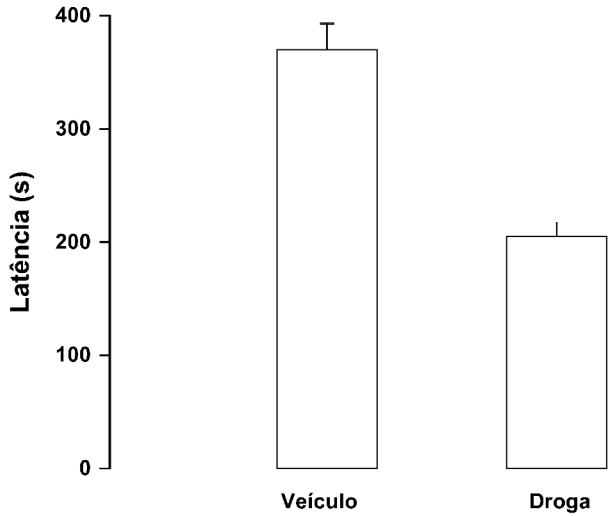
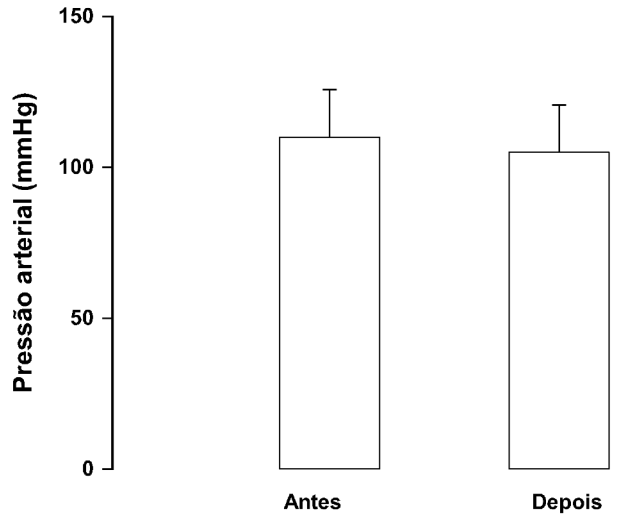

Latência (s)
400
300
200
100
0
Veículo
Droga


Pressão arterial (mmHg)
150
100
50
0
Antes
Depois

Seminário 4a

Group Statistics

	trat	N	Mean	Std. Deviation	Std. Error Mean
latencia	1	3	3,7167 E2	22,54625	13,01708
	2	11	2,0518 E2	62,85033	18,95009

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
latencia	Equal variances assumed	2,225	,162	4,399	12	,001	166,48485	37,84792	84,02131	248,94839
	Equal variances not assumed			7,242	10,251	,000	166,48485	22,99022	115,42922	217,54047

