Statistical Analysis of the Number of Infections with Corona Virus in Some Arab Countries Using the Method of Least Significant Difference

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Abstract *: In this research, we applied actual data related to the number of infections with the Corona virus for some Arab countries for the month of February of the year 2022, where the method of least significant difference (LSD) was used to find out the significant differences in the number of infections between any two Arab countries. First, the completely random design method (CRD) was used to obtain a table of analysis of variance (ANOVA) and to know in general whether there are significant differences in the number of injuries between Arab countries or not, by rejecting the null hypothesis* H_0*, the method of least significance LSD was used to compare the number of injuries between Arab countries (Is there a moral difference or not).*

Keywords : Completely Randomized Design, Least Significant Difference, Corona virus.

I. INTRODUCTION

Recently, due to the spread of the Corona virus, many scientific researches have been published in this regard, for example,

Al-Muhanna S. and others [6] introduced a newly discovered coronavirus, COVID-19, creates a new infectious illness. According to clinical observations , people's age and gender appear to have a role in their vulnerability to COVID-19. The study included 36607 subjects (evenly distributed between sexes) , and their ages ranged from 10 to 80 years. According to the study's findings, males were found to be more infected than females, and the people between the ages of 30 and 39 were more common than people of other ages range. Bonyan R. and others [5] introduced the cross-sectional, online descriptive questionnaire-based study in February and March 2020 a total of 485 participants from Arabic-speaking countries (Jordan, United Arab Emirates, the Kingdom of Saudi Arabia, Qatar, Palestine, and Egypt). they conclude that COVID-19 pandemic is causing global panic; thus, awareness and practices of preventive measures of COVID-19 should be increased through public educational campaigns, which should be planned in accordance with communities' and countries' attitudes toward COVID-19. Collaborative efforts between ministries of heath and residents of every country should be implemented. S. Hosseini S. and Jahromi R. [7] searched for descriptive statistical analyses to detect coronavirus-seeking behavior versus coronavirus releases in the Middle East in 2020. Findings show that people in the Middle East use various keyword solutions to search for COVID-19 in Google. There is a significant correlation between coronavirus confirmed cases and scientific productivity (January 2020–December 2020). Also, there is a positive association between the number of deaths and the number of scientific publications (except Jordan). It was a positive and significant association between online coronavirus-seeking behavior on Google (RSVs) and the confirmed cases (except Syria and Yemen). Furthermore, it was a positive relationship between RSVs and scientific productivity in the Middle East (except Bahrain and Qatar). From an infodemiological viewpoint, there is a significant correlation between coronavirus information demand and its information provision. Alwahaibi N. and others [2] searched for official websites from the Ministries of Health and other official sources in all 22 Arab countries. Medline, Science Direct and Google Scholar websites were also used to search for COVID-19, 2019 novel coronavirus, SARS-CoV-2 and coronavirus. The time period was from 1 January 2020 to 31 May 2020. The results: As of May 31, 2020, COVID-19 has caused 290,428 confirmed cases, 3,696 deaths and 157,886 cured cases in all Arab countries. In terms of confirmed cases, Saudi Arabia followed by Qatar, UAE, Kuwait and Egypt have the highest reported cases. However, the total number of deaths was dominant in Egypt, followed by Algeria, Saudi Arabia, Sudan and UAE. In comparison to other non-Arab countries and confirmed cases, Arab countries come fourth after USA, Brazil and Russia. In terms of death, the Arab world is not listed as the top ten affected countries as only scored eight deaths per million have been recorded.

ANOVA was used to compare several variables or groups in order to find out the possibility of significant differences between those variables or not by knowing the value of F in the analysis of variance table. If the value of F is greater than the tabular value of F, then the null hypothesis H_0 is rejected and also we conclude that there are significant differences

between the variables. But if the value of F in the analysis of variance table is less than the table F value, then we accept the null hypothesis H_0 and we conclude from this that there are no significant differences between the variables. Later, other statistical methods or multiple comparison tests were proposed, where the least significant difference test is one of those tests and the most widely used. This test depends on finding the least significant difference between the arithmetic means of the variables under study and at a known level of significance, where the absolute value of the difference between the arithmetic mean of any two pairs of variables is compared with the value of LSD, and the final result of these couplers helps us to make a decision about important pairs. A number of special tests for multiple comparisons were compared based on simulation (by Kramer and Swanson) and it was found that the LSD method is the most effective way to find out the significant differences between variables, as it was applied when the tabular F value in the ANOVA table was a significant value.

