.503	53.335	55.345
	8	51.396	.503	50.391	52.401
75	0	62.978	.503	61.973	63.983
	2	56.816	.503	55.811	57.821
	4	45.794	.503	44.789	46.799
	6	54.012	.503	53.007	55.017
	8	52.636	.503	51.631	53.641

Estimated Marginal

### 1. umur

Dependent Variable:LDL

umur	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
45	44.110	.225	43.661	44.560
60	53.446	.225	52.997	53.896
75	54.447	.225	53.998	54.897

Post Hoc

**LDL**

Tukey HSD

umur	N	Subset		
		1	2	3
45	25	44.1104		
60	25		53.4464	
75	25			54.4472
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 1,263.

**2. Seligi**

Dependent Variable:LDL

Seligi	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
0	56.860	.290	56.280	57.440
2	51.385	.290	50.804	51.965
4	45.095	.290	44.515	45.676
6	50.951	.290	50.371	51.532
8	49.049	.290	48.468	49.629

**LDL**

Tukey HSD

Seligi	N	Subset			
		1	2	3	4
4	15	45.0953			
8	15		49.0487		
6	15			50.9513	
2	15			51.3847	
0	15				56.8600
Sig.		1.000	1.000	.828	1.000

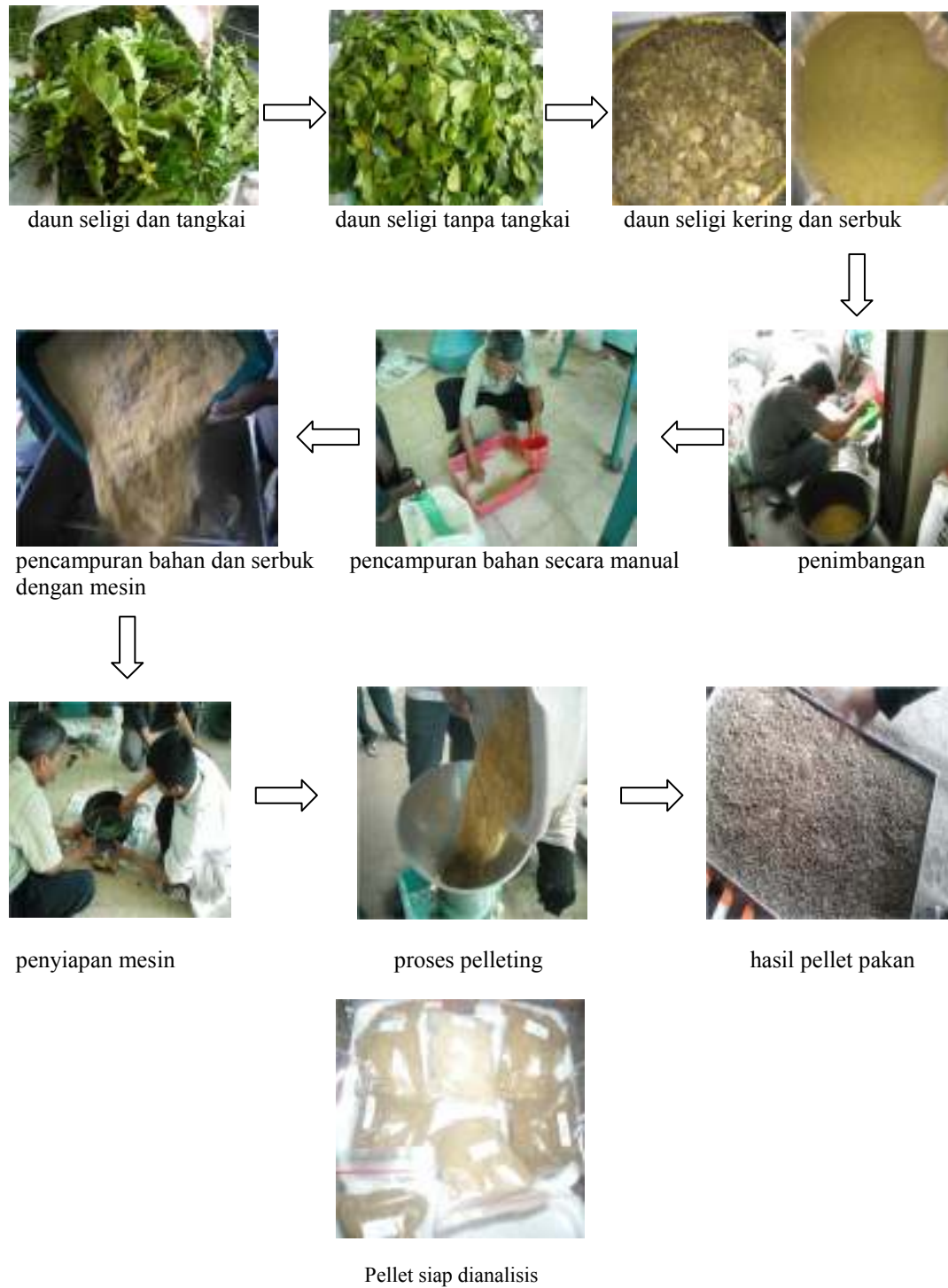
Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 1,263.