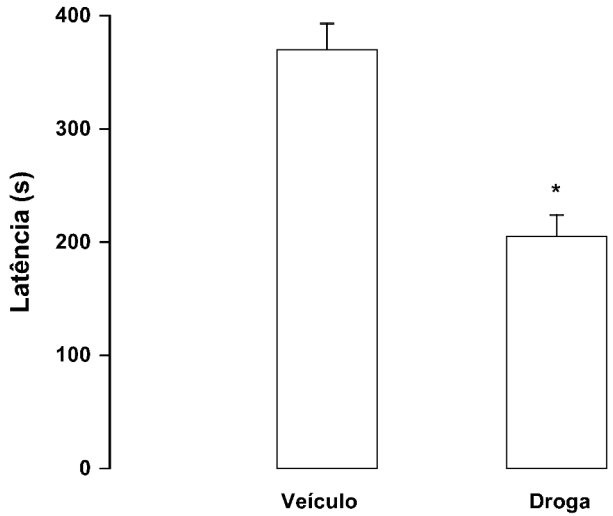
Seminário 4b

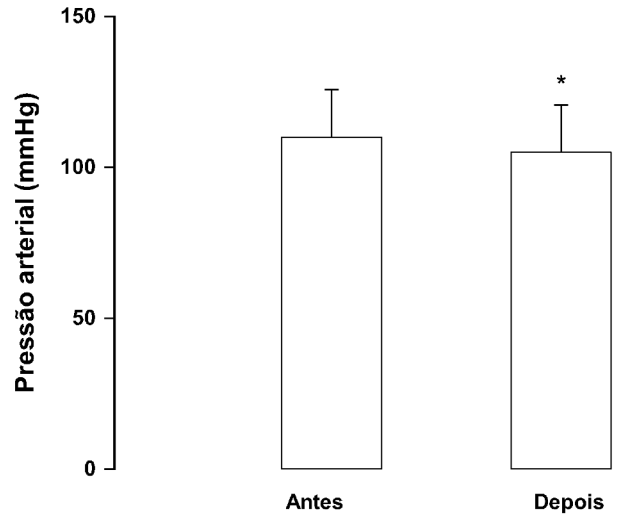
Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PDantes	1,1000 E2	5	15,81139	7,07107
	PDdepois	1,0500 E2	5	15,73213	7,03562

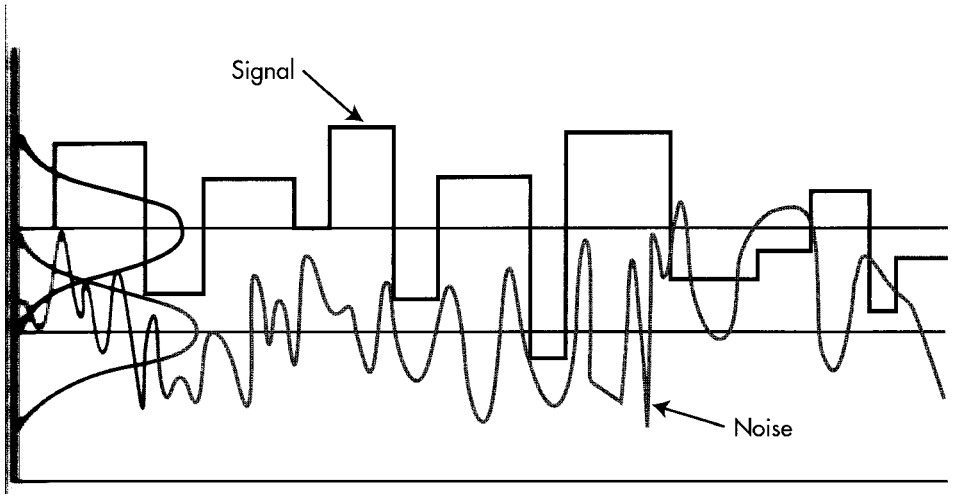
Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	PDantes - PDdepois	5,00000	1,58114	,70711	3,03676	6,96324	7,071	4	,002


