One-way Analysis of Variance (ANOVA)

The P value is < 0.0001, considered extremely significant.
Variation among column means is significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
wt wt vs het wt	-146.45	11.976	*** P<0.001
wt wt vs het KO	-121.02	10.395	*** P<0.001
wt wt vs wt KO	-1.445	0.1271	ns P>0.05
wt KO vs het wt	-145.00	11.937	*** P<0.001
wt KO vs het KO	-119.58	10.347	*** P<0.001
het KO vs het wt	-25.427	2.050	ns P>0.05

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 38.404
The P value is < 0.0001.
Bartlett's test suggests that the differences among the SDs is extremely significant.
Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.1298	>0.10	Yes
wt KO	0.3003	<0.0001	No
het wt	0.1597	0.0994	Yes
het KO	0.1880	0.0083	No

At least one column failed the normality test with P<0.05.
Consider using a nonparametric test or transforming the data

(i.e. converting to logarithms or reciprocals).

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	3	526720	175573
Residuals (within columns)	116	486902	4197.4
Total	119	1013622	

F = 41.829 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	32	128.31	26.087	4.612	124.50
wt KO	33	129.76	56.855	9.897	120.00
het wt	25	274.76	84.881	16.976	250.00
het KO	30	249.33	80.826	14.757	222.50

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	94.000	186.00	118.91	137.72
wt KO	41.000	414.00	109.59	149.93
het wt	168.00	464.00	239.72	309.80
het KO	134.00	459.00	219.16	279.51

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One-way Analysis of Variance (ANOVA)

The P value is < 0.0001, considered extremely significant.
Variation among column means is significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
wt KO vs het wt	-104.62	9.640	*** P<0.001
wt KO vs wt wt	-16.008	1.967	ns P>0.05
wt KO vs het KO	-6.777	---	ns P>0.05
het KO vs het wt	-97.846	10.200	*** P<0.001
het KO vs wt wt	-9.231	---	ns P>0.05
wt wt vs het wt	-88.616	9.058	*** P<0.001

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett's test can only be performed when every column has at least five values.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.2948	0.0139	No
wt KO	0.4486	0.0014	No
het wt	Too few values to test.		
het KO	0.2627	0.0218	No

At least one column failed the normality test with P<0.05.
Consider using a nonparametric test or transforming the data (i.e. converting to logarithms or reciprocals).

Intermediate calculations. ANOVA table

Source of	Degrees of	Sum of	Mean

variation	freedom	squares	square
Treatments (between columns)	3	25674	8558.1
Residuals (within columns)	26	11485	441.73
Total	29	37159	

F = 19.374 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	10	27.661	27.123	8.577	17.803
wt KO	5	11.653	10.568	4.726	7.303
het wt	3	116.28	36.031	20.802	121.70
het KO	12	18.431	12.866	3.714	12.080

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	3.767	89.936	8.260	47.063
wt KO	6.157	30.530	-1.466	24.773
het wt	77.843	149.29	26.764	205.79
het KO	6.454	42.297	10.256	26.605

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One-way Analysis of Variance (ANOVA)

The P value is 0.6955, considered not significant.
Variation among column means is not significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
het KO vs wt wt	-4.520	1.548	ns P>0.05
het KO vs wt ko	-2.851	---	ns P>0.05
het KO vs het wt	-0.9832	---	ns P>0.05
het wt vs wt wt	-3.537	---	ns P>0.05
het wt vs wt ko	-1.867	---	ns P>0.05
wt ko vs wt wt	-1.670	---	ns P>0.05

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 5.141
The P value is 0.1617.
Bartlett's test suggests that the differences among the SDs is not significant.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.2498	0.0535	Yes
wt ko	0.2713	0.0550	Yes
het wt	0.1605	>0.10	Yes
het KO	0.2255	>0.10	Yes

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square

Treatments (between columns)	3	129.72	43.239
Residuals (within columns)	39	3486.0	89.385
Total	42	3615.7	