## LAMPIRAN 2. PROSES PENELITIAN

### A. Proses pembuatan pellet pakan komersial puyuh yang diberi suplemen serbuk daun seligi dengan takaran yang berbeda





B. Penyiapan kandang, pemeliharaan puyuh dan produksi telur



Sampel telur siap dianalisis

C. Penyiapan ternak untuk analisis imunitas



D. Pengukuran kualitas internal telur



E. Uji ekspresi IL-1 dan kadar iNOS metode ELISA



Pemisahan serum dalam darah



shaker

Elisa reader

Penghitungan IL-1

F. Proses Analisis Kadar Lemak dan Protein Telur Puyuh



Proses analisis kualitas telur puyuh

Judul Buku

# TEKNOLOGI HASIL PERTANIAN



Oleh

**Wardah  
Tatang Sepandi**

## PRAKATA

Puji dan syukur, penulis panjatkan kepada Allah SWT yang telah memberi kesehatan dan kemampuan sehingga Buku Teknologi Hasil Pertanian ini dapat diselesaikan. Buku ini bertujuan untuk memberi pedoman kepada pembaca dalam rangka peningkatan pemahaman tentang teknologi hasil pertanian.

Buku ini terdiri dari 17 bab yang mendeskripsikan dan membahas tentang Peran dan landasan ilmu teknologi hasil pertanian, resiko alami bahan pangan, fisiologi pascapanen, pengawetan pangan dengan suhu rendah (chilling), pembekuan, proses termal, pengeringan, pengeringan beku, fermentasi, bahan kimia tambahan pangan, teknologi pangan semi basah, pikel, iradiasi pangan, pengemasan dan emulsifikasi pangan, serta pangan fungsional. Pemahaman terhadap materi pada buku ini penting untuk mencapai kompetensi dasar dan penunjang teknologi hasil pertanian.

Pada kesempatan ini, penulis mengucapkan terima kasih kepada semua pihak yang telah memberi doa dan dorongan semangat sehingga penulis dapat menyelesaikan buku ini. Kekurangan dan kelemahan buku ini tentu dapat ditemui baik dari segi materi maupun cara penulisannya. Oleh karena itu, penulis berharap kritik dan saran sehingga buku ini dapat diperbaiki sebagaimana mestinya.

Surabaya, November 2015

Penulis

## DAFTAR ISI

	Halaman
PRAKATA .....	i
DAFTAR ISI .....	ii
DAFTAR TABEL .....	iii
DAFTAR GAMBAR .....	iv
BAB1 PENDAHULUAN .....	1
BAB 2 RESIKO ALAMI BAHAN PANGAN .....	8
BAB 3 FISILOGI PASCA PANEN .....	17
BAB 4 TEKNOLOGI HASIL PERTANIAN PADA SUHU DINGIN .....	29
BAB 5 TEKNOLOGI PEMBEKUAN .....	41
BAB 6 PROSES TERMAL .....	57
BAB 7 TEKNOLOGI PENGERINGAN .....	81
BAB 8 TEKNOLOGI PENGERINGAN BEKU .....	98
BAB 9 FERMENTASI PANGAN .....	108
BAB 10 TEKNOLOGI PENGOLAHAN PANGAN SEMI BASAH ..	125
BAB 11 TEKNOLOGI PIKEL .....	134
BAB 12 TEKNOLOGI PENGAWETAN DAN PENGOLHAN PANGAN DENGAN BAHAN KIMIA .....	141
BAB 13 IRADIASI PANGAN .....	161
BAB 14 PENGEMASAN PANGAN .....	170
BAB 15 EMULSIFIKASI PANGAN.....	180
BAB 16 PANGAN FUNGSIONAL .....	201
BAB17 PRODUK OLAHAN PANGAN .....	231
DAFTAR PUSTAKA .....	

