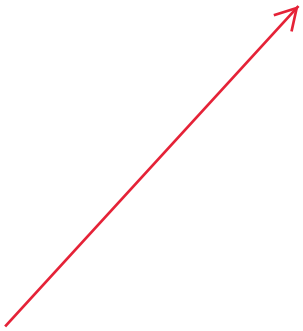
Obs	time	treat	treat2	treat3
1	2.3	control	control	control
2	1.7	control	control	control
3	3.6	sucrose	sucrose	sugar
4	4.0	sucrose	sucrose	sugar
5	3.0	glucose	sixcarb	sugar
6	2.8	glucose	sixcarb	sugar
7	2.1	fructose	sixcarb	sugar
8	2.3	fructose	sixcarb	sugar



time is the response variable (time until 50% of the insects in the cage died)

treat is the indicator (classification or grouping) variable for the full model with 4 means

treat2 is the indicator (classification or grouping) variable for the reduced model with 3 means

treat3 is the indicator (classification or grouping) variable for the most reduced model with 2 means

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
treat	4	control fructose glucose sucrose

Number of Observations Read	8
Number of Observations Used	8

there are n=8 observations

analysis for the full model with 4 means

the class (classification) level information box shows the names of the 4 groups/means

The GLM Procedure

Coefficients for Estimate fructose vs glucose		
		Row 1
Intercept		0
treat	control	0
treat	fructose	1
treat	glucose	-1
treat	sucrose	0

These are the coefficients of the linear combination used to compare the full model with the reduced model. The contrast here is between the fructose mean and the glucose mean.

The full model has means: mu_C, mu_F, mu_G, mu_S

The reduced model has means: mu_C, mu_(sixcarb), mu_S

To move to the reduced model we need mu_F = mu_G,
or equivalently, mu_F-mu_G = 0

The GLM Procedure

Dependent Variable: time

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	3.97500000	1.32500000	17.67	0.0090
Error	4	0.30000000	0.07500000		
Corrected Total	7	4.27500000			

The basic ANOVA table for the full model

The overall F-test
H_0: the 4 means are the same

R-Square	Coeff Var	Root MSE	time Mean
0.929825	10.04996	0.273861	2.725000

The overall time mean

Source	DF	Type I SS	Mean Square	F Value	Pr > F
treat	3	3.97500000	1.32500000	17.67	0.0090

Source	DF	Type III SS	Mean Square	F Value	Pr > F
treat	3	3.97500000	1.32500000	17.67	0.0090

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
fructose vs glucose	1	0.49000000	0.49000000	6.53	0.0629

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
fructose vs glucose	-0.70000000	0.27386128	-2.56	0.0629	-1.46036081	0.06036081

The contrast sum of squares and F-test for comparing the full model (C,F,G,S) and the reduced model (C,sixcarb,S).

H_0: mu_F = mu_G (we do not need the full model)

P-value = .0629

We fail to reject H_0 and conclude that we do not need separate means for the two six carbon sugar groups.

