IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 8, Issue 6, December- January, 2021
ISSN: 2320 – 8791 (Impact Factor: 2.317)
www.ijreat.org

Is there any effect of coronavirus, COVID-19 on relative humidity and temperature?

Ranabir Chanda[1*], Sanjib Bahadur[2], Dr. Subhasis Samanta[3], Pragya Baghel[2]
[1]Sana College of Pharmacy, Kodad, Telangana, India
[2]Columbia Institute of Pharmacy, Vill. Tekari, Near Vidhan Sabha, Raipur (CG), India
[3]Medical Practitioner, Binayak Multispeciality Hospital, Sinthee, Kolkata, West Bengal, India.

Abstract
A novel human virus called coronavirus, COVID-19, has become a new pandemic disease since last week of December, 2019. It causes severe respiratory tract infections in humans. It is transmitted from human to human within a incubation times between two to ten days. It is spread via droplets, contaminated hands or organic or inorganic surfaces. Several case studies have been observed as per age group and socio-economic conditions of patients, density of population and the effect of corona virus on different zones. In our case study, we would like to highlight the effect of relative humidity and temperature on corona virus infection. We have observed the effect of relative humidity and temperature of different countries though out the world on corona virus. Data were collected from various reports and surveys, published in World Health Organization (WHO) websites and worldometer. As per our observation, it can be concluded that the coronavirus, COVID-19, is not significantly affected by humidity ($p>0.05$) whereas temperature is affecting cases of COVID-19 significantly.

Key words: coronavirus, COVID-19, relative humidity, temperature

Introduction

In early December 2019, a number of pneumonia cases of unknown origins found in Wuhan, Hubei province, China (1,2). It was reported that most of the patients exposed to the Huanan Seafood Wholesale Market selling many species of live animals. The disease rapidly spread to other parts of China, and globally, to many countries. On January, 3 2020, a new member of enveloped RNA coronavirus was identified in samples of bronchoalveolar lavage fluid from a patient in Wuhan and this case was confirmed as the cause of this disease by the Chinese Center for Disease Control and Prevention (China CDC) (3). On 7th January, 2020, the World Health Organization (WHO) declared it as the 2019 novel coronavirus (i.e., 2019-nCoV). On 11th February, 2020, WHO named the illness associated with 2019-nCoV as the 2019 coronavirus disease or COVID-19 (4).
Immediately this disease COVID-19 has been spread on Europe, then North America and ultimately whole world. WHO has declared the COVID-19 a public health emergency of international concern (PHEIC) (5). This COVID-19 has become a pandemic disease since mid of the February, 2020, WHO declared PHEIC is an urgent call, at the highest level, for the international community to launch a global coordinated effort to stop the outbreak, which requires strong public health response, high-level political commitment and sufficient funding. The report obtained from 2nd March, 2020, a total of 80174 COVID-19 cases in China and 8774 cases in 64 countries and regions have been confirmed (6). The area of survival, epidemiological and clinical patters of the COVID-19 remain largely unclear, particularly on the effect of corona virus (COVID-19) on relative humidity and temperature. In this study we have explored the effect of relative humidity and temperature on the transmission patterns of COVID-19 in different countries.

Methods

We collected data from world meter on 29th April, 2020 (7). After collection and analyzing the data of corona virus pandemic cases from different countries, we studied the effect of relative humidity (%), temperature (°C) on spreading of corona virus or COVID-19. For our analysis, we selected different countries, their relative humidity and temperature from different zones worldwide.

Statistical Analysis

Data so collected was subjected to statistical analysis. Statistical analysis was performed using SPSS v14.0 statistical software. Two dependent factors, relative humidity (%), X1 and temperature (°C) X2 were selected. Effect of these two dependent factors was studied on number of COVID-19 infected cases per million of population of different countries.

Results and Discussions

As per observation given in table 1, we selected ten countries from South America. The average relative humidity of these ten countries was almost same. The average temperatures of all countries were between 6 to 23°C. The average relative humidity was between 39 to 95%. The highest average relative humidity was observed in Bolivia (94%) and the highest average temperature was observed in El Salvador and Paraguay (23^0C). The lowest average temperature was observed in Bolivia (6^0C) and average relative humidity was observed in Chile (39%).

Brazil was suffering from highest number of COVID-19 infected cases. It was 73235. Its number of COVID-19 infected patients per 1 million populations was also high in Brazil and it was 345. The average relative humidity and temperature of Brazil was 89% and 16°C respectively. Paraguay had the lowest number of coronavirus, COVID-19 infected patients and it was 239.The average relative humidity and temperature of Paraguay were 72% and 23^0C respectively. The highest coronavirus, COVID-19 cases per 1milium population was observed in Ecuador (1375) and the lowest was in Venezuela (12). In Brazil and Paraguay these were 345 and 34 respectively.