## DAFTAR TABEL

No	Tabel	halaman
1	Contoh buah klimaterik dan non klimaterik .....	13
2	Kecepatan respirasi produk hasil pertanian .....	14
3	Kemampuan pendinginan garam pada beberapa konsentrasi .....	21
4	Kerusakan bahan pangan pada penyimpanan dingin .....	24
5	Lama simpan beberapa jenis komoditi hasil pertanian pada penyimpanan dingin .....	25
6	Titik beku beberapa jenis bahan pangan .....	29
7	Laju letal pada berbagai suhu pemanasan .....	42
8	Laju letal pada proses pemanasan suhu konstan .....	42
9	Laju letalitas pada waktu dan suhu pemanasan produk dalam kontainer .....	43
10	Temperatur kolap untuk beberapa jenis pangan beku .....	63
11	Jenis vitamin yang hilang selama pembekuan pada pangan .....	64



## DAFTAR GAMBAR

No	Gambar	halaman
1	Landasan pengembangan teknologi hasil pertanian .....	2
2	Waktu tenggang dan resiko alami bahan pangan .....	5
3	Laju respirasi klimaterik dan non klimaterik pada buah dan sayuran	12
4	Perubahan pati menjadi gula selama pematangan .....	14
5	Perubahan pectin menjadi asam galakturonat selama pematangan .....	15
6	Perubahan pati menjadi asam organic .....	15
7	Perubahan klorofil menjadi klorin dan purpurin .....	16
8	Kurva pembekuan es pada bahan pangan .....	28
9	Berat jenis air dan es .....	30
10	Kurva pembekuan pangan .....	30
11	Pembentukan Kristal es pada pembekuan pangan .....	32
12	Kurva pembekuan cepat dan lambat pada bahan pangan .....	33
13	Kurva laju letal berdasarkan waktu .....	44
14	Kurva kematian bakteri secara logaritmik pada suhu T <sup>o</sup> F	49
15	Kurva TDT .....	49
16	Kurva kadar air bahan pangan .....	53
17	Konsentrasi solute pada berbagai suhu dalam system campuran .....	54
18	Perpindahan energi dan massa pada proses pengeringan pangan .....	54
19	Ilustrasi pengeringan langsung dan tidak langsung .....	56
20	Ilustrasi berbagai tipe pengering .....	57
21	Diagram hubungan tekanan dengan suhu terhadap perubahan bentuk bahan pangan .....	60
22	Diagram transfer massa dan panas pada pengeringan beku .....	61
23	Struktur porus pangan yang dikering bekuan .....	62
24	Penurunan konsentrasi solute selama pembekuan .....	64
25	Peralatan pengeringan beku .....	65
26	Jalur metabolisme mikroorganisme .....	73
27	Kurva kadar air dan aktivitas air .....	76
28	Jenis mikroba, aktivitas air minimal dan kurva aktivitas air .....	77
29	Proses emulsifikasi .....	109

## LAMPIRAN 4. TEKNOLOGI TEPAT GUNA (BOOKLET) UNTUK PENGABDIAN MASYARAKAT

### PETUNJUK PRAKTIS (BOOKLET) FORMULASI DAN PEMBUATAN PAKAN PUYUH

Oleh :

Dr. Ir. Wardah., MP., MM

Dr. Ir. Tatang Sopandi., MP

UNIVERSITAS 17 AGUSTUS 1945  
SURABAYA  
2015

Keberhasilan usaha peternakan

1. Breeding (bibit)
2. Feeding (pemberian pakan)
3. Manajemen (tata laksana pemeliharaan)

Biaya pakan sebesar 75% dari biaya produksi



1

2

Pakan adalah bahan organik dan inorganik yang diberikan kepada ternak yang sebagian atau keseluruhan dapat dicerna tanpa mengganggu kesehatan ternak



3

### Pembagian Bahan Pakan Ternak

1. Pakan kasar : pakan yang banyak mengandung serat kasar (lebih dari 8%) dan rendah kandungan energi. contoh: jerami padi, jerami jagung, pucuk tebu dan hijauan lain
2. Hijuan segar : rumput dan hijauan lain yang baru dipotong atau tersedia di padang rumput
3. Silase: hijauan yang sengaja diawetkan melalui proses fermentasi



4

4. Pakan sumber energi : pakan yang mengandung energi lebih dari 250 kkal/kg contoh: biji-bijian (jagung, cantel, kedele, kacang dll), umbian (ketela pohon, ketela rambat, kentang dll), minyak (kelapa, sawit, kedele dll), lemak hewan, hasil ikutan (limbah) industri pertanian (bekatul, dedak, pollard, tetes dll)