F = 0.4837 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	11	52.846	13.286	4.006	52.800
wt ko	9	51.177	7.195	2.398	49.140
het wt	13	49.309	8.333	2.311	48.830
het KO	10	48.326	7.253	2.294	49.325

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	34.530	85.240	43.921	61.771
wt ko	43.680	68.340	45.646	56.707
het wt	32.110	59.140	44.273	54.345
het KO	34.170	60.340	43.138	53.514

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One-way Analysis of Variance (ANOVA)

The P value is < 0.0001, considered extremely significant.
Variation among column means is significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
wt ko vs het wt	-81.853	7.942	*** P<0.001
wt ko vs het KO	-19.016	1.741	ns P>0.05
wt ko vs wt wt	-14.081	---	ns P>0.05
wt wt vs het wt	-67.772	6.961	*** P<0.001
wt wt vs het KO	-4.935	---	ns P>0.05
het KO vs het wt	-62.837	6.286	*** P<0.001

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 15.233
The P value is 0.0016.
Bartlett's test suggests that the differences among the SDs is very significant.
Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.1274	>0.10	Yes
wt ko	0.2352	>0.10	Yes
het wt	0.1772	>0.10	Yes
het KO	0.2023	>0.10	Yes

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	3	46717	15572
Residuals (within columns)	39	44058	1129.7
Total	42	90776	

F = 13.785 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	11	88.499	15.576	4.696	87.670
wt ko	9	74.418	24.587	8.196	64.330
het wt	13	156.27	51.084	14.168	138.13
het KO	10	93.434	24.677	7.803	87.490

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	61.000	111.50	78.035	98.963
wt ko	46.570	116.50	55.519	93.317
het wt	97.250	253.75	125.40	187.14
het KO	60.570	132.10	75.783	111.09

* * *

One-way Analysis of Variance (ANOVA)

The P value is 0.0014, considered very significant.
Variation among column means is significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
het wt vs wt ko	-5.012	5.917	*** P<0.001
het wt vs wt wt	-3.265	4.080	* P<0.05
het wt vs het KO	-2.413	2.936	* P<0.05
het KO vs wt ko	-2.599	2.896	ns P>0.05
het KO vs wt wt	-0.8523	---	ns P>0.05
wt wt vs wt ko	-1.747	---	ns P>0.05

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 6.228
The P value is 0.1010.
Bartlett's test suggests that the differences among the SDs is not significant.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.2286	>0.10	Yes
wt ko	0.2069	>0.10	Yes
het wt	0.1427	>0.10	Yes
het KO	0.2125	>0.10	Yes

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square

Treatments (between columns)	3	144.43	48.144
Residuals (within columns)	39	297.61	7.631
Total	42	442.05	

F = 6.309 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	11	9.267	2.750	0.8292	8.720
wt ko	9	11.014	4.099	1.366	9.680
het wt	13	6.002	2.092	0.5801	5.930
het KO	10	8.415	1.974	0.6242	8.075

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	5.530	16.050	7.420	11.115
wt ko	6.510	17.340	7.864	14.165
het wt	2.920	9.390	4.738	7.266
het KO	5.930	13.080	7.003	9.827

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One-way Analysis of Variance (ANOVA)

The P value is 0.0331, considered significant.
Variation among column means is significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q		P value
wt wt vs Het wt	-42.389	4.127	*	P<0.05
wt wt vs het ko	-27.500	2.514	ns	P>0.05
wt wt vs wt ko	-10.389	---	ns	P>0.05
wt ko vs Het wt	-32.000	3.211	ns	P>0.05
wt ko vs het ko	-17.111	---	ns	P>0.05
het ko vs Het wt	-14.889	---	ns	P>0.05

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 26.696
The P value is < 0.0001.
Bartlett's test suggests that the differences among the SDs is extremely significant.
Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.5132	<0.0001	No
wt ko	0.3242	0.0070	No
Het wt	0.2031	>0.10	Yes
het ko	0.2465	>0.10	Yes

At least one column failed the normality test with P<0.05.
Consider using a nonparametric test or transforming the data

(i.e. converting to logarithms or reciprocals).