Latência (s)
400
300
200
100
0
*
Veículo
Droga

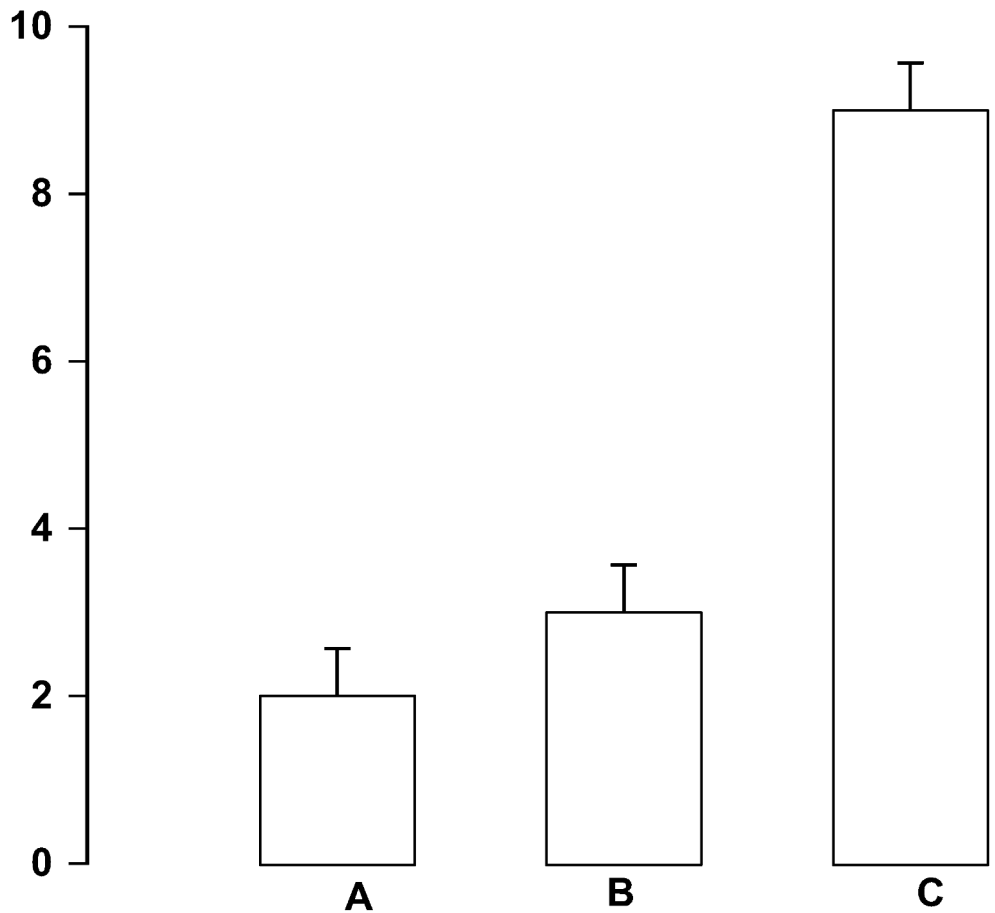

Pressão arterial (mmHg)
150
100
50
0
*
Antes
Depois

Comparação de mais de duas amostras|: Anova



Anova de um fator (one-way ANOVA)

Trat	Efeito
1,00	1,00
1,00	2,00
1,00	3,00
2,00	2,00
2,00	3,00
2,00	4,00
3,00	8,00
3,00	9,00
3,00	10,00


10
8
6
4
2
0
A
B
C

ANOVA

Técnica na qual o total da variação presente de um conjunto de dados é fracionado em vários componentes.

A análise indica a magnitude da contribuição de cada uma das fontes neste total

Trat	Efeito
A	1,00
A	2,00
A	3,00
B	2,00
B	3,00
B	4,00
C	8,00
C	9,00
C	10,00

$X_A = 2$
$X_B = 3$
$X_C = 9$

$X_{global} = 4,66$

SS (soma dos quadrados) within:
A: $(1-2)^2+(2-2)^2+(3-2)^2=2$
B: $(2-3)^2+(3-3)^2+(4-3)^2=2$
C: $(8-9)^2+(9-9)^2+(10-9)^2=2$

$SS_{within} = 2 + 2 + 2 = 6$

$SS_{between} = 3((2-4,66)^2+(3-4,66)^2+(9-4,66)^2)) = 86,0$

Test of Homogeneity of Variances

data

Levene Statistic	df1	df2	Sig.
,000	2	6	1,000

ANOVA

data

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	86,000	2	43,000	43,000	,000
Within Groups	6,000	6	1,000		
Total	92,000	8			

ETA-squared (representado por η^2): expressa a % da variância da variável explicada pelo fator. **Seu cálculo na ANOVA é fácil: dividir a soma dos quadrados (SS) do fator (ex. tratamento) pelo total**. Um η^2 de 0.01 seria considerado pequeno, um de 0.06 moderado e de 0.14 grande

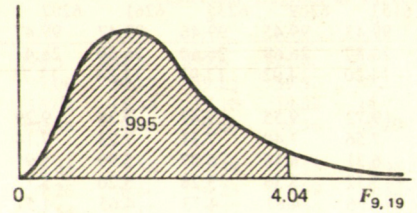
No caso= 86/92=0,93

(Stevens J. Applied multivariade statistics for the social sciences. 4th Ed., Lawrance Erlbaum Associates, Mahwah, NJ, 2001).