5

5. Sumber protein: bahan pakan yang mengandung protein lebih dari 20%. contoh: tepung ikan, tepung darah, kacang-kacangan/legum (kedele, kacang tanah, turi, gamal dll), bungkil (bungkil kelapa, sawit, kedele, jagung dll)

6. Sumber mineral : tepung tulang, kapur, garam, dll



6

7. Sumber vitamin : buah-buahan, tauge, kacang –kacangan dan wortel
8. Bahan aditif: bahan yang ditambahkan ke dalam pakan dalam jumlah sedikit, contoh: penambah aroma, rasa, meningkatkan immunitas



7

## PERTIMBANGAN PEMILIHAN BAHAN BAKU PAKAN

1. Nutrisi : pakan harus mengandung nutrisi yang sesuai dengan kebutuhan pakan
2. Ketersediaan dan penggunaannya tidak bersaing dengan manusia sehingga mudah didapat
3. Harganya murah
4. Tidak mengandung racun atau zat antinutrisi

8

## NUTRISI PAKAN

1. Air ; sebagai pelarut dan pengangkut nutrisi, membantu proses pencernaan, metabolisme, kelancaran kerja syaraf dan pancaindra dan sebagai pelincin
2. Mineral ; memelihara keseimbangan asam basa tubuh, kepekaan syaraf, mengatur permeabilitas membran dan transpor serta sebagai koenzim
3. Protein
4. Lemak
5. Karbohidrat, dan
6. Vitamin

9

## PROSESING PAKAN

- Pemotongan (chopping)
- Pengeringan (drying)
- Penggilingan (grinding)
- Perendaman (soaking)
- Pemasakan (cooking)
- Pembuatan pelet (pelleting)
- Crumbling (pembuatan butiran)
- Pembuatan silase (ensiling)



10

## EVALUASI MUTU PAKAN

1. Fisik/visual
2. Mikroskopis
3. Kimia



11

## FORMULASI PAKAN

1. [Lihat tabel kebutuhan nutrisi pakan sesuai tujuan beternak](#)
2. Lihat tabel komposisi zat (nutrisi) bahan baku
3. Pertimbangan faktor pembatas
4. Pertimbangan harga
5. Susun ransum



12

### Kebutuhan nutrisi puyuh

Kebutuhan nutrisi	Starter	Grower	Layer
Kadar air maks. (%)	14,0	14,0	14,0
Protein kasar maks. (%)	19,0	17,0	17,0
Lipid kasar maks. (%)	7,0	7,0	7,0
Serat kasar maks. (%)	6,5	7,0	7,0
Absorbas. (%)	5	8,0	14,0
Kalsium (Ca) (%)	0,90-1,20	0,90-1,20	2,70-3,70
Fosfor total (P) (%)	0,60-1,00	0,60-1,00	0,60-1,00
Fosfor tersedia (P) maks. (%)	0,40	0,40	0,40
Energi metabolisabel (ME) (Kkal/kg)	2.800	2.600	2.700
Total alkaloidin maks. (pp/kg)	40,0	40,0	40,0
Asam amino			
- Lysin maks. (%)	1,10	0,80	0,80
- Metionin maks. (%)	0,40	0,35	0,40
- Metionin + sistin min. (%)	0,60	0,50	0,60

Sumber : SNI (2006)

13

Bahan-bahan	ME	PK	Ca	P	SK	LS
Jagung	3400	9,6	0,02	0,27	3,5	2,4
Delek	1225	11,5	0,07	1,4	15,5	7
Bekatul	2500	14	0,05	1,48	6	12,4
Bungkil kedelai	2300	48	0,22	0,67	6	0,9
Tepung darah	1098	89,3	0,1	0,22	0,6	1,3
tepung daging-saling	1985	30	7	4	2,5	10
3-Sarati sawit	9000	9	9	6	9	8
Tepung ikan	2500	62	5	3	1	5
<b>Kebutuhan nutrisi standar</b>	<b>2900</b>	<b>24,5</b>	<b>1</b>	<b>0,48</b>	<b>3,5</b>	<b>2,5</b>