II. RESEARCH IMPORTANCE

The importance of the research lies in the following:

1. Knowing the significant differences in the number of corona virus infections in general among the selected Arab countries under study.
2. Knowing the significant differences in the number of injuries between each two Arab countries under study.
3. Clarifying the number of Corona virus infections for the month of February 2022, and paying attention to the details of the number in this month.

III. MATERIALS AND METHODS

A. Completely Randomized Design CRD

The Completely randomized design CRD refers to the random assignment of experimental units to a set of treatments. It is essential to have more than one experimental unit per treatment to estimate the magnitude of experimental error and to make probability statements concerning treatment effects. We can use the ANOVA table for CRD with equal replication by following table: [3],[4],[3],[8].

Table 1. Analysis of variance (ANOVA) for CRD with equal replication

S.O.V	df	SS	MS	$F\ cal.$
Treatment	$t-1$	$\sum \frac{Y_i^2}{r} - CF$	$\frac{SST}{t-1}$	$\frac{MST}{MSE}$
Error	$t(r-1)$	$SST - SSt$	$\frac{SSE}{t(r-1)}$	
Total	$tr-1$	$\sum Y_{ij}^2 - cf$		

Where , S.O.V = source of variation, df = degree of freedom, SS = sum of squares, MS = mean square. Also the analysis of variance ANOVA for CRD with unequal replication can use it depend on the following table:

Table 2. Analysis of variance (ANOVA) for CRD with unequal replication

S.O.V	df	SS	MS	$F\ cal.$
Treatment	$t-1$	$\sum \frac{Y_i^2}{r_i} - cf$	$\frac{SST}{t-1}$	$\frac{MST}{MSE}$
Error	$\sum r_i - t$	$SST - SSt$	$\frac{SSE}{\sum r_i - t}$	
Total	$\sum r_i - 1$	$\sum Y_{ij}^2 - cf$		

B. Practical Example

- With Equal Replication (Equal sample size) : The number of (COVID-19) for the month of February 2022 for some selected Arab countries is shown in the following table .Find a table of analysis of variance (ANOVA) to find out whether there are significant differences between the number of injuries in the Arab countries or not.

Table 3-A. The number of corona virus infections for some Arab countries (February 2022), when the data is equal frequencies (equal sample size).

R= N	Iraq A	Kuwait B	UAE C	Amman D
1	1203	584	605	563
2	945	607	622	507
3	878	582	644	693
4	1603	846	696	696
5	1499	866	782	974
6	1736	1012	740	1224
7	1685	1053	626	1036
8	2074	1329	651	1123
9	1159	1195	725	1027
10	1234	1019	790	1478
11	2326	1348	882	1440
12	2246	1501	895	1430
13	2639	1917	957	1511
14	2984	2166	930	1979
15	3011	2562	1191	1342
16	2036	2268	1266	1295
17	2014	2254	1395	2065
18	3776	2896	1474	1743
19	4220	3324	1588	2356
20	4681	3463	1538	2303
21	5360	3989	1615	2410
22	5285	4294	1704	2084
23	3589	4232	2015	1538
24	4316	4445	1991	2524
25	6569	5407	2114	1998
26	6949	5990	2232	2335
27	8293	6592	2163	2828
28	7901	6436	2084	2420
SUM	92211	74177	34915	44921

Table 3-B. The number of corona virus infections for some Arab countries (February 2022), when the data is equal frequencies (equal sample size).