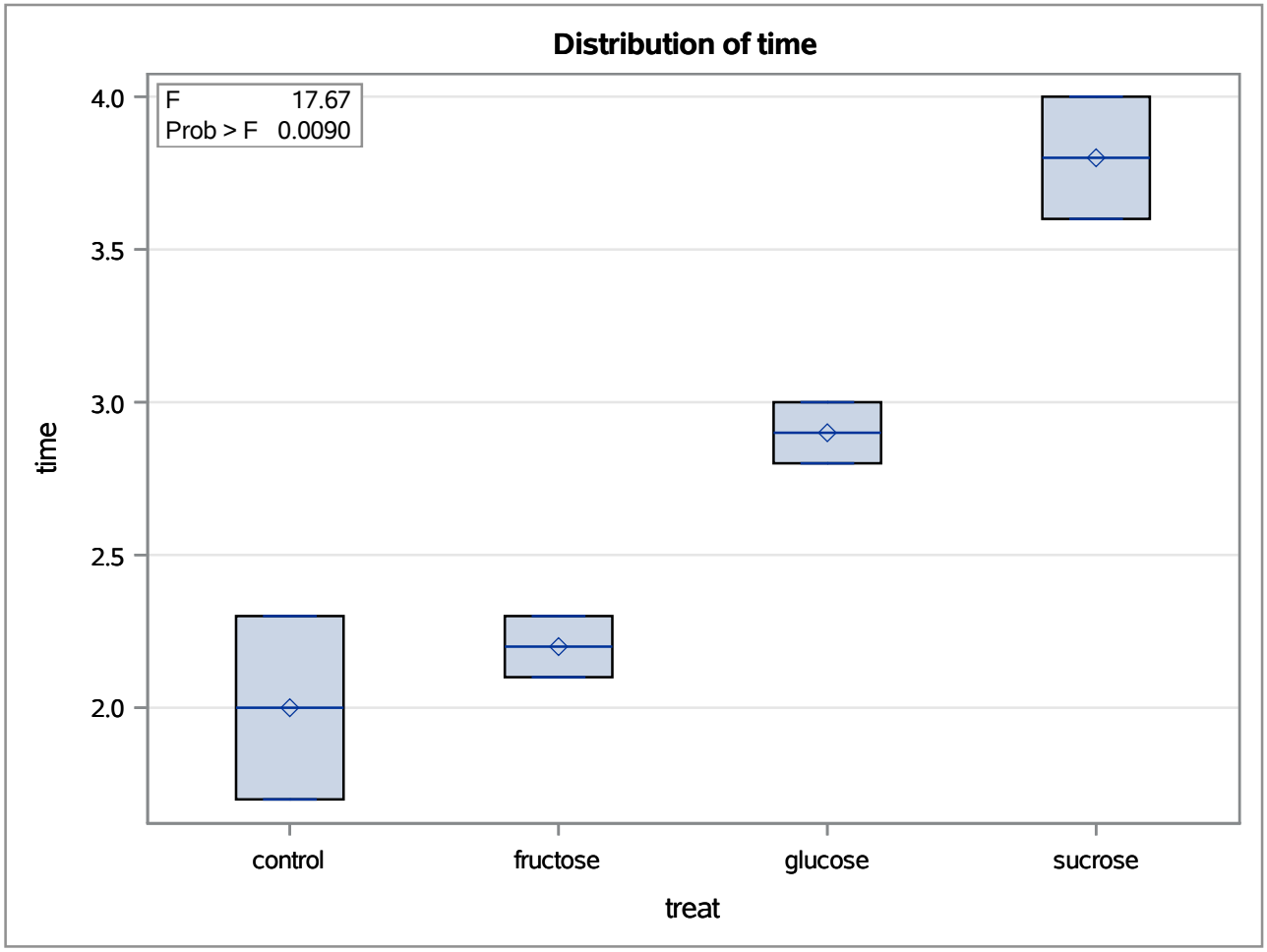
The t-test is equalvalent to the F-test

This box contains the estimate and confidence interval for mu_F-mu_G

plus the t-test for
H_0: mu_F-mu_G = 0

The GLM Procedure

Dependent Variable: time



The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
treat2	3	control sixcarb sucrose

Number of Observations Read	8
Number of Observations Used	8

The GLM Procedure

Dependent Variable: time

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	3.48500000	1.74250000	11.03	0.0147
Error	5	0.79000000	0.15800000		
Corrected Total	7	4.27500000			

The basic ANOVA table for the reduced model with 3 means

R-Square	Coeff Var	Root MSE	time Mean
0.815205	14.58687	0.397492	2.725000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
treat2	2	3.48500000	1.74250000	11.03	0.0147

Source	DF	Type III SS	Mean Square	F Value	Pr > F
treat2	2	3.48500000	1.74250000	11.03	0.0147

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
6-carbons vs sucrose	1	2.08333333	2.08333333	13.19	0.0150

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
6-carbons vs sucrose	-1.25000000	0.34423829	-3.63	0.0150	-2.13489269	-0.36510731

The contrast sum of squares and F-test for comparing the reduced model (C,sixcarb,S) and the most reduced model (C,sugar).

H_0: mu_sixcarb = mu_S (we do not need the 3 means model)

P-value = .0150
(strong evidence mu_sixcarb notequl mu_S)

We reject H_0 and conclude that we DO NEED separate means for the sixcarb group and the sucrose group.