Table J

Percentiles of the F Distribution

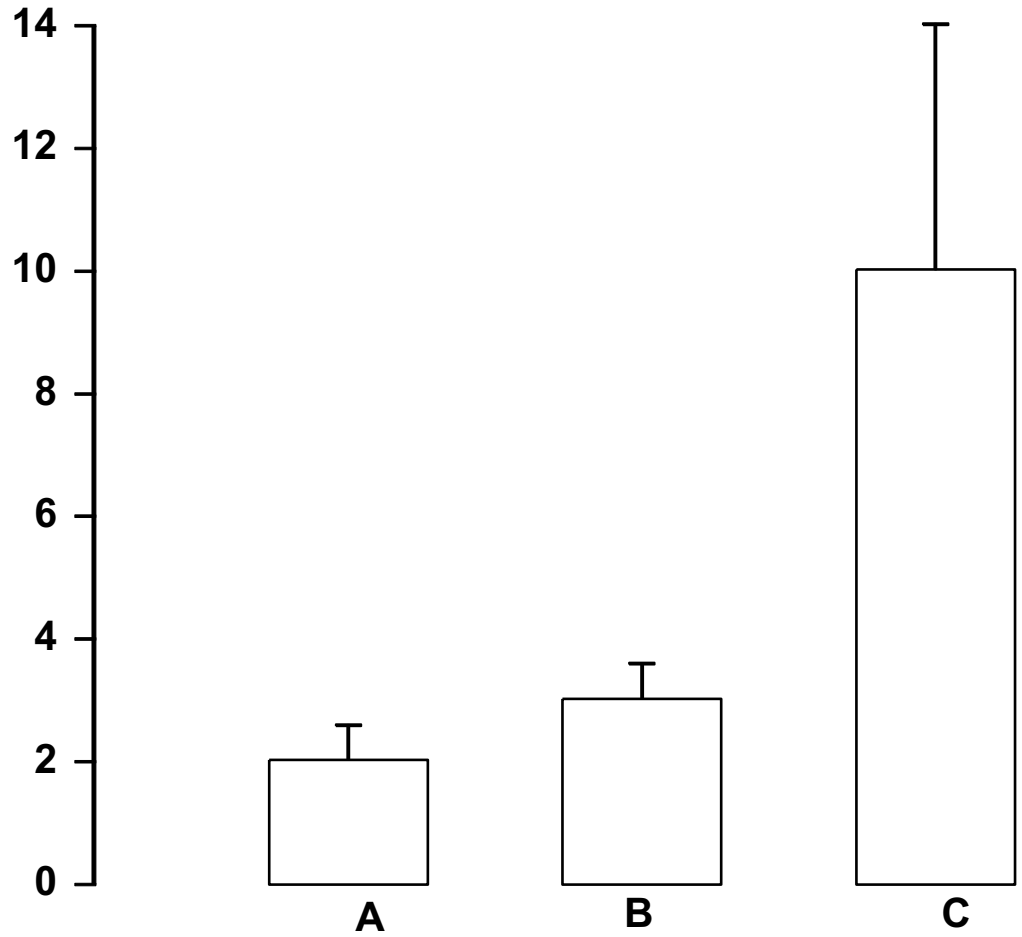
$F_{.995}$



Denominator Degrees of Freedom	Numerator Degrees of Freedom 1	2	3	4	5	6	7	8	9
1	16211	20000	21615	22500	23056	23437	23715	23925	24091
2	198.5	199.0	199.2	199.2	199.3	199.3	199.4	199.4	199.4
3	55.55	49.80	47.47	46.19	45.39	44.84	44.43	44.13	43.88
4	31.33	26.28	24.26	23.15	22.46	21.97	21.62	21.35	21.14
5	22.78	18.31	16.53	15.56	14.94	14.51	14.20	13.96	13.77
6	18.63	14.54	12.92	12.03	11.46	11.07	10.79	10.57	10.39
7	16.24	12.40	10.88	10.05	9.52	9.16	8.89	8.68	8.51
8	14.69	11.04	9.60	8.81	8.30	7.95	7.69	7.50	7.34
9	13.61	10.11	8.72	7.96	7.47	7.13	6.88	6.69	6.54
10	12.83	9.43	8.08	7.34	6.87	6.54	6.30	6.12	5.97
11	12.23	8.91	7.60	6.88	6.42	6.10	5.86	5.68	5.54
12	11.75	8.51	7.23	6.52	6.07	5.76	5.52	5.35	5.20
13	11.37	8.19	6.93	6.23	5.79	5.48	5.25	5.08	4.94
14	11.06	7.92	6.68	6.00	5.56	5.26	5.03	4.86	4.72
15	10.80	7.70	6.48	5.80	5.37	5.07	4.85	4.67	4.54
16	10.58	7.51	6.30	5.64	5.21	4.91	4.69	4.52	4.38
17	10.38	7.35	6.16	5.50	5.07	4.78	4.56	4.39	4.25
18	10.22	7.21	6.03	5.37	4.96	4.66	4.44	4.28	4.14
19	10.07	7.09	5.92	5.27	4.85	4.56	4.34	4.18	4.04
20	9.94	6.99	5.82	5.17	4.76	4.47	4.26	4.09	3.96
21	9.83	6.89	5.73	5.09	4.68	4.39	4.18	4.01	3.88
22	9.73	6.81	5.65	5.02	4.61	4.32	4.11	3.94	3.81
23	9.63	6.73	5.58	4.95	4.54	4.26	4.05	3.88	3.75
24	9.55	6.66	5.52	4.89	4.49	4.20	3.99	3.83	3.69
25	9.48	6.60	5.46	4.84	4.43	4.15	3.94	3.78	3.64
26	9.41	6.54	5.41	4.79	4.38	4.10	3.89	3.73	3.60
27	9.34	6.49	5.36	4.74	4.34	4.06	3.85	3.69	3.56
28	9.28	6.44	5.32	4.70	4.30	4.02	3.81	3.65	3.52
29	9.23	6.40	5.28	4.66	4.26	3.98	3.77	3.61	3.48
30	9.18	6.35	5.24	4.62	4.23	3.95	3.74	3.58	3.45
40	8.83	6.07	4.98	4.37	3.99	3.71	3.51	3.35	3.22
60	8.49	5.79	4.73	4.14	3.76	3.49	3.29	3.13	3.01
120	8.18	5.54	4.50	3.92	3.55	3.28	3.09	2.93	2.81
∞	7.88	5.30	4.28	3.72	3.35	3.09	2.90	2.74	2.62