R= N	Bahrain E	Qatar F	Morocco G	Egypt H
1	2916	311	83	1521
2	2416	308	142	1743
3	2599	297	188	1811

4	2732	326	259	1832
5	3006	343	362	1892
6	3425	365	357	1989
7	2885	394	427	2003
8	3904	416	190	2009
9	3260	442	298	2025
10	3651	434	524	2053
11	3762	452	508	2071
12	4288	447	636	2101
13	4839	498	645	2117
14	4818	547	822	2129
15	5266	601	369	2131
16	4623	613	634	2145
17	5750	607	969	2179
18	6104	657	1148	2189
19	6818	783	1333	2191
20	7121	776	1499	2194
21	7042	819	1618	2272
22	7709	923	721	2301
23	7434	912	1202	2298
24	7273	903	2067	2291
25	8063	997	2266	2281
26	7854	1183	2861	2278
27	8173	1245	3051	2291
28	5808	1236	3080	2223
SUM	143539	17835	28259	58560

Table 3-C. The number of corona virus infections for some Arab countries (February 2022), when the data is equal frequencies (equal sample size).

R= N	Algeria I	Syria J	Lebanon K	Libya L
1	77	100	1533	1394
2	72	105	2428	0
3	103	115	2727	938
4	115	120	3152	1276
5	123	128	3748	1373
6	164	128	3978	1815
7	147	125	3101	2307
8	118	132	3145	2292
9	251	124	3729	0
10	316	125	4090	1208
11	375	130	5211	2457
12	424	137	6063	2884
13	405	130	3731	2490
14	413	130	3717	2800
15	526	125	4443	3648
16	503	122	5935	0
17	532	126	6954	3345
18	518	135	6060	3733
19	585	124	8488	3272

20	610	114	6482	3326
21	502	90	6351	2832
22	378	89	6147	4242
23	792	85	8472	0
24	970	85	8472	3917
25	951	87	9446	3656
26	1365	86	10760	4371
27	1403	81	7314	4266
28	1343	61	6279	4429
SUM	14081	3139	151911	68311

There are several steps to find a table of analysis of variance and then conclude whether there are significant differences between the number of infections with the Corona virus for the month of February for some Arab countries under study. We will start with these steps one by one.

Step 1. Write the hypotheses to be tested

$H_0: \mu_1 = \mu_2 = \cdots = \mu_{12}$

$H_1: \mu_1 = \mu_2 = \cdots \neq \mu_{12}$

Step 2. Calculate the Correction Factor:

$CF = \frac{Y_{\cdots}^2}{tr} = 1594099987.7$

Step 3. Calculate the total SS (SST)

SST=$\sum Y_{ij}^2 - CF = = 1491373775.2$

Step 4. Calculate the treatment SS (SSt)

SSt=$\sum \frac{Y_i^2}{r} - CF = = 918146378.9$

Step 5. Calculate the Error SS(SSE)

SSE=$SST - SSt = 573227396.3$

Step 6. Complete the ANOVA table

Table 4. Table of analysis of variance for corona virus data when using a completely randomized design based on equal replications (equal sample size).

S.O.V	df	SS	MS	F cal.
Treatment	11	918146378.9	83467852.6	47.2
Error	324	573227396.3	1769220.3	
Total	336	1491373775.2		

Step 7. Look up table F-values : $F_{(11,324,0.05)} = 1.75$

Step 8. Make conclusion: Since $F_{calc}(47.17) > F_{(11,324,0.05)} = (1.75)$, we reject H_0 at the 95% level of confidence.

- With Unequal Replication (Unequal sample size): The number of (COVID-19) for the month of February 2022 for some selected Arab countries is shown in the following table. Find a table of analysis of variance (ANOVA) to find out whether there are significant differences between the number of injuries in the Arab countries or not.

Table 5-A. The number of corona virus infections for some Arab countries (February 2022), when the data is unequal frequencies (unequal sample size).