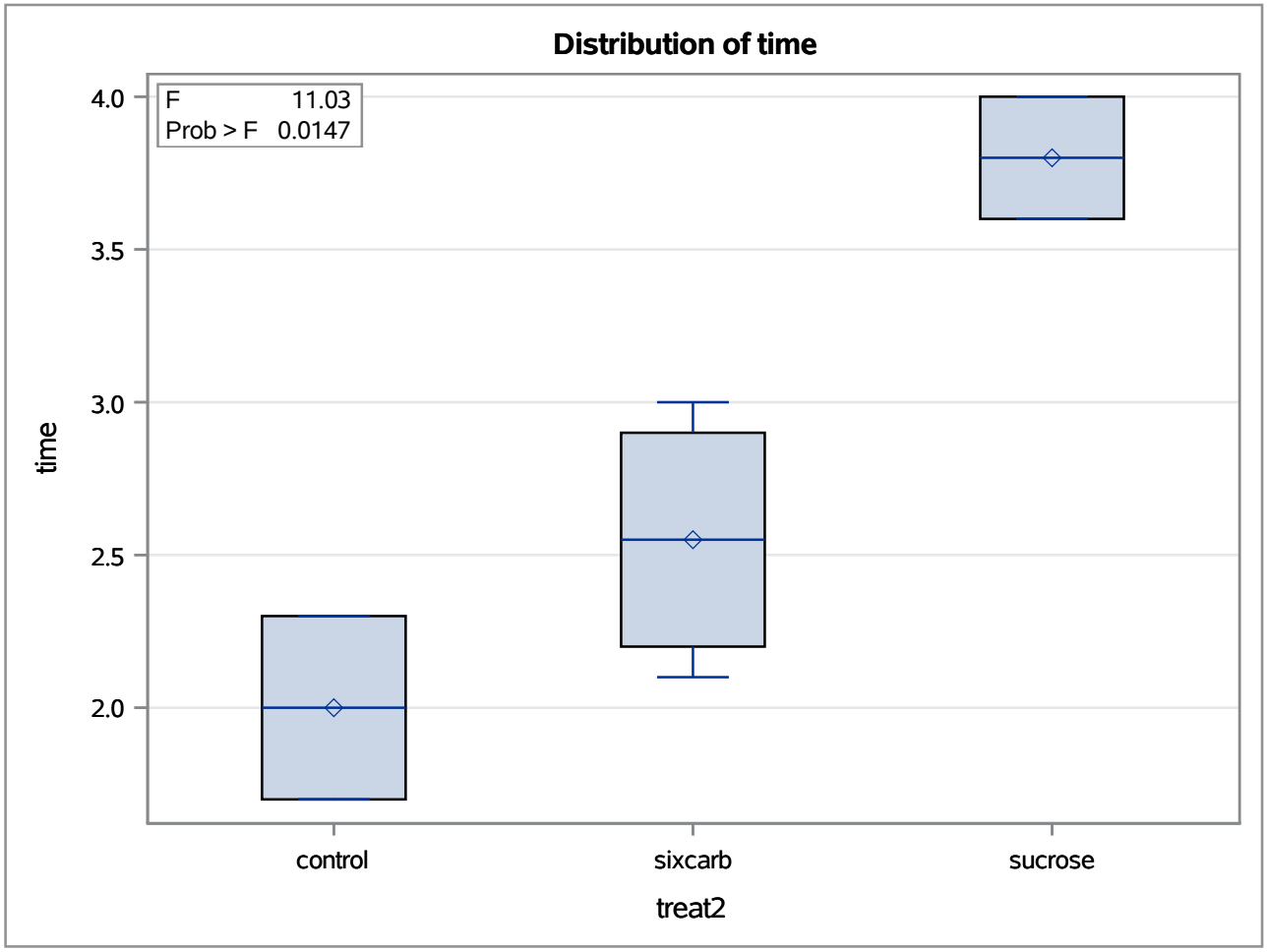
The t-test is equivalent to the t-test in the 6-carbons vs sucrose line

95% confidence interval for mu_sixcarb - mu_S

With 95% confidence, mu_S is between .3651 and 2.1349 days larger than mu_sixcarb

The GLM Procedure

Dependent Variable: time



The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
treat3	2	control sugar

Number of Observations Read	8
Number of Observations Used	8

most reduced model with 2 means (C,sugar)

