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COMPARING BRUCELLOSIS INFECTIONS IN SAUDI ARABIA REGIONS AND ESTIMATING ITS GENERAL TREND (2010-2020)

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ABSTRACT

This study compares Brucellosis infections in Saudi Arabia regions (13 regions) and estimating its general trend for the period (2010-2020), statistical methods used to analyze data were descriptive statistics, Analysis of variance, Kruskal Wallis and least square method. The study concluded that there is a significant difference between Brucellosis infections in Saudi Arabia regions and the trend in coming years is increasing as general and recommended that more care must be given to the regions Macca, Qaseem and Aseer.

Key words: Brucellosis, infections, comparing infections and trend

Introduction

Brucellosis constitutes a major health and economic problem in many parts of the world, including countries of the Mediterranean Basin, the Middle East, and the Arabian Gulf⁽⁵⁾. It is primarily a contagious disease of domestic animals—goats, sheep, cows, camels, and dogs. Interhuman transmission of brucellosis has been rarely reported. ⁽¹⁾ Humans are commonly infected through ingestion of raw milk, cheese or meat, or through direct contact with infected animals, products of conception or animal discharges (e.g., among shepherds, farmers and veterinarians), and through inhalation of infectious aerosols (e.g., by workers in abattoirs and microbiology laboratories). The Infection found in both male and female for all ages.

Although the number of infected people in Kingdom of Saudi Arabia (KSA) decreases from 4460 in 2010 to 2372 in 2020, but it still high, in addition, in terms of the number of infections, it tops the list of infectious diseases in 2020 which constitutes a problem and calls for attention to the disease

and conducting studies and research about it. The paper focuses on testing if there is a significant difference between number of infections in the different regions in KSA or not. The important of this paper arises from that it gives a clear picture for the most infected regions, so there must be high attention and more care to reduce infection in these regions.

Source of data: The source of data is the yearly books issued by ministry of health in KSA from (2010 to 2020).

Hypothesis: HO: There is no statistically significant relationship between infections by Brucellosis in KSA regions.

H1: There is statistically significant relationship between infections by Brucellosis in KSA regions

Analysis Method: Analysis done by SPSS (version 22) and Minitab. The data analysis process of this study included two stages. The first is a descriptive analysis to describe the data. The second stage is hypothesis testing with analysis of variance (ANOVA), one-way analysis to test is there is statistically significant relationship between infection by Brucellosis in KSA regions or not. Using ANOVA since there are more than two groups, this in case the data fulfilled the ANOVA conditions, if not the non-parametric test "Kruskal Wallis will be used because it can work when ANOVA conditions unfulfilled.

Data:

Year	Riyadh	Mecca	Madinah	Qaseem	Eastern	Aseer	Tabuk	Hail	Northern	Jazzan	Najran	Albaha	Aljouf	Total
2010	289	406	353	1047	544	1049	60	322	81	68	209	34	7	4469
2011	375	269	236	782	581	877	60	389	84	50	201	25	13	3942
2012	452	226	176	907	487	793	13	209	118	62	121	79	18	3661
2013	302	289	170	824	463	336	21	241	268	65	142	110	33	3264
2014	249	287	181	686	469	353	22	178	236	32	222	137	58	3110
2015	375	269	236	782	581	877	60	389	84	50	201	25	13	3942
2016	216	603	151	635	473	572	144	230	507	22	333	132	44	4062
2017	286	820	224	535	654	656	122	103	432	7	720	76	57	4692
2018	782	1401	285	422	542	660	132	124	309	5	556	126	123	5467
2019	511	1019	332	310	469	409	148	379	188	15	315	58	104	4257
2020	366	574	114	234	328	205	49	219	52	7	188	20	36	2392
Total								278			320			
	4203	6163	2458	7164	5591	6787	831	3	2359	383	8	822	506	

Table (1): Infections by Brucellosis in KSA from 2010 to 2020 by regions

Source: yearly books issued by ministry of health in KSA from (2010 to 2020).

Descriptive analysis:

Comparing infections in 2010 with in 2020, there is decrease in infections in all regions accept in Riyadh and Macca regions. The highest infections were in Macca region in 2018. Generally, there is decrease in total of infections from 2010 to 2014, then increased till 2019 and then registered a clear decrease in 2020 as in the graph below:



Graph (1): Total number of infections by Brucellosis from 2010 to 2020 in KSA:

The following graph shows the total number of infections in all regions from 2010 to 2020 in descending order:



Graph (2): Total number of infections by Brucellosis in all regions of KSA from 2010 to 2020

The graph shows that the highest infections from 2010 to 2020 was in Qaseem region (7164) and the lower was in Jazan region (383).



Graph (3): Comparison of infection between 2019 and 2020 in all regions

Graph (3) compares number of infections by Brucellosis in 2010 and 2020 for all regions to show the change during the interval of study and it's obvious that there is decrease in all regions.