R=N	Iraq	Kuwait	UAE	Amman

	A	B	C	D
1	1203	584	605	563
2	945	607	622	507
3	878	582	644	693
4	1603	846	696	696
5	1499	866	782	974
6	1736	1012	740	1224
7	1685	1053	626	1036
8	2074	1329	651	1123
9	1159	1195	725	1027
10	1234	1019	790	1478
11	2326	1348	882	1440
12	2246	1501	895	1430
13	2639	1917	957	1511
14	2984	2166	930	1979
15	3011	2562	1191	1342
16	2036	2268	1266	1295
17	2014	2254	1395	2065
18	3776	2896	1474	1743
19	4220	3324	1588	2356
20	4681	3463	1538	2303
21	5360	3989	1615	2410
22	5285	4294	1704	2084
23	3589	4232	2015	1538
24	4316	4445	-	2524
25	6569	5407	-	1998
26	-	5990	-	2335
27	-	6592	-	2828
28	-	-	-	2420
SUM	69068	67741	24331	44921

Table 5-B. The number of corona virus infections for some Arab countries (February 2022), when the data is unequal frequencies (unequal sample size).

R=N	Bahrain E	Qatar F	Morocco G	Egypt H
1	2916	311	83	1521
2	2416	308	142	1743
3	2599	297	188	1811
4	2732	326	259	1832
5	3006	343	362	1892
6	3425	365	357	1989
7	2885	394	427	2003
8	3904	416	190	2009
9	3260	442	298	2025
10	3651	434	524	2053
11	3762	452	508	2071
12	4288	447	636	2101
13	4839	498	645	2117
14	4818	547	822	2129
15	5266	601	369	2131

16	4623	613	634	2145
17	5750	607	969	2179
18	6104	657	1148	2189
19	6818	783	1333	2191
20	7121	776	1499	2194
21	7042	819	1618	2272
22	7709	923	721	2301
23	7434	912	1202	2298
24	7273	903	2067	2291
25	8063	997	2266	2281
26	7854	1183	2861	2278
27	-	1245	3051	-
28	-	-	3080	-
SUM	129558	16599	28259	54046

Table 5-C. The number of corona virus infections for some Arab countries (February 2022), when the data is unequal frequencies (unequal sample size).

R=N	Algeria I	Syria J	Lebanon K	Libya L
1	77	100	1533	1394
2	72	105	2428	0
3	103	115	2727	938
4	115	120	3152	1276
5	123	128	3748	1373
6	164	128	3978	1815
7	147	125	3101	2307
8	118	132	3145	2292
9	251	124	3729	0
10	316	125	4090	1208
11	375	130	5211	2457
12	424	137	6063	2884
13	405	130	3731	2490
14	413	130	3717	2800
15	526	125	4443	3648
16	503	122	5935	0
17	532	126	6954	3345
18	518	135	6060	3733
19	585	124	8488	3272
20	610	114	6482	3326
21	502	90	6351	2832
22	378	89	6147	4242
23	792	85	8472	0
24	970	85	8472	3917
25	951	87	9446	3656
26	1365	86	10760	-
27	-	81	7314	-
28	-	61	6279	-
SUM	11335	3139	151911	55245

Steps to find ANOVA:

Step 1. Write the hypotheses to be tested

$H_0: \mu_1 = \mu_2 = \cdots = \mu_{12}$

$H_1: \mu_1 = \mu_2 = \cdots \neq \mu_{12}$

Step 2. Calculate the Correction Factor:

$CF = \frac{Y_{ij}^2}{\sum r_i} = 1358160124.3$

Step 3. Calculate the total SS (SST)

SST = $\sum Y_{ij}^2 - CF = 1311025370.6$

Step 4. Calculate the treatment SS (SSt)

$SSt = \sum \frac{Y_i^2}{r_i} - CF = 848627713.2$

Step 5. Calculate the Error SS(SSE)

SSE=$SST - SSt = 462397657.3$

Step 6. Complete the ANOVA table

Table 6. Table of analysis of variance for corona virus data when using a completely randomized design based on unequal replications (unequal sample size).

S.O.V	df	SS	MS	F cal.
Treatment	11	848627713.2	77147973.9	50.8
Error	305	462397657.3	1516057.8	
Total	316	1311025370.6		

Step 7. Look up table F-values : $F_{table} = 1.75$,

Step 8. Make conclusion : Since F_{calc} (50.8) > F_{table} (1.75), we $reject\ H_0$ at the 95% level of confidence.