The GLM Procedure

Dependent Variable: time

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1.40166667	1.40166667	2.93	0.1380
Error	6	2.87333333	0.47888889		
Corrected Total	7	4.27500000			

The basic ANOVA table for the most reduced model with 2 means

R-Square	Coeff Var	Root MSE	time Mean
0.327875	25.39516	0.692018	2.725000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
treat3	1	1.40166667	1.40166667	2.93	0.1380

Source	DF	Type III SS	Mean Square	F Value	Pr > F
treat3	1	1.40166667	1.40166667	2.93	0.1380

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
control vs sugars	1	1.40166667	1.40166667	2.93	0.1380

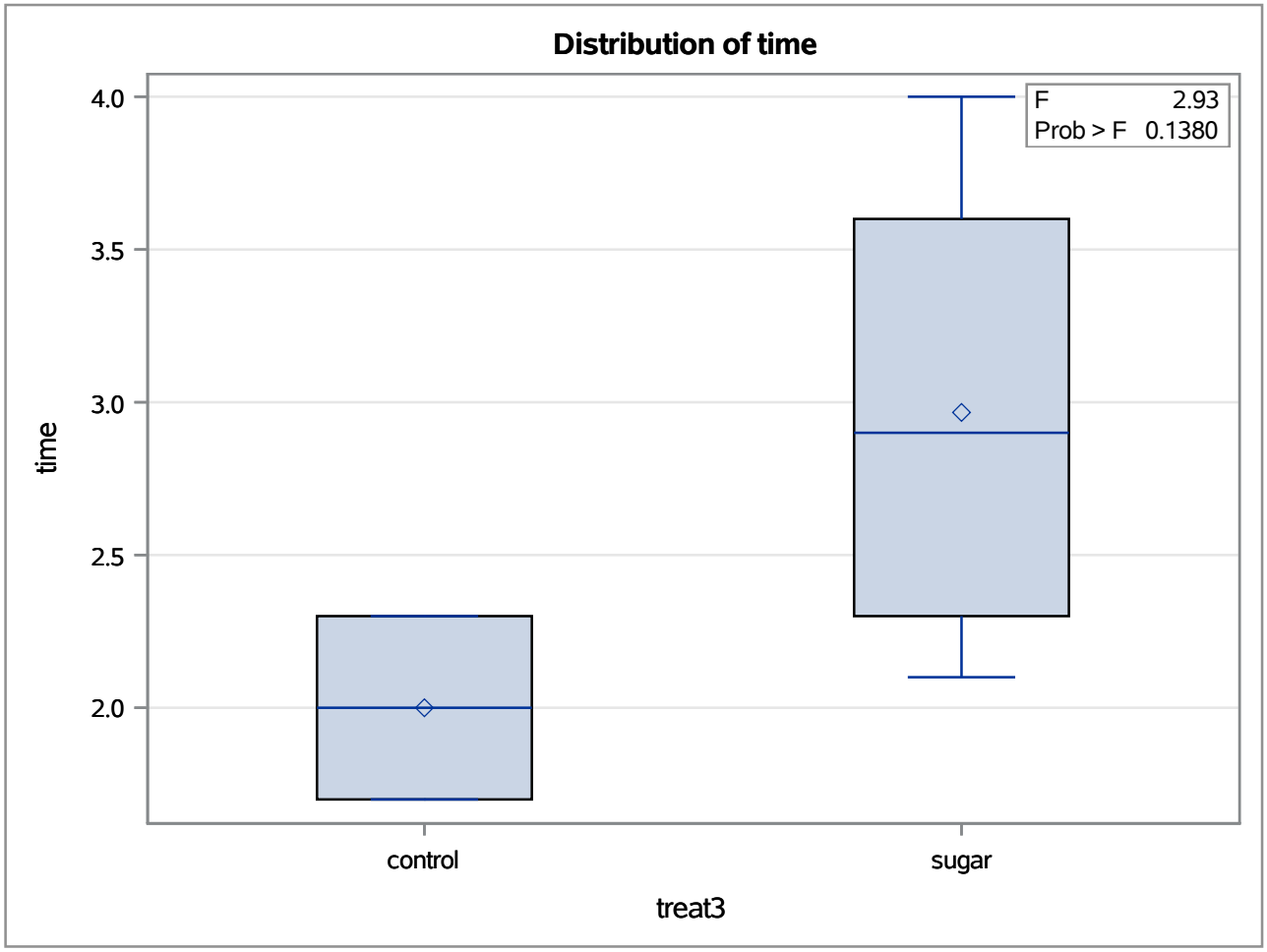
Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
control vs sugars	-0.96666667	0.56503032	-1.71	0.1380	-2.34924605	0.41591271