City	Riyadh	Mecca	Madinah	Qaseem	Eastern	Aseer	Tabuk	Hail	Northern	Jazzan	Najran	Albaha	Aljouf
Average													
OT													
infections	382	560	223	651	508	617	75	253	214	34	291	74	46
Range	566	1175	239	813	326	844	135	286	455	63	599	117	116
Standard deviation	159	380	75	254	86	268	51	103	153	25	186	46	38

Table (2): Descriptive Statistics for infections by Brucellosis in all regions

Source: done by the researcher

Table (2) shows that there are large variations in averages and ranges and standard deviations, which gives indication for variety of infections among regions.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average of infections	344	303	282	251	239	303	312	361	421	327	184
Range	1040	864	894	791	664	964	601	813	1396	1004	567
Standard deviation	354	288	296	216	185	288	218	288	380	260	166

Table (3): Descriptive Statistics for infections by Brucellosis in all years

Source: done by the researcher

Table (3) shows that variations in averages and ranges and standard deviations are less than between regions in table (1), which gives indication for less variety of infections among years than among

regions. Also, the average of infections decreased from in 2020 to184 case Which means the success of the control methods used.

Data analysis:

Comparing infections: ANOVA requires Normality of Data and Homogeneity of Groups variances ⁽⁴⁾, so they should be tested first to see if ANOVA can be applied or not. Testing normality of data using independent sample t-test, some groups have P-vale less than 0.05 which indicate that they are not normal. Also testing homogeneity of Groups variances using Kolmogorov Smirnov Gives some P-vale less than 0.05 indicating that there is no homogeneity of Groups variances. Therefore, ANOVA cannot be applied. So, the non-parametric test "Kruskal Wallis" will be used because it can work when ANOVA conditions unfulfilled, "The Kruskal-Wallis test is considered a non-parametric test, and it is similar to the one-way analysis of variance test, except that when one of the conditions of one-way analysis of variance, such as the condition of normality or the condition of homogeneity of variance, is unfulfilled, it is possible to Apply the Kruskal-Wallis test "⁽⁴⁾

Kruskal Wallis Result: Kruskal Wallis test shows zero P-value which is less than 0.05 indicating that there is significant difference between groups, this decision based on Ramsey " You can reject H0 if the P-value associated with Kruskal Wallis < 0.05, otherwise you must fail to reject it"⁽³⁾

To know the source of this variation post hoc test should be done" Tests that enable to narrow our conclusion to specifically where these population inequalities are to be found" ⁽⁷⁾, and the best test is scheffe test, since it can be used even the data is not normal and there are heterogeneous variances. The following are the P-value less than 0.05 according to scheffe test which indicate there is significant difference between these regions:

Regions	Macca-Tabuk	Macca-Jazan	Macca-Albaha	Macca-Aljouf
P-value	0`	0	0	0
Regions	Maddinah-Qaseem	Maddinah-	Qassem-Tabuk	Qaseem-Hail
		Eastern		
P-value	0.002	0.009	0	0.008
Regions	Qaseem-Northrn	Qaseem-Jazan	Qaseem-Najran	Qaseem-Albaha
P-value	0.001	0	0.033	0
Regions	Qaseem-Aljouf	Eastern-Tabuk	Eastern-Jazan	Eastern-Albaha
P-value	0	0.002	0	0.008
Regions	Eastern-Aljouf	Aseer-Tabuk	Aseer-Hail	Aseer-Northern
P-value	0	0	0.029	0.07
Regions	Aseer-Jazan	Aseer-Albaha	Aseer-Aljouf	
P-value	0	0	0	

Table (4): Regions have significant difference due to Scheffe test

Source: done by the researcher

The Differences in favor of the regions Macca, Qaseem, Aseer, Madinah and Eastern.

Table (4) shows that Qaseem, Aseer and Macca have the higher infections 7164, 6787 and 6163 respectively and this due to that these regions have a big animal wealth compared to other regions.

Infections general trend:

The trend is the long run-term movement of a time series, there are many methods for estimating trend but here the method used is the least square method (LSM) to estimate the infections trend of Brucellosis in KSA.

The trend equation is ⁽²⁾

$$y_t = a + bx$$

Where, y_t is the infections at time t

- *a* and *b* are constants
- *x* is the time found from the value of *t*

Applying LSM yield the following trend equation:

$$y_t = 3927 + 0.9x$$

So, the coming estimations for infections from 2021 to 2025 as in table (5):

Table (5): Estimation of infections from 2021 to 2025

year	2021	2022	2023	2027	2025
estimation	3938	3939	3940	3941	3942

Source: done by the researcher

It is obvious that its increasing time series, but its slight increase and this result comes from high infections in some years. But if we look to table (1) we find that total infections in 2020 witnessed a great decrease, which means there was good control to the disease, and this may affect the estimated infections for coming years by decrease.

Results:

According to the previous analysis is the following results were listed:

- There is significant difference between averages of infections by Brucellosis in KSA regions.
- The Differences in favor of the regions Macca, Qaseem, Aseer, Madinah and Eastern, because they has a big animal wealth than other regions.
- The regions Qaseem, Aseer and Macca have the heist average of infections.
- The year 2020 witnessed a great decrease in the number of infections in all regions indicating good control for the disease.
- The regions Jazan, Aljouf and Tabuk have the lowest average of infections.
- Coming years may witness decrease in total infections in KSA, although the trend shows an increase, because the last year 2020 witnessed great decrease compared to the years before.

Recommendations:

- More care must be given to the regions Macca, Qaseem and Aseer.
- Continuing in the same plan for controlling the disease.

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