C. Least Significant Difference (LSD)

The LSD is called an F-protected LSD because it is calculated and used only when H_0 rejected. We calculate the LSD only when H_0 rejected. $LSD = t_{\frac{\propto}{2}} \times S_{\overline{Y_1} - \overline{Y_2}}$, and df for t = Error df

- If $r_1 = r_2 = \cdots = r_n$, then $S_{\overline{Y_1} - \overline{Y_2}} = \sqrt{\frac{2MSE}{r}}$,
- If $r_i \neq r_{i'}$, then $S_{\overline{Y_1} - \overline{Y_2}} = \sqrt{MSE\left(\frac{1}{r_i} + \frac{1}{r_i'}\right)}$

If the different between two treatment means is greater than the LSD, then those treatment means are significantly different at the $1-\propto$ % level of confidence. [1],[2],[3]. We continue with example 1. We have the following treatment means

Table 7. Corona virus infection mean for some Arab countries for the month of February 2022 when equal replication (equal sample size).

Treat.	A	B	C
Mean	3293.25	2649.17	1246.96
Tret.	D	E	F
Mean	1604.32	5126.39	636.96
Treat.	G	H	I
Mean	1009.25	2091.42	502.89
Treat.	J	K	L
Mean	112.11	5425.39	2439.67

Step 1. Calculate the LSD value

$LSD = t_{\frac{\propto}{2}} \times S_{\overline{Y_1} - \overline{Y_2}} = 696.7$

We round the value 696.7 to 697.

Step 2. Making a table 8:

Table 8. Rank treatment means from low to high in Table 7.

Treat.	J	I	F
Mean	112.11	502.89	636.96
Treat.	G	C	D
Mean	1009.25	1246.96	1604.32
Treat.	H	L	B
Mean	2091.43	2439.68	2649.18
Treat.	A	E	K
Mean	3293.25	5126.39	5425.39

Step 3. Calculate differences between treatment means to determine which ones are significantly different from each other. If the difference between two treatment means is greater than LSD value , then those treatment means are significantly different at the 95% level of confidence.

Table 9. Result of the significant differences between the average number of injuries for each two Arab country

Treat's pair	$\bar{X}_\iota - \bar{X}_J$	LSD	Conclusion
Syria& Algeria	390.78	697	Not Sig.
Syria& Qatar	524.85	697	Not Sig.
Syria& Morocco	897.14	697	Sig.
Algeria& Qatar	134.04	697	Not Sig.
Algeria& Morocco	506.36	697	Not Sig.
Algeria& UAE	744.07	697	Sig.
Qatar& Morocco	372.29	697	Not Sig.
Qatar& UAE	610	697	Not Sig.
Qatar & Amman	967.36	697	Sig.
Morocco& UAE	237.71	697	Not Sig.
Morocco& Amman	595.07	697	Not Sig.
Morocco& Egypt	1082.18	697	Sig.
UAE & Amman	357.36	697	Not Sig.
UAE & Egypt	844.47	697	Sig.
Amman & Egypt	487.11	697	Not Sig.
Amman & Libya	835.36	697	Sig.
Egypt&	348.25	697	Not

Libya			Sig.
Egypt& Kuwait	557.75	697	Not Sig.
Egypt& Iraq	1201.82	697	Sig.
Libya & Kuwait	209.5	697	Not Sig.
Libya & Iraq	853.57	697	Sig.
Kuwait& Iraq	644.07	697	Not Sig.
Kuwait& Bahrain	2477.21	697	Sig.
Iraq& Bahrain	1833.14	697	Sig.
Bahrain& Lebanon	299	697	Not Sig.

Table 10: The final result of extracting the moral differences between the number of injuries for some Arab countries for the month of February of 2022, based on the test of the least significant difference. (with equal replications or equal sample size)

Treat.	J	I	F
Mean	112.11_{a}	502.89_{ab}	636.96_{abc}
Treat.	G	C	D
Mean	1009.25_{bcd}	1246.96_{cd}	1604.32_{de}
Treat.	H	L	B
Mean	2091.43_{ef}	2439.68_{f}	2649.18_{fg}
Treat.	A	E	K
Mean	3293.25_{g}	5126.39	5425.39

In the case of unequal repetitions, we apply the data in example 2 to have the following treatment means.