This information is NOT NEEDED since we were not able to justify simplification of the model with 3 means to the model with 2 means

most reduced model with 2 means (C,sugar)

The GLM Procedure

Dependent Variable: time



detailed analysis for the model with 3 means

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
treat2	3	control sixcarb sucrose

Number of Observations Read	8
Number of Observations Used	8

detailed analysis for the model with 3 means

The GLM Procedure

Dependent Variable: time

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	3.48500000	1.74250000	11.03	0.0147
Error	5	0.79000000	0.15800000		
Corrected Total	7	4.27500000			

R-Square	Coeff Var	Root MSE	time Mean
0.815205	14.58687	0.397492	2.725000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
treat2	2	3.48500000	1.74250000	11.03	0.0147

Source	DF	Type III SS	Mean Square	F Value	Pr > F
treat2	2	3.48500000	1.74250000	11.03	0.0147

H_0: mu_C = mu_S

H_0: mu_sixcarb = mu_S

H_0: mu_sixcarb=mu_C

H_0: mu_S = (mu_C+mu_F+mu_G)/3

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
control vs sucrose	1	3.24000000	3.24000000	20.51	0.0062
6-carbons vs sucrose	1	2.08333333	2.08333333	13.19	0.0150
6-carbons vs control	1	0.40333333	0.40333333	2.55	0.1710
sucrose vs others	1	3.38272727	3.38272727	21.41	0.0057

mu_C - mu_S

mu_sixcarb - mu_S

mu_sixcarb - mu_C

mu_S - (mu_C+mu_F+mu_G)/3

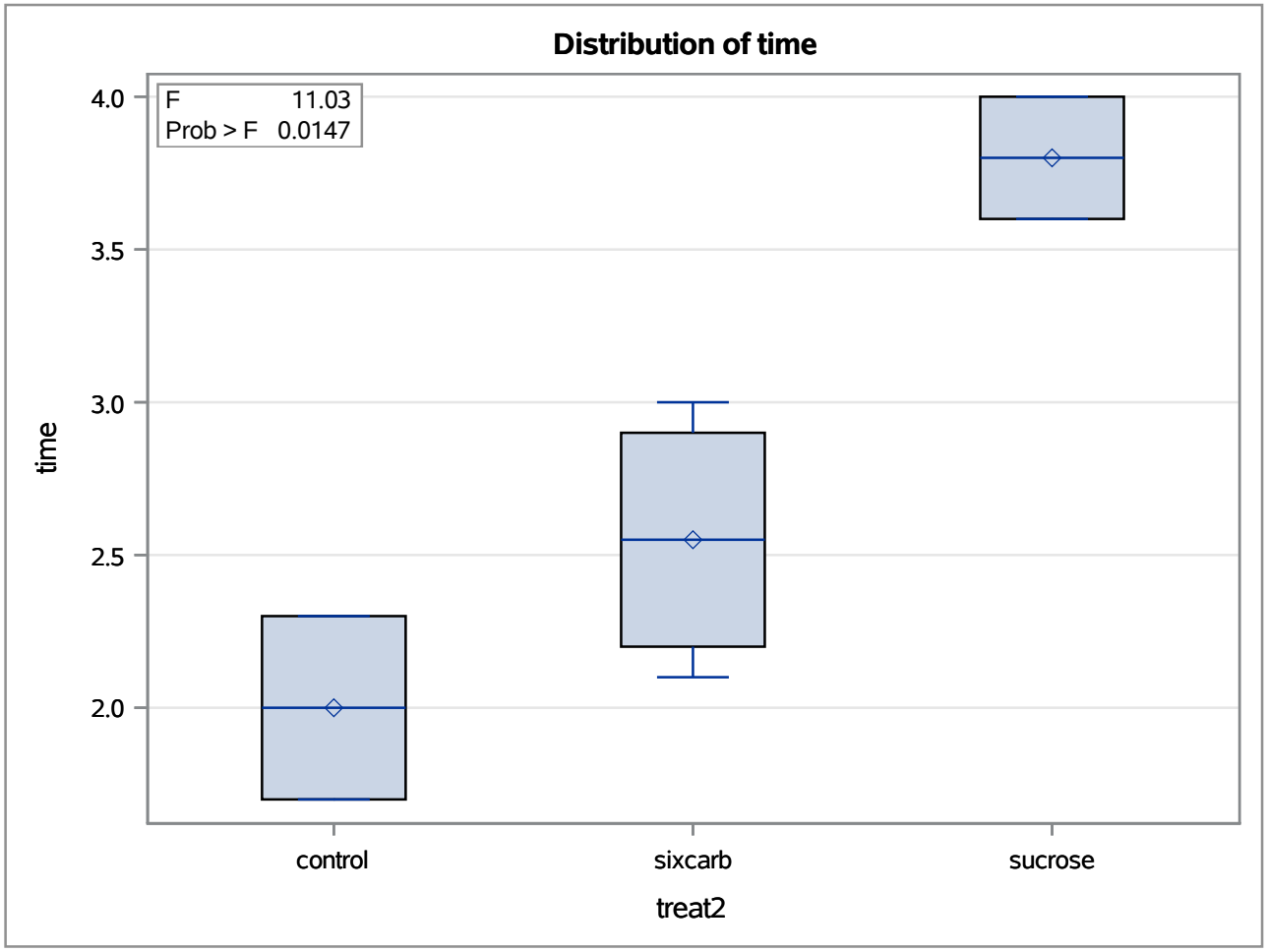
Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
control vs sucrose	-1.80000000	0.39749214	-4.53	0.0062	-2.82178607	-0.77821393
6-carbons vs sucrose	-1.25000000	0.34423829	-3.63	0.0150	-2.13489269	-0.36510731
6-carbons vs control	0.55000000	0.34423829	1.60	0.1710	-0.33489269	1.43489269
sucrose vs others	1.52500000	0.32958307	4.63	0.0057	0.67777975	2.37222025