In table 2, three countries are there from North America. The average relative humidity of these countries was between 56 to 82% and the range of average temperature was 8 to 17^0C. The highest and lowest average humidity were found in USA (82%) and Mexico (56%). The highest and lowest average temperature were observed in Mexico (17^0C) and USA and Canada (8^0C).

USA was suffering from highest number of coronavirus, COVID-19 infected patients. It was 1035765. The average relative humidity and temperature of USA were 82% and 8^0C respectively. Mexico had the lowest number of coronavirus, COVID-19 infected patients and it was 16752. The average relative humidity and temperature of Mexico were 56% and ^{0}C respectively. The highest coronavirus, COVID-19 cases per 1milium population was observed in USA (3129) and the lowest was in Mexico (16752).

In table 3, ten European countries were included. Average relative humidity (%) and temperature of these countries were almost same. The range of humidity was 43 (Turkey) to 91% (Netherlands). The range of temperature was 10 (United Kingdom) to 19°C (Turkey). The highest and lowest average humidity were found in Netherlands (91%) and Turkey (43%). The highest and lowest average temperature were found in Turkey (19^0C) and United Kingdom (10^0C).

The highest coronavirus, COVID-19 infected patients were observed in Spain. It was 232128. In Spain, the COVID-19 infected cases per 1 million populations were 4965. It was the highest in Europe. The average relative humidity and temperature of Spain were 73% and 12^0C respectively. Portugal had the lowest number of coronavirus, COVID-19 infected patients and it was 24322. The average relative humidity and temperature of Portugal were 81% and 17^0C respectively. The highest coronavirus, COVID-19 cases per 1milium population was observed in Spain (4965) and

the lowest was in Russia (681). In Portugal, the number of coronavirus, COVID-19 cases per 1 million populations was 2385.

Ten Asian countries were included in table 4. All were having in almost similar relative humidity and temperature. The average relative humidity (%) range was 32 to 82. The relative humidity of Indonesia was highest and it was 82%. The lowest average relative humidity was observed in China (30%). The average temperature range was 22 to 33. The highest average temperature was observed in India and it was 33°C. The lowest average temperature was observed in Iran and Japan and it was 20°C. The highest coronavirus, COVID-19 infected patients was found in Iran (92584). The average relative humidity and temperature of Iran were 35% and 20^0C respectively. The lowest coronavirus, COVID-19 infected patients was found in Myanmar (150). The average relative humidity and temperature of Myanmar were 68% and 32^0C respectively. The highest and lowest coronavirus, COVID-19 infected cases per 1 million populations were found in Iran (1102) and Myanmar (3) respectively.

In table 5, ten countries from African region were selected. These countries had almost same average relative humidity (%) and temperature (°C). The average relative humidity and temperature range were 49 to 87% and 12 to 27^0C respectively. Uganda had highest (87%) and Egypt had the lowest average relative humidity (49) . Congo had the highest average temperature (28^0C) and South Africa had the lowest average temperature (12°C). Egypt had been suffering highest number of coronavirus, COVID-19 infected patients (5042). The average temperature and relative humidity of Egypt were 49% and 21^0C respectively. Angola had the lowest number of coronavirus, COVID-19 infected patients (27). The average temperature and relative humidity of Angola were 79% and 27^0C respectively. The highest coronavirus, COVID-19 cases per 1milium population was found in South Africa (84) and the lowest was in Angola (0.8). In Egypt the number of coronavirus, COVID-19 infected cases per 1 million populations was 49.

Statistical analysis was performed using SPSS v14.0 software. Estimated regression coefficients of are $\beta_0 = 2366.182$, $\beta_1 = 2.322$ and $\beta_2 = -88.868$ as expressed in table 6(a). The p-value of testing null hypothesis for effect of relative humidity (X1) $\beta_1 = 0.821$, therefore, null hypothesis was rejected. It can be concluded that there is no significant effect of relative humidity (X1) on number of infected cases COVID-19 (per million of population). However, p-value of effect of temperature (X2) was found to be $\beta_1 = 0.00$ which indicate that temperature is significantly affecting the number of COVID infection cases. R square value in table 6(b) indicates that 28.6% of total variance of number of infected case of COVID-19 is explained by the estimated regression equation, Y=2366.18+2.32*X1-88.87X2. p-value associated for this whole statistical analysis is 0.001 as shown in table 6(c). Therefore, it can be concluded that the current regression analysis describes the relationship between dependent factor (Y1) and independent factors (X1, X2). Figure 1 shows scatter plot between the X2 and Y1. It can be observed that as
the temperature increases, number of infected cases of COVID-19 decreases.

