



## COMPARISON STUDY OF DIFFERENT METHODS TO DETECT THE SYMPTOMATIC POSITIVE CASES OF CORONAVIRUS: A HOSPITAL BASED STUDY

### Microbiology

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### ABSTRACT

**Introduction:** COVID-19 arose in the City of Wuhan in China around the date 31st December 2019. The situation became critical due to numerous infected cases in the "Huanan Seafood Market". Human coronavirus HKU1 (HCoV-HKU1), Human coronavirus 229E (HCoV-229E), Human coronavirus OC43 (HCoV-OC43), Human coronavirus NL63 (HCoV-NL63), Severe acute respiratory syndrome-related coronavirus (SARS-CoV-1), Middle East respiratory syndrome-related coronavirus (MERS-CoV), Novel coronavirus SARS-CoV-2 are the variants of COVID-19. In our present study, we identify about the various methods to detect Coronavirus.

#### Aims & Objectives:

- To identify various variant of Coronavirus.
- Identify the various methods for the detection of Coronavirus.
- Comparison study between Real time PCR method, Antigen test and Antibody test.

**Material and Methods:** The methods through which Coronavirus are detected are RT-PCR Test, Antigen Test and Antibody test in 488 symptomatic positive cases. **Result:** The number of positive patients infected by Alpha variant was 316 followed by Delta variant which had 126. Also, Beta and Gamma Variant 22 patients each and the percentage was 4.51% each. The prevalence of male patients was high as compared with female patient in RT-PCR test than Antigen Test. A total of 180 male patients was found in RT-PCR Test whereas 82 were female patients in RT-PCR Test when compared with Antigen test a total of 100 male patients and 55 female patients were found. The prevalence of RT-PCR test and Antigen Test was higher in aged group between 11-20 yr followed by 21-30 yr and 31-40 yr and the values was 97 and 65, 88 and 63, 51 and 10 respectively. Also, the prevalence to identified positive sample for both RT-PCR and Antigen Test in Urban and Rural area was 166 and 80, 158 and 60 respectively. The comparison study between RT-PCR test and Antibody test according to gender, different aged group and location between RT-PCR and Antibody test. 180 male patients showed positive test from RT-PCR Test and whereas only 51 male patients were under Antibody test group. the maximum number of positive patients found aged group between 11-20 yr for both the test group and the number was 97 and 21 respectively. The number of positive patients found in urban region was 166 and 10 for RT-PCR and Antibody test group respectively. And for rural region, the value was 158 and 14 for RT-PCR Test group and Antibody Test group respectively. **Conclusion:** The number of positives samples included 64.75% Alpha Variant, 26.23% Delta variant and 4.51% each for Beta and Gamma Variant. Prevalence of both the test group was higher in young aged group than the older one. In case of region among both the test group, the prevalence of RT-PCR test group was higher than that of Antigen test group. The prevalence much higher in RT-PCR test when compared among gender. The prevalence for Antibody test group was higher in older aged group when compared with RT-PCR test group patients. Also, the prevalence was high in Urban region when tested with RT-PCR test when compared with Antibody test in both Urban and Rural region.

### KEYWORDS

Coronavirus, RT-PCR, Antigen, Antibody

#### INTRODUCTION:

COVID-19 arose in the City of Wuhan in China around the date 31st December 2019. The situation became critical due to numerous infected cases in the "Huanan Seafood Market". (1). SARS-CoV-2 is a member of the family of Coronaviridae, a subfamily of Orthocoronavirinae within the order of Nidovirales. (2) Coronaviruses are named based on their characteristic common feature: Crown-like glycoprotein spikes, called virions, littering their membrane, which envelops a non-segmented, large, positive-sense single-stranded RNA, with size between 26,000 – 37,000 bases. (3,4,5). Currently, four significant proteins have been identified in coronaviruses: S (spike), E (envelope), M (membrane), and N (nucleocapsid) proteins. (117) They are part of a genomic framework identified as 5'-leader-UTR-replicase-S (Spike)-E (Envelope)-M (Membrane)-N (Nucleocapsid)-3'UTRpoly (A) tail, which contains accessory genes at the 3' end. (4) Within the membrane, there are also other polypeptides and nucleoproteins, RNA polymerase, 3-chymotrypsin-like protease, papain-like protease, helicase, glycoprotein, and accessory proteins. (6-9) The M- and E- proteins are essential for viral assembly, and the N-protein is essential for RNA synthesis. (3,10). Most importantly, the spike protein (S-protein) is essential for the interaction between the virus and the target cell: It mediates ACE2 receptor binding and fusion of virus and host cell membrane. (9).