Anova de um fator (one-way): o problema da falta de homogeneidade de variâncias

Trat	Efeito
1,00	1,00
1,00	2,00
1,00	3,00
2,00	2,00
2,00	3,00
2,00	4,00
3,00	5,00
3,00	7,00
3,00	18,00


14
12
10
8
6
4
2
0
A
B
C

Test of Homogeneity of Variances

data3

Levene Statistic	df1	df2	Sig.
9,333	2	6	,014

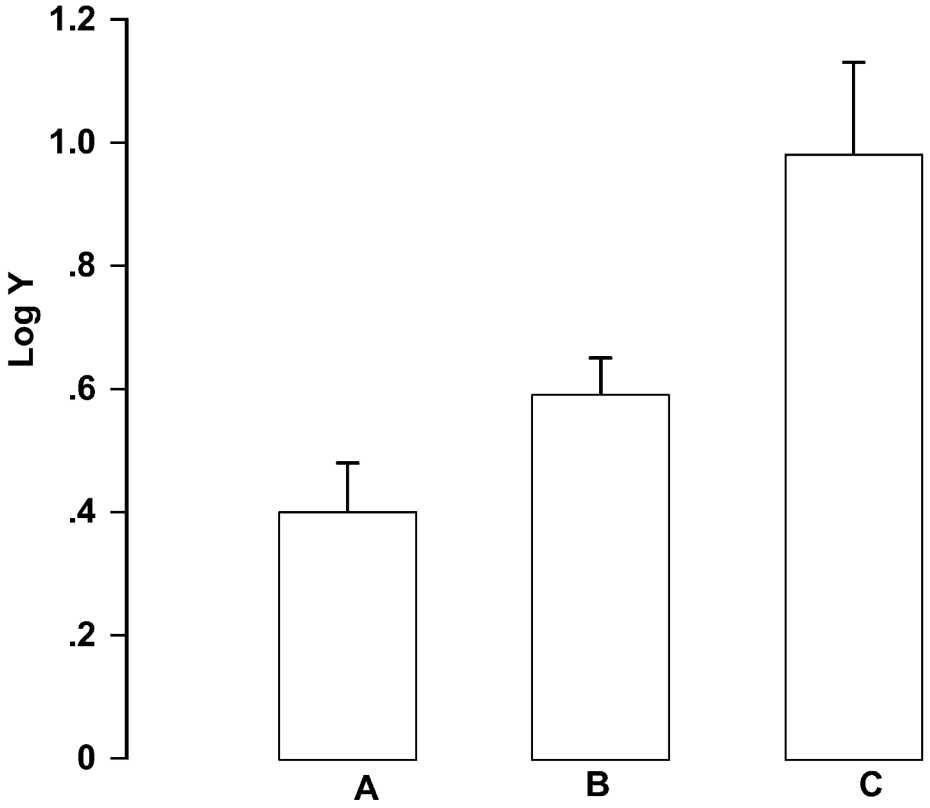
ANOVA

data3

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	114,000	2	57,000	3,353	,105
Within Groups	102,000	6	17,000		
Total	216,000	8			