Conclusion

As per our observation in different countries worldwide, we confirmed that there is a significant effect of temperature (°C) on infection of COVID-19. However, relative humidity (%) do not have any significant effect on infection of COVID-19. After our statistical analysis we confirmed that if the temperature increases, number of infected cases of COVID-19 decreases and vice versa.

References

1. Qun Li, M.Med., Xuhua Guan, Peng Wu, Xiaoye Wang, Lei Zhou, Yeqing Tong, Ruiqi Ren, Kathy S.M. Leung, Eric H.Y. Lau, Jessica Y. Wong, Xuesen Xing, Nijuan Xiang, Yang Wu, Chao Li, Qi Chen, Dan Li, Tian Liu, Jing Zhao, Man Liu, Wenxiao Tu, Chuding Chen, Lianmei Jin, Rui Yang, Qi Wang, Suhua Zhou, Rui Wang, Hui Liu, Yinbo Luo, Yuan Liu, Ge Shao, Huan Li, Zhongfa Tao, Yang Yang, Zhiqiang Deng, Boxi Liu, Zhitao Ma, Yanping Zhang, Guoqing Shi, Tommy T.Y. Lam, Joseph T. Wu, George F. Gao, Benjamin J. Cowling, Bo Yang, Gabriel M. Leung, Zijian Feng,. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia., The new England journal of medicine., 2020, 382(13):1199-1207.
2. Chaolin Huang, Yeming Wang, Xingwang Li, Lili Ren, Jianping Zhao, Yi Hu, Li Zhang, Guohui Fan, Jiuyang Xu, Xiaoying Gu, Zhenshun Cheng, Ting Yu, Jiaan Xia, Yuan Wei, Wenjuan Wu, Xuelei Xie, Wen Yin, Hui Li, Min Liu, Yan Xiao, Hong Gao, Li Guo, Jungang Xie, Guangfa Wang, Rongmeng Jiang, Zhancheng Gao, Qi Jin, Jianwei Wang†, Bin Cao., Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China., *Lancet*. 2020;395(10223):497-506. doi: 10.1016/S0140-6736(20)30183-5.
3. Na Zhu, Dingyu Zhang, Wenling Wang, Xingwang Li, Bo Yang, Jingdong Song, Xiang Zhao, Baoying Huang, Weifeng Shi, Roujian Lu, Peihua Niu, Faxian Zhan, Xuejun Ma, Dayan Wang, Wenbo Xu, Guizhen Wu, George F. Gao, Wenjie Tan., A Novel Coronavirus from Patients with Pneumonia in China, 2019., The New England Journal of Medicine.,2020, 382(8): 727-733.
4. Roujian Lu, Xiang Zhao, Juan Li, Peihua Niu, Bo Yang, Honglong Wu, Wenling Wang, Hao Song, Baoying Huang, Na Zhu, Yuhai Bi, Xuejun Ma, Faxian Zhan, Liang Wang, Tao Hu, Hong Zhou, Zhenhong Hu, Weimin Zhou, Li Zhao, Jing Chen, Yao Meng, Ji Wang, Yang Lin, Jianying Yuan, Zhihao Xie, Jinmin Ma, William J Liu, Dayan Wang, Wenbo Xu, Edward C Holmes, George F Gao, Guizhen Wu, Weijun Chen, Weifeng Shi, Wenjie Tan., Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding., *Lancet*. 2020; 395 (10224):565-574. doi: 10.1016/S0140-6736(20)30251-8.
5. https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov). Accessed 3/3/2020.
6. Yuanyuan Dong, Xi Mo, Yabin Hu, Xin Qi, Fang Jiang, Zhongyi Jiang, Shilu Tong., Epidemiological Characteristics of 2143 Pediatric Patients With 2019 Coronavirus Disease in China., 2020, American Academy of Pediatrics, www.aappublications.org/news.
7. https://www.worldometers.info/coronavirus/

Table 1: Average Relative Humidity, Temperature, Density of Population and Number of COVID-19 Cases found in Some South American Countries

Sl No	Country	Population (Crores)	Average humidity (%)	Average Temperature (^{0}C)	Cases found	Cases/1M population
1	Argentina	4.45	80	14	4127	91
2	Bolivia	1.14	94	6	1053	90
3	Chile	1.87	39	11	14365	751
4	Colombia	4.96	95	8	5949	117
5	Peru	3.2	88	18	31190	946
6	Venezuela	2.89	78	21	329	12
7	Brazil	20.95	89	16	73235	345
8	Ecuador	1.71	93	9	24258	1375
9	El Salvador	0.642	87	23	317	58
10	Paraguay	0.696	72	23	239	34

Table 2: Average Relative Humidity, Temperature, Density of Population and Number of COVID-19 Cases found in Some North American Countries

Sl. No	Country	Population (Crores)	Average humidity (%)	Average Temperature (^{0}C)	Cases found	Cases/1M population
1	USA	32.82	82	8	1035765	3129
2	Canada	3.76	59	8	50026	1325
3	Mexico	12.62	56	17	16752	130