Table 11: corona virus infection mean for some Arab countries for the month of February 2022 when unequal replication (unequal sample size).

Treat.	A	B	C
N=R	25	27	23
Mean	2762.72	2508.92	1057.87
Treat.	D	E	F
N=R	28	26	27
Mean	1604.32	4983	614.78
Treat.	G	H	I
N=R	28	26	26
Mean	1009.25	2078.69	435.96
Treat.	J	K	L
N=R	28	28	25
Mean	112.11	5425.39	2209.8

Step 1. Calculate the LSD values

LSD.1: Treat. A or L & Treat. B or F:

$$=1.960\sqrt{1516057.8\left(\frac{1}{25}+\frac{1}{27}\right)}\cong 669.8$$

LSD.2: Treat. A or L & Treat. C:

$$=1.960\sqrt{1516057.8\left(\frac{1}{25}+\frac{1}{23}\right)}\cong 697.3$$

LSD.3: Treat. A or L & Treat. D or G or J or K:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{25}+\frac{1}{28}\right)} \cong 664.1$$

LSD.4: Treat. A or L & Treat. E or H or I:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{25}+\frac{1}{26}\right)} \cong 676$$

LSD.5: Treat. A & Treat. L :

$$= 1.960\sqrt{1516057.8\left(\frac{1}{25}+\frac{1}{25}\right)} \cong 682.6$$

LSD.6: Treat. B or F & Treat. C :

$$= 1.960\sqrt{1516057.8\left(\frac{1}{27}+\frac{1}{23}\right)} \cong 684.8$$

LSD.7: Treat. B or F & Treat. E or H or I:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{27}+\frac{1}{26}\right)} \cong 663.11$$

LSD.8: Treat. B or F & Treat. D or G or J or K:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{27}+\frac{1}{28}\right)} \cong 651$$

LSD.9: Treat. B & Treat. F:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{27}+\frac{1}{27}\right)} \cong 657$$

LSD.10: Treat. C & Treat. E or H or I:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{23}+\frac{1}{26}\right)} \cong 691$$

LSD.11: Treat. C & Treat. D or G or J or K:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{23}+\frac{1}{28}\right)} \cong 679.14$$

LSD.12: Treat. C & Treat. C:

$$=1.960\sqrt{1516057.8\left(\frac{1}{23}+\frac{1}{23}\right)} \cong 711.65$$

LSD.13: Treat. E H I & Treat. D or G or J or K:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{26}+\frac{1}{28}\right)} \cong 657.3$$

LSD.14: Treat. E & Treat. H or I:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{26}+\frac{1}{26}\right)} \cong 669.33$$

LSD.15: Treat. D & Treat. G or J or K:

$$= 1.960\sqrt{1516057.8\left(\frac{1}{28}+\frac{1}{28}\right)} \cong 645$$

Step 2. Making a table 11

Table 12: Rank treatment means from low to high in table 10.

Treat.	J	I	F
N=R	28	26	27
Mean	112.11	435.96	614.78
Treat.	G	C	D
N=R	28	23	28
Mean	1009.25	1057.87	1604.32
Treat.	H	L	B
N=R	26	25	27
Mean	2078.69	2209.8	2508.93

Treat.	A	E	K
N=R	25	26	28
Mean	2762.72	4983	5425.39

Step 3. Calculate differences between treatment means to determine which ones are significantly different from each other. If the difference between two treatment means is greater than LSD value , then those treatment means are significantly different at the 95% level of confidence.