Trat	Efeito	Log efeito	
1,00		1,00	,30
1,00		2,00	,48
1,00		3,00	,60
2,00		2,00	,48
2,00		3,00	,60
2,00		4,00	,70
3,00		5,00	,78
3,00		7,00	,90
3,00		18,00	1,28

Anova de uma fator: transformação dos dados



Test of Homogeneity of Variances

lgdata3

Levene Statistic	df1	df2	Sig.
1,651	2	6	,268

ANOVA

lgdata3

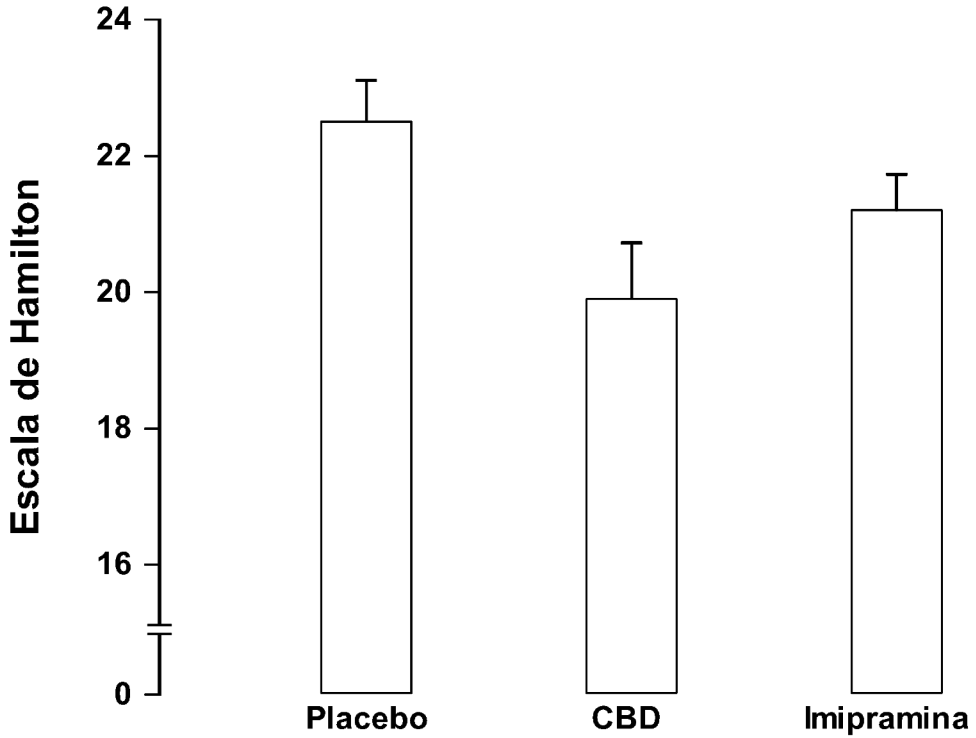
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,450	2	,225	6,546	,031
Within Groups	,206	6	,034		
Total	,656	8			

Testes post-hoc

Descriptives

segunda semana

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1,00	10	22,5000	1,95789	,61914	21,0994	23,9006	19,00	25,00
2,00	10	19,9000	2,60128	,82260	18,0392	21,7608	17,00	26,00
3,00	10	21,2000	1,68655	,53333	19,9935	22,4065	19,00	24,00
Total	30	21,2000	2,31040	,42182	20,3373	22,0627	17,00	26,00


Escala de Hamilton
24
22
20
18
16
0
Placebo
CBD
Imipramina

ANOVA

segunda semana

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	33,800	2	16,900	3,771	,036
Within Groups	121,000	27	4,481		
Total	154,800	29			

MULTIPLE RANGE AND MULTIPLE F TESTS*

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1. INTRODUCTION

The common practice for testing the homogeneity of a set of n treatment means in an analysis of variance is to use an F (or z) test. This procedure has special desirable properties for testing the homogeneity hypothesis that the n population means concerned are equal. An F test alone, however, generally falls short of satisfying all of the practical requirements involved. When it rejects the homogeneity hypothesis, it gives no decisions as to which of the differences among the treatment means may be considered significant and which may not.