Table 3: Average Relative Humidity, Temperature, Density of Population and Number of COVID-19 Cases found in Some European Countries

Sl. No	Country	Population (Crores)	Average humidity (%)	Average Temperature (^{0}C)	Cases found	Cases/1M population
1	United Kingdom	6.66	77	10	161145	2374
2	France	6.7	76	14	165911	2542
3	Italy	6.04	76	18	201505	3333
4	Spain	4.69	73	12	232128	4965
5	Germany	8.3	76	12	159912	1909
6	Belgium	1.15	82	12	47334	4084
7	Turkey	8.2	43	19	114653	1359
8	Russia	14.45	68	12	99399	681
9	Netherlands	1.73	91	11	38416	2242
10	Portugal	1.03	81	17	24322	2385

Table 4: Average Relative Humidity, Temperature, Density of Population and Number of COVID-19 Cases found in Some Asian Countries

Sl. No	Country	Population (Crores)	Average humidity (%)	Average Temperature (^{0}C)	Cases found	Cases/1M population
1	China	139.27	30	25	82858	58
2	Japan	12.65	44	20	13736	109
3	Iran	8.18	35	20	92584	1102
4	Taiwan	2.38	62	30	429	18
5	Thailand	6.94	71	30	2947	42
6	India	135.26	65	33	31332	23
7	Bangladesh	16.14	70	30	6462	39
8	Indonesia	26.77	82	29	9511	35
9	Myanmar	5.39	68	32	150	3
10	Afghanistan	3.72	38	24	1828	47

Table 5: Average Relative Humidity, Temperature, Density of Population and Number of COVID-19 Cases found in Some African Countries

Sl No	Country	Population (Crores)	Average humidity (%)	Average Temperature (^{0}C)	Cases found	Cases/1M population
1	Kenya	5.14	69	22	374	7
2	Nigeria	19.59	72	27	1532	7
3	Uganda	4.27	87	22	79	2
4	South Africa	5.78	82	12	4996	84
5	Egypt	9.84	49	21	5042	49
6	Cameroon	2.52	86	24	1806	68
7	Ethiopia	10.92	63	21	126	1
8	Congo	8.41	80	28	207	38
9	Angola	3.08	79	27	27	0.8
10	Zambia	1.74	50	23	95	5

Table 6: a) Coefficient of regression analysis on effect of independent factors (X1, X2) on dependent factors (Y1)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2366.182	957.849		2.470	0.018
	X1	2.322	10.208	0.032	0.227	0.821
	X2	-88.868	23.419	-0.526	-3.795	0.000

b) Model Summary of regression analysis

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	0.535[a]	0.286	0.251	1096.35809

[a]Predictors: (Constant), X2, X1

c) ANOVA of effect of independent factors (X1, X2) on dependent factors (Y1)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19281509.086	2	9640754.543	8.021	.001[a]
	Residual	48080042.181	40	1202001.055		
	Total	67361551.267	42			

a Predictors: (Constant), X2, X1

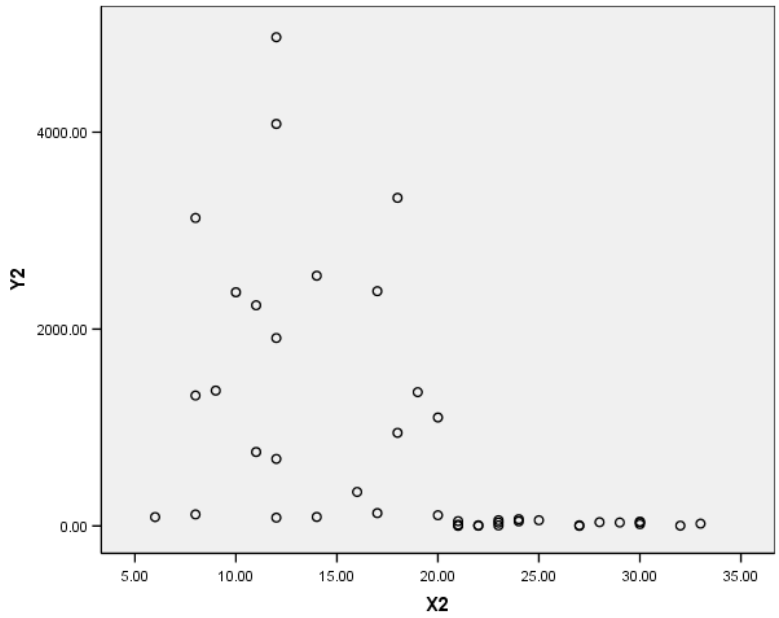

Figure 1: Effect of temperature (X2) on number of infected cases of COVID-19 per million population