

# Performance of Growth Parameters

Characteristic	T0, N = 4	T25, N = 4	T50, N = 4	T75, N = 4	T100, N = 4	p-value
Initial_Length	12.91 ± 0.04	12.85 ± 0.07	12.88 ± 0.09	12.84 ± 0.03	12.82 ± 0.07	0.4
Initial_Weight	35.88 ± 0.33	35.64 ± 0.73	35.61 ± 0.59	36.20 ± 0.36	35.58 ± 1.47	0.8
Final_Length	16.51 ± 0.21	16.72 ± 0.27	17.05 ± 0.16	17.75 ± 0.17	16.79 ± 0.34	<0.001
Final_Weight	79.9 ± 3.1	83.8 ± 3.0	87.5 ± 2.7	97.9 ± 1.2	84.2 ± 4.4	<0.001
Feed	10,049 ± 293	9,992 ± 210	9,847 ± 371	10,262 ± 1,060	9,952 ± 595	0.9
Weight_gain	44.0 ± 3.3	48.1 ± 3.1	51.9 ± 2.3	61.7 ± 1.6	48.6 ± 4.6	<0.001
Length_gain	3.61 ± 0.22	3.88 ± 0.29	4.17 ± 0.16	4.91 ± 0.18	3.96 ± 0.32	<0.001
PWG	123 ± 10	135 ± 10	146 ± 6	170 ± 6	137 ± 15	<0.001
DWG	0.26 ± 0.02	0.29 ± 0.02	0.31 ± 0.01	0.37 ± 0.01	0.29 ± 0.03	<0.001
SGR	0.207 ± 0.012	0.221 ± 0.011	0.232 ± 0.006	0.257 ± 0.006	0.222 ± 0.017	<0.001
FCR	0.229 ± 0.012	0.208 ± 0.015	0.190 ± 0.015	0.166 ± 0.017	0.205 ± 0.011	<0.001

## Post Hoc Analysis

Call:

```
aov(formula = Initial_Length ~ TREATMENT, data = Feed)
```

Terms:

```

                TREATMENT  Residuals
Sum of Squares  0.01780222  0.05974167

```

Deg. of Freedom                      4                      15

Residual standard error: 0.06310925

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	0.01780	0.004451	1.117	0.385
Residuals	15	0.05974	0.003983		

Call:

```
aov(formula = Final_Length ~ TREATMENT, data = Feed)
```

Terms:

	TREATMENT	Residuals
Sum of Squares	3.668829	0.859259
Deg. of Freedom	4	15

Residual standard error: 0.2393406

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	3.669	0.9172	16.01	2.73e-05 ***
Residuals	15	0.859	0.0573		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
aov(formula = Length_gain ~ TREATMENT, data = Feed)
```

Terms:

	TREATMENT	Residuals
Sum of Squares	3.888150	0.885601
Deg. of Freedom	4	15

Residual standard error: 0.2429816

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	3.888	0.972	16.46	2.32e-05 ***
Residuals	15	0.886	0.059		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Tukey multiple comparisons of means  
95% family-wise confidence level

Fit: aov(formula = Length\_gain ~ TREATMENT, data = Feed)

\$TREATMENT

	diff	lwr	upr	p adj
T100-T0	0.35360244	-0.1769461	0.8841510	0.2871555
T25-T0	0.26818783	-0.2623607	0.7987364	0.5420173
T50-T0	0.55777574	0.0272272	1.0883243	0.0371371
T75-T0	1.30224469	0.7716961	1.8327932	0.0000143
T25-T100	-0.08541461	-0.6159632	0.4451339	0.9864088
T50-T100	0.20417330	-0.3263752	0.7347218	0.7577715
T75-T100	0.94864224	0.4180937	1.4791908	0.0004821
T50-T25	0.28958791	-0.2409606	0.8201365	0.4708056
T75-T25	1.03405686	0.5035083	1.5646054	0.0001965
T75-T50	0.74446894	0.2139204	1.2750175	0.0045635

Call:

aov(formula = Weight\_gain ~ TREATMENT, data = Feed)

Terms:

	TREATMENT	Residuals
Sum of Squares	707.6206	149.6208
Deg. of Freedom	4	15

Residual standard error: 3.158278

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	707.6	176.91	17.73	1.48e-05 ***
Residuals	15	149.6	9.97		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Tukey multiple comparisons of means  
95% family-wise confidence level

Fit: aov(formula = Weight\_gain ~ TREATMENT, data = Feed)

\$TREATMENT

diff	lwr	upr	p adj
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T100-T0	4.5474343	-2.3486422	11.443511	0.2963818
T25-T0	4.1017857	-2.7942908	10.997862	0.3900003
T50-T0	7.8435440	0.9474674	14.739620	0.0223704
T75-T0	17.6270320	10.7309555	24.523109	0.0000088
T25-T100	-0.4456486	-7.3417251	6.450428	0.9996023
T50-T100	3.2961096	-3.5999669	10.192186	0.5919838
T75-T100	13.0795977	6.1835212	19.975674	0.0002622
T50-T25	3.7417582	-3.1543183	10.637835	0.4763879
T75-T25	13.5252463	6.6291698	20.421323	0.0001837
T75-T50	9.7834881	2.8874115	16.679565	0.0041602

Call:

```
aov(formula = PWG ~ TREATMENT, data = Feed)
```

Terms:

	TREATMENT	Residuals
Sum of Squares	5046.872	1534.578
Deg. of Freedom	4	15

Residual standard error: 10.1146

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	5047	1261.7	12.33	0.000122 ***
Residuals	15	1535	102.3		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Tukey multiple comparisons of means

95% family-wise confidence level

```
Fit: aov(formula = PWG ~ TREATMENT, data = Feed)
```

\$TREATMENT

	diff	lwr	upr	p adj
T100-T0	14.020483	-8.064677	36.10564	0.3300806
T25-T0	12.350963	-9.734197	34.43612	0.4479505
T50-T0	22.889471	0.804311	44.97463	0.0405043
T75-T0	47.587905	25.502745	69.67307	0.0000652
T25-T100	-1.669520	-23.754680	20.41564	0.9992617
T50-T100	8.868988	-13.216172	30.95415	0.7292869
T75-T100	33.567422	11.482262	55.65258	0.0022804

T50-T25	10.538508	-11.546652	32.62367	0.5934308
T75-T25	35.236942	13.151782	57.32210	0.0014618
T75-T50	24.698434	2.613274	46.78359	0.0250455

Call:

```
aov(formula = DWG ~ TREATMENT, data = Feed)
```

Terms:

	TREATMENT	Residuals
Sum of Squares	0.025071591	0.005301191
Deg. of Freedom	4	15

Residual standard error: 0.01879928

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	0.025072	0.006268	17.73	1.48e-05 ***
Residuals	15	0.005301	0.000353		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Tukey multiple comparisons of means

95% family-wise confidence level

Fit: aov(formula = DWG ~ TREATMENT, data = Feed)

\$TREATMENT

	diff	lwr	upr	p adj
T100-T0	0.02706806	-0.013980013	0.06811614	0.2963818
T25-T0	0.02441539	-0.016632683	0.06546347	0.3900003
T50-T0	0.04668776	0.005639687	0.08773584	0.0223704
T75-T0	0.10492281	0.063874735	0.14597088	0.0000088
T25-T100	-0.00265267	-0.043700745	0.03839540	0.9996023
T50-T100	0.01961970	-0.021428374	0.06066777	0.5919838
T75-T100	0.07785475	0.036806674	0.11890282	0.0002622
T50-T25	0.02227237	-0.018775704	0.06332045	0.4763879
T75-T25	0.08050742	0.039459344	0.12155549	0.0001837
T75-T50	0.05823505	0.017186973	0.09928312	0.0041602

Call:

```
aov(formula = SGR ~ TREATMENT, data = Feed)
```

Terms:

	TREATMENT	Residuals
Sum of Squares	0.005566727	0.001821691
Deg. of Freedom	4	15

Residual standard error: 0.01102026

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	0.005567	0.0013917	11.46	0.000183 ***
Residuals	15	0.001822	0.0001214		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Tukey multiple comparisons of means  
95% family-wise confidence level

Fit: aov(formula = SGR ~ TREATMENT, data = Feed)

\$TREATMENT

	diff	lwr	upr	p adj
T100-T0	0.015566102	-0.0084965439	0.03962875	0.3132447
T25-T0	0.013967304	-0.0100953415	0.03802995	0.4128836
T50-T0	0.025422944	0.0013602984	0.04948559	0.0360237
T75-T0	0.050191397	0.0261287519	0.07425404	0.0000938
T25-T100	-0.001598798	-0.0256614431	0.02246385	0.9995561
T50-T100	0.009856842	-0.0142058031	0.03391949	0.7152847
T75-T100	0.034625296	0.0105626503	0.05868794	0.0036868
T50-T25	0.011455640	-0.0126070055	0.03551829	0.5954393
T75-T25	0.036224093	0.0121614479	0.06028674	0.0024846
T75-T50	0.024768453	0.0007058079	0.04883110	0.0422061

Call:

aov(formula = FCR ~ TREATMENT, data = Feed)

Terms:

	TREATMENT	Residuals
Sum of Squares	0.008613801	0.003060359
Deg. of Freedom	4	15

Residual standard error: 0.01428369

Estimated effects may be unbalanced

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TREATMENT	4	0.008614	0.002154	10.55	0.000285 ***
Residuals	15	0.003060	0.000204		

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Tukey multiple comparisons of means  
95% family-wise confidence level

Fit: aov(formula = FCR ~ TREATMENT, data = Feed)

\$TREATMENT

	diff	lwr	upr	p adj
T100-T0	-0.02342350	-0.05461184	0.007764836	0.1923973
T25-T0	-0.02059669	-0.05178503	0.010591645	0.2950973
T50-T0	-0.03855313	-0.06974147	-0.007364797	0.0124131
T75-T0	-0.06245856	-0.09364690	-0.031270223	0.0001467
T25-T100	0.00282681	-0.02836153	0.034015147	0.9984953
T50-T100	-0.01512963	-0.04631797	0.016058705	0.5789709
T75-T100	-0.03903506	-0.07022340	-0.007846721	0.0113159
T50-T25	-0.01795644	-0.04914478	0.013231895	0.4205538
T75-T25	-0.04186187	-0.07305021	-0.010673531	0.0065729
T75-T50	-0.02390543	-0.05509376	0.007282911	0.1781173