To illustrate, Table I shows results of a barley grain yield experiment conducted by E. Shulkcum of this Institute at Accomac, Virginia, in 1951. Seven varieties, A, B, $\cdots$, G, were replicated six times in a randomized block design. The F ratio (in section b) for testing the homogeneity of the varietal means is highly significant. This indicates that one or more of the differences among the means are significant but it does not specify which ones.

TABLE I. BARLEY GRAIN YIELDS IN BUSHELS PER ACRE

a) *Varietal Means Ranked in Order*

A	F	G	D	C	B	E
49.6	58.1	61.0	61.5	67.6	71.2	71.3

b) *Analysis of Variance*

Source	*d.f.*	*m.s.*	*F*
Between varieties	6	366.97	4.61**
Between blocks	5	141.95	
Error	30	79.64	

c) *Standard Error of a Varietal Mean*

$$s_m = \sqrt{79.64/6} = 3.643 \qquad (n_2 = 30)$$

Médias: Placebo: 22,5; IMO: 19,9, CBD: 22,5
V= 27
N (por grupo)= 10
MS Erro: SQR (4,481/10) = 0,669 (valor para multiplicar pelo da tabela)

TABLE 1 (*Continued*)

CRITICAL VALUES FOR DUNCAN'S NEW MULTIPLE RANGE TEST

PROTECTION LEVEL $P = (.95)^{p-1}$; SIGNIFICANCE LEVEL $\alpha = .05$

ν \ p	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97	17.97
2	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085	6.085
3	4.501	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516	4.516
4	3.927	4.013	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033
5	3.635	3.749	3.797	3.814	3.814	3.814	3.814	3.814	3.814	3.814	3.814	3.814	3.814	3.814	3.814	3.81[illegible]	3.814	3.814
6	3.461	3.587	3.649	3.680	3.694	3.697	3.697	3.697	3.697	3.697	3.697	3.697	3.697	3.697	3.697	3.697	3.697	3.697
7	3.344	3.477	3.548	3.588	3.611	3.622	3.626	3.626	3.626	3.626	3.626	3.626	3.626	3.626	3.626	3.626	3.626	3.626
8	3.261	3.399	3.475	3.521	3.549	3.566	3.575	3.579	3.579	3.579	3.579	3.579	3.579	3.579	3.579	3.579	3.579	3.579
9	3.199	3.339	3.420	3.470	3.502	3.523	3.536	3.544	3.547	3.547	3.547	3.547	3.547	3.547	3.547	3.547	3.547	3.547
10	3.151	3.293	3.376	3.430	3.465	3.489	3.505	3.516	3.522	3.525	3.526	3.526	3.526	3.526	3.526	3.526	3.526	3.526
11	3.113	3.256	3.342	3.397	3.435	3.462	3.480	3.493	3.501	3.506	3.509	3.510	3.510	3.510	3.510	3.510	3.510	3.510
12	3.082	3.225	3.313	3.370	3.410	3.439	3.459	3.474	3.484	3.491	3.496	3.498	3.499	3.499	3.499	3.499	3.499	3.499
13	3.055	3.200	3.289	3.348	3.389	3.419	3.442	3.458	3.470	3.478	3.484	3.488	3.490	3.490	3.490	3.490	3.490	3.490
14	3.033	3.178	3.268	3.329	3.372	3.403	3.426	3.444	3.457	3.467	3.474	3.479	3.482	3.484	3.484	3.485	3.485	3.485
15	3.014	3.160	3.250	3.312	3.356	3.389	3.413	3.432	3.446	3.457	3.465	3.471	3.476	3.478	3.480	3.481	3.481	3.481
16	2.998	3.144	3.235	3.298	3.343	3.376	3.402	3.422	3.437	3.449	3.458	3.465	3.470	3.473	3.477	3.478	3.478	3.478
17	2.984	3.130	3.222	3.285	3.331	3.366	3.392	3.412	3.429	3.441	3.451	3.459	3.465	3.469	3.473	3.475	3.476	3.476
18	2.971	3.118	3.210	3.274	3.321	3.356	3.383	3.405	3.421	3.435	3.445	3.454	3.460	3.465	3.470	3.472	3.474	3.474
19	2.960	3.107	3.199	3.264	3.311	3.347	3.375	3.397	3.415	3.429	3.440	3.449	3.456	3.462	3.467	3.470	3.472	3.473
20	2.950	3.097	3.190	3.255	3.303	3.339	3.368	3.391	3.409	3.424	3.436	3.445	3.453	3.459	3.464	3.467	3.470	3.472
24	2.919	3.066	3.160	3.226	3.276	3.315	3.345	3.370	3.390	3.406	3.420	3.432	3.441	3.449	3.456	3.461	3.465	3.469
30	2.888	3.035	3.131	3.199	3.250	3.290	3.322	3.349	3.371	3.389	3.405	3.418	3.430	3.439	3.447	3.454	3.460	3.466
40	2.858	3.006	3.102	3.171	3.224	3.266	3.300	3.328	3.352	3.373	3.390	3.405	3.418	3.429	3.439	3.448	3.456	3.463
60	2.829	2.976	3.073	3.143	3.198	3.241	3.277	3.307	3.333	3.355	3.374	3.391	3.406	3.419	3.431	3.442	3.451	3.460
120	2.800	2.947	3.045	3.116	3.172	3.217	3.254	3.287	3.314	3.337	3.359	3.377	3.394	3.409	3.423	3.435	3.446	3.457
∞	2.772	2.918	3.017	3.089	3.146	3.193	3.232	3.265	3.294	3.320	3.343	3.363	3.382	3.399	3.414	3.428	3.442	3.454