These are comparison-wise (one at a time) hypothesis tests and confidence intervals. We need to make an adjustment for multiple comparisons. See the following for the experiment-wise simultaneous 95% confidence intervals.

detailed analysis for the model with 3 means

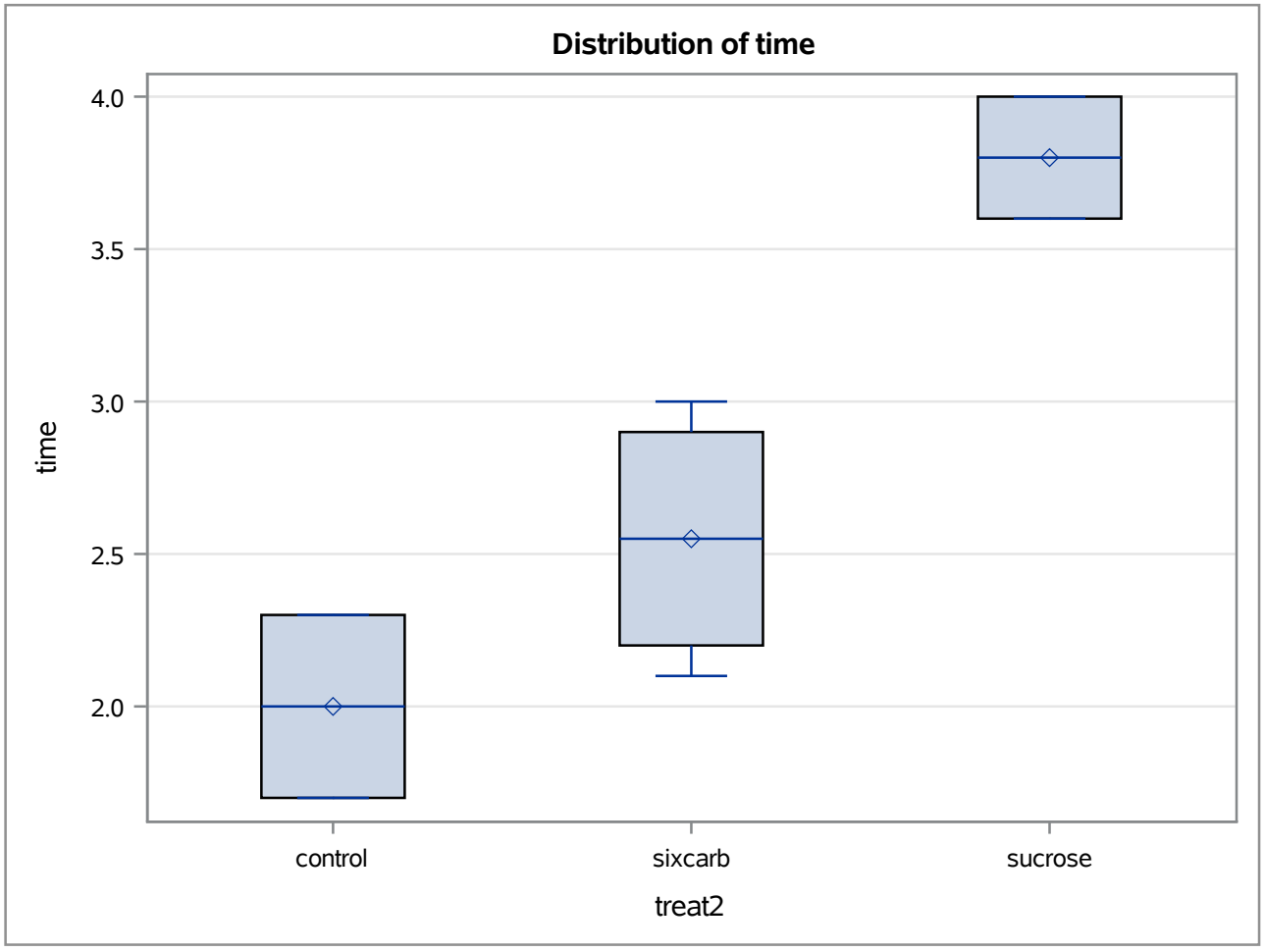
The GLM Procedure

Dependent Variable: time



detailed analysis for the model with 3 means

The GLM Procedure



detailed analysis for the model with 3 means

The GLM Procedure

Scheffe's Test for time

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Error Degrees of Freedom	5
Error Mean Square	0.158
Critical Value of F	5.78614

Comparisons significant at the 0.05 level are indicated by *.**

treat2 Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
sucrose - sixcarb	1.2500	0.0790	2.4210	***
sucrose - control	1.8000	0.4478	3.1522	***