14

### Formula Pakan Puyuh -I Hasil perhitungan metode trial and error

Bahan pakan	%	ME	PK	Ca	P	SK	LS
Jagung	45	2350	3,87	0,009	5	1,575	1,09
Delek	22	1225	3,03	0,007	0,24	1,39	0,7
Bekatul	15	375	2,1	0,0035	0,22	0,9	1,86
Bungkil kedelai	11	253	7,2	0,048	5	0,9	0,133
tepung darah	3	104,8	4,463	0,003	0,016	0,03	0,063
Tepung daging-saling	5	99,25	2,5	0,23	0,2	0,125	0,5
Minyak sawit	2	172	0	0	0	0	0
Tepung ikan	8	165	1,86	0,13	0,08	0,05	0,25
<b>Total</b>	<b>100</b>	<b>2012,55</b>	<b>23,145</b>	<b>0,1763</b>	<b>0,88</b>	<b>3,11</b>	<b>4,40</b>
<b>Kebutuhan nutrisi standar</b>		<b>2900</b>	<b>24,5</b>	<b>1</b>	<b>0,48</b>	<b>3,5</b>	<b>2,5</b>

15

### Perhitungan biaya yang dikeluarkan untuk membuat 50 kg ransum

Bahan Pakan	Jumlah	Perkiraan Biaya	Biaya per kg	Jumlah
Jagung	7	1,2	Rp 12000	Rp 12000
Delek	10	1,2	Rp 12000	Rp 12000
Delek Dried	7	1,2	Rp 12000	Rp 12000
Delek-Pel	10	1	Rp 10000	Rp 10000
Ikan	10	10,2	Rp 10000	Rp 41000
Biji Kacang	10	7,2	Rp 70000	Rp 11000
Tepung Daging Saling	5	1,2	Rp 10000	Rp 12000
Minyak	2	1	Rp 10000	Rp 10000
<b>Total</b>	<b>68</b>	<b>36</b>		<b>Rp 127.000</b>

16

### FORMULA PAKAN PUYUH (Grower)

Bahan pakan	%	ME	PK	Ca	P	SK	LS
Jagung	36,82	1244,40	3,15	0,01	0,13	1,28	0,88
Bongkum	8,71	217,75	3,67	0,06	0,01	0,13	0,90
Bekatul	24,25	606,25	3,42	0,01	0,38	1,46	3,01
Tepung Bapek	2,29	85,70	0,04	0,01	0,03	0,04	0,03
Tepung daun pepaya	4,33	35,89	0,16	0,18	0,01	0,01	0,09
Bungkil kedelai	8,33	228,75	4,39	0,03	0,06	0,55	0,08
Tepung daging bekatul	16,32	313,96	3,04	1,06	0,14	0,41	0,60
<b>Total</b>	<b>100,00</b>	<b>2932,75</b>	<b>17,05</b>	<b>1,27</b>	<b>0,70</b>	<b>3,87</b>	<b>4,89</b>

17

### FORMULA PAKAN PUYUH (Starter-2)

Bahan pakan	%	ME	PK	Ca	P	SK	LS
Jagung	50,00	1700,00	4,30	0,01	0,14	1,75	1,20
Delek/pasir	13,00	389,00	1,95	0,02	0,04	1,50	0,05
Bungkil kedelai	12,00	300,00	5,76	0,04	0,08	0,72	0,11
Tepung ikan	10,00	190,00	4,20	0,50	0,10	0,10	0,50
Bungkil kelapa	7,00	154,04	1,50	0,01	0,04	1,08	0,88
Tepung biji kapas	3,00	205,00	2,05	0,01	0,01	0,80	0,24
Minyak kelapa sawit	3,00	258,00	0,30	0,00	0,00	0,00	0,00
<b>Jumlah</b>	<b>100,00</b>	<b>3096,04</b>	<b>21,56</b>	<b>0,39</b>	<b>0,62</b>	<b>5,35</b>	<b>2,98</b>

18

### FORMULA PAKAN PUYUH (Layer)

Bahan pakan	%	ME	PK	Ca	P	SK	LE	
Jagung	50,00	1700,00	4,30	0,01		0,14	1,75	1,20
Dedek/palard	8,00	98,00	0,91	0,01		0,11	1,24	0,09
Bungkil kelapa	0,40	207,93	1,75	0,02		0,06	1,45	1,18
Bungkil kedelai	17,60	440,00	8,45	0,08		0,12	1,06	0,16
Keong mas	10,00	192,00	1,61	0,91		0,23	0,08	0,04
Minyak kelapa sawit	3,00	258,00	0,00	0,00		0,00	0,00	0,00
Premix	2,00	0,00	0,00	2,00		1,00	0,00	0,00
Jumlah	100,00	2895,93	17,02	3,01		1,66	3,55	2,66