Treat. I & Treat. J: $323.85^{ns} < LSD.13$

Treat. F & Treat. J :$502.69^{ns} < LSD.8$

Treat. G & Treat. J: $897.14^{*} > LSD.15$

Treat. F & Treat. I : $178.84^{ns} < LSD.7$

Treat. G & Treat. I : $573.29^{ns} < LSD.13$

Treat. C & Treat. I: $612.91^{ns} < LSD.10$

Treat. D & Treat. I : $1167.36^{*} > LSD.13$

Treat. G & Treat. F: $394.45^{ns} < LSD.8$

Treat. C & Treat. F: $443.07^{ns} < LSD.6$

Treat. D & Treat. F: $989.52^{*} > LSD.8$

Treat. C & Treat. G: $48.62^{ns} < LSD.11$

Treat. D & Treat. G:$595.07^{ns} < LSD.15$

Treat. H & Treat. G: $1069.44^{*} > LSD.13$

Treat. D & Treat. C: $546.451^{ns} < LSD.11$

Treat. H & Treat. C: $1020.82^{*} > LSD.10$

Treat. H & Treat. D: $474.38^{ns} < LSD.13$

Treat. L & Treat. D: $605.48^{ns} < LSD.3$

Treat. B & Treat. D: $904.58^{*} > LSD.8$

Treat. L & Treat. H:$131.1^{ns} < LSD.4$

Treat. B & Treat. H: $430.2^{ns} < LSD.7$

Treat. A & Treat. H: $684.02^{*} > LSD.4$

Treat. B & Treat. L: $299.13^{ns} < LSD.1$

Treat. A & Treat. L: $552.92^{ns} < LSD.1$

Treat. E & Treat. L: $2773.2^{*} > LSD.4$

Treat. A & Treat. B: $253.79^{ns} < LSD.1$

Treat. E & Treat. B: $2474.1^{*} > LSD.7$

Treat. E & Treat. A: $2220.28^{*} > LSD.4$

Treat. K & Treat. E: $442.4^{ns} < LSD.13$

Then we have the results in the following table

Table 13: the final result of extracting the moral differences between the number of injuries for some Arab countries for the month of February of 2022, based on the test of the least significant difference. (when unequal replications or unequal sample size)

Treat.	J	I	F
N=R	28	26	27
Mean	112.11_{a}	435.96_{ab}	614.78_{ab}
Treat.	G	C	D
N=R	28	23	28
Mean	1009.25_{bc}	1057.87_{bc}	1604.32_{cd}
Treat.	H	L	B
N=R	26	25	27
Mean	2078.69_{de}	2209.8_{def}	2508.93_{ef}
Treat.	A	E	K

N=R	25	26	28
Mean	2762.72_f	4983	5425.39

IV. CONCLUSION

1. When using a complete randomized design, we derive the following observations:

- From Table 4, Since $F_{calc}(47.17) > F_{table}\ (1.75), so$ we reject H_0 at the 95% level of confidence. We conclude that there are clear moral differences in the number of coronavirus infections among some Arab countries for the month of February of the year 2022 , when we use equal sample size.
- From Table 6, Since $F_{calc}\,(50.8) > F_{table}\,(1.75)$, we reject H_0 at the 95% level of confidence. We conclude that there are clear moral differences in the number of coronavirus infections among some Arab countries for the month of February of the year 2022 , when we use unequal sample size.

2. When we use the least significant difference test, we can deduce the following observations:

- Through Table 10 and when the number of sample size are equal, there are high moral differences in the number of corona virus infections for the month of February of 2022 between some Arab countries without others, for example (between Syria and Morocco), (UAE and Algeria), (Oman and Qatar), (Morocco and Egypt), (Egypt and the Emirates), (Egypt and the Emirates), (Oman and Qatar), (Morocco and Egypt), (Egypt and the Emirates), (Oman and Libya), (Iraq and Egypt), (Iraq and Libya), (Bahrain and Kuwait), (Bahrain and Iraq).
- Through Table 13 and when the number of sample size are unequal, There are high moral differences in the number of corona virus infections for the month of February of 2022 between some Arab countries without others, for example (Syria and Morocco), (Oman and Algeria), (Qatar and Oman), (Morocco and Egypt), (UAE and Egypt), (Kuwait and Oman), (Iraq and Egypt), (Bahrain and Libya), (Bahrain and Kuwait) , (Bahrain and Iraq)

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