sixcarb - sucrose	-1.2500	-2.4210	-0.0790	***
sixcarb - control	0.5500	-0.6210	1.7210	
control - sucrose	-1.8000	-3.1522	-0.4478	***
control - sixcarb	-0.5500	-1.7210	0.6210	

pairwise comparisons

mu_S - mu_sixcarb

mu_S - mu_C

mu_sixcarb - mu_S

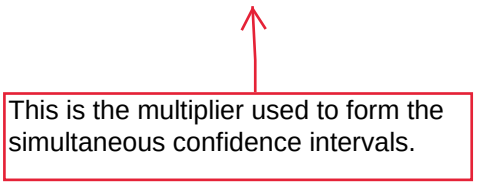
etc

These are simultaneous 95% confidence intervals.

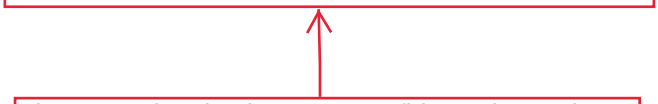
An adjustment has been made to take into account multiple comparisons.

the multiplier for the Scheffe intervals

Obs	F	multi
1	5.78614	3.40180



Obs	differ	estimate	stderr	lowerCL	upperCL
1	C_S	-1.800	0.39749	-3.15219	-0.44781
2	6_S	-1.250	0.34424	-2.42103	-0.07897
3	6_C	0.550	0.34424	-0.62103	1.72103
4	S_(Cand6	1.525	0.32958	0.40382	2.64618



These are the simultaneous confidence intervals computed earlier. Here they were constructed manually to demonstrate the procedure.