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	3	8934.8	2978.3
Residuals (within columns)	29	25914	893.58
Total	32	34849	

F = 3.333 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	8	1.500	4.243	1.500	0.000
wt ko	9	11.889	16.190	5.397	0.000
Het wt	9	43.889	42.557	14.186	35.000
het ko	7	29.000	39.162	14.802	15.000

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	0.000	12.000	-2.048	5.048
wt ko	0.000	40.000	-0.5557	24.333
Het wt	0.000	112.00	11.177	76.601
het ko	0.000	108.00	-7.220	65.220

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One-way Analysis of Variance (ANOVA)

The P value is < 0.0001, considered extremely significant.
Variation among column means is significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
wt Ko vs het wt	-109.44	8.927	*** P<0.001
wt Ko vs het KO	-35.095	2.678	ns P>0.05
wt Ko vs wt wt	-4.667	---	ns P>0.05
wt wt vs het wt	-104.78	8.291	*** P<0.001
wt wt vs het KO	-30.429	---	ns P>0.05
het KO vs het wt	-74.349	5.673	*** P<0.001

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 12.826
The P value is 0.0050.
Bartlett's test suggests that the differences among the SDs is very significant.
Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.1852	>0.10	Yes
wt Ko	0.1554	>0.10	Yes
het wt	0.2090	>0.10	Yes
het KO	0.2768	>0.10	Yes

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	3	67877	22626
Residuals (within columns)	29	39229	1352.7
Total	32	107106	

F = 16.726 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	8	91.000	12.259	4.334	90.500
wt Ko	9	86.333	27.436	9.145	84.000
het wt	9	195.78	39.701	13.234	205.00
het KO	7	121.43	57.076	21.573	118.00

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	76.000	112.00	80.750	101.25
wt Ko	47.000	129.00	65.244	107.42
het wt	138.00	252.00	165.26	226.29
het KO	61.000	236.00	68.641	174.22

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One-way Analysis of Variance (ANOVA)

The P value is 0.0893, considered not quite significant.
Variation among column means is not significantly greater than expected by chance.

Student-Newman-Keuls Multiple Comparisons Test

Comparison	Mean Difference	q	P value
het wt vs wt wt	-20.323	3.631	ns P>0.05
het wt vs wt Ko	-10.177	---	ns P>0.05
het wt vs het KO	-4.566	---	ns P>0.05
het KO vs wt wt	-15.757	---	ns P>0.05
het KO vs wt Ko	-5.612	---	ns P>0.05
wt Ko vs wt wt	-10.145	---	ns P>0.05

With Student-Newman-Keuls test, it is impossible to calculate confidence intervals.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 11.263
The P value is 0.0104.
Bartlett's test suggests that the differences among the SDs is significant.
Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
wt wt	0.5132	<0.0001	No
wt Ko	0.3224	0.0076	No
het wt	0.2103	>0.10	Yes
het KO	0.2531	>0.10	Yes

At least one column failed the normality test with P<0.05.
Consider using a nonparametric test or transforming the data

(i.e. converting to logarithms or reciprocals).

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	3	1901.2	633.73
Residuals (within columns)	29	7696.2	265.38
Total	32	9597.3	

F = 2.388 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
wt wt	8	98.305	4.794	1.695	100.00
wt Ko	9	88.160	16.255	5.418	100.00
het wt	9	77.982	20.377	6.792	86.097
het KO	7	82.548	18.706	7.070	85.769

Group	Minimum	Maximum	95% Confidence Interval From	To
wt wt	86.441	100.00	94.297	102.31
wt Ko	59.771	100.00	75.665	100.65
het wt	48.242	100.00	62.319	93.646
het KO	54.237	100.00	65.247	99.849

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