Exemplo

Descriptives

segunda semana

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1,00	10	22,5000	1,95789	,61914	21,0994	23,9006	19,00	25,00
2,00	10	19,9000	2,60128	,82260	18,0392	21,7608	17,00	26,00
3,00	10	21,2000	1,68655	,53333	19,9935	22,4065	19,00	24,00
Total	30	21,2000	2,31040	,42182	20,3373	22,0627	17,00	26,00

V= 27

N (por grupo)= 10

MS Erro: SQR (4,481/10) = 0,669 (valor para multiplicar pelo da tabela)

ANOVA

segunda semana

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	33,800	2	16,900	3,771	,036
Within Groups	121,000	27	4,481		
Total	154,800	29			

Valores críticos para médias com distância de 2: 0,669 x 2,919= 1,95

Valores críticos para médias com distância de 3: 0,669 x 3,066= 2,01

Diferença das Médias: Placebo x CBD: 1,3; (valor crítico: 1,95)

Placebo x IMP: 2,6 (valor crítico: 2,01): $p<0,05$

CBD X IMP: 1,3; (valor crítico: 1,95)

Multiple Comparisons

Dependent Variable: segunda semana

	(I) 1=placebo, 2=imipramina, 3=CBD	(J) 1=placebo, 2=imipramina, 3=CBD	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	1,00	2,00	2,60000*	,94673	,028	,2527	4,9473
		3,00	1,30000	,94673	,369	-1,0473	3,6473
	2,00	1,00	-2,60000*	,94673	,028	-4,9473	-,2527
		3,00	-1,30000	,94673	,369	-3,6473	1,0473
	3,00	1,00	-1,30000	,94673	,369	-3,6473	1,0473
		2,00	1,30000	,94673	,369	-1,0473	3,6473
LSD	1,00	2,00	2,60000*	,94673	,011	,6575	4,5425
		3,00	1,30000	,94673	,181	-,6425	3,2425
	2,00	1,00	-2,60000*	,94673	,011	-4,5425	-,6575
		3,00	-1,30000	,94673	,181	-3,2425	,6425
	3,00	1,00	-1,30000	,94673	,181	-3,2425	,6425
		2,00	1,30000	,94673	,181	-,6425	3,2425
Bonferroni	1,00	2,00	2,60000*	,94673	,032	,1835	5,0165
		3,00	1,30000	,94673	,543	-1,1165	3,7165
	2,00	1,00	-2,60000*	,94673	,032	-5,0165	-,1835
		3,00	-1,30000	,94673	,543	-3,7165	1,1165
	3,00	1,00	-1,30000	,94673	,543	-3,7165	1,1165
		2,00	1,30000	,94673	,543	-1,1165	3,7165

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

segunda semana

	1=placebo, 2=imipramina, 3=CBD	N	Subset for alpha = .05	
			1	2
Tukey HSD[a]	2,00	10	19,9000	
	3,00	10	21,2000	21,2000
	1,00	10		22,5000
	Sig.		,369	,369
Duncan[a]	2,00	10	19,9000	
	3,00	10	21,2000	21,2000
	1,00	10		22,5000
	Sig.		,181	,181

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10,000.