Accounting for the recent discovery of SARS-CoV-2 and the resultant disease COVID-19, there currently are a total of 7 coronaviruses known to be able to infect humans (11)

- Human coronavirus HKU1 (HCoV-HKU1)
- Human coronavirus 229E (HCoV-229E)
- Human coronavirus OC43 (HCoV-OC43)

- Human coronavirus NL63 (HCoV-NL63)
- Severe acute respiratory syndrome-related coronavirus (SARS-CoV-1)
- Middle East respiratory syndrome-related coronavirus (MERS-CoV)
- Novel coronavirus SARS-CoV-2

Since December 2019, SARS-CoV-2 has infected at least 64.1 million people in 190 countries or regions and caused at least 1.45 million deaths (status: December 01, 2020) – a case-fatality rate of roughly 2.3%. (12) Although the overall number of recovered patients is continuously increasing, the number of newly confirmed cases and deaths is still surging.

There are various method through which the Coronavirus can be detected. Antigen Test, Antibody test and RT-PCR Test are among them. In our present study, we identify about the various methods to detect Coronavirus.

#### Aims & Objectives:

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- Comparison study between Real time PCR method, Antigen test and Antibody test.

#### MATERIAL AND METHODS:

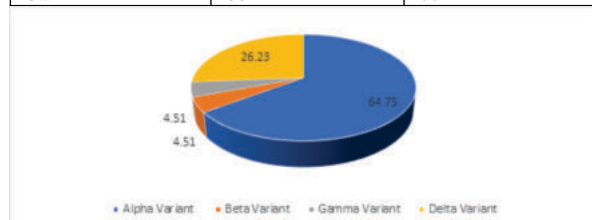
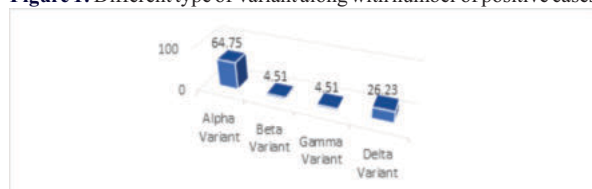
A total of 488 positive cases (Symptomatic) were included in our study aged between 0 to 90 years. Study was conducted in Department of Microbiology, Index Medical College and Research Center, Indore (M.P.) between 2020 to 2022.

**Table 1: Various Methods To Detect COVID-19**

| S.No. | Method        |
|-------|---------------|
| 1.    | RT-PCR Test   |
| 2.    | Antigen Test  |
| 3.    | Antibody Test |

**OBSERVATIONS AND RESULTS:****Table 2: Different Type Of Variant Along With Number Of Positive Cases**

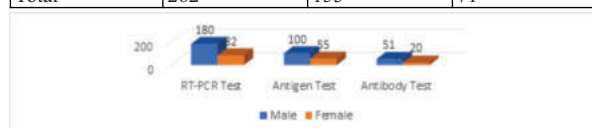
| Type of Variant | Number of Samples | Percentage |
|-----------------|-------------------|------------|
| Alpha           | 316               | 64.75      |
| Beta            | 22                | 4.51       |
| Gamma           | 22                | 4.51       |
| Delta           | 128               | 26.23      |
| Total           | 488               | 100        |

**Figure 1: Different type of Variant along with number of positive cases****Figure 2: Different type of Variant and prevalence (in %)**

In table no. 2. and Figure no.1 & 2 , the prevalence of variant among positive samples are shown, Alpha variant have 316 positive samples and the percentage is 64.75%. Beta variant detected in 22 samples and the percentage is 4.51%, 22 number of Gamma variant found in the total positive sample and the percentage is 4.51%.Delta variant have 128 positive samples having 26.23% in total positive samples.

**Table 3: Comparison Of Various Type Of Test To Detect COVID-19 According To Gender.**

| Gender | RT-PCT Test | Antigen Test | Antibody Test |
|--------|-------------|--------------|---------------|
| Male   | 180         | 100          | 51            |
| Female | 82          | 55           | 20            |
| Total  | 262         | 155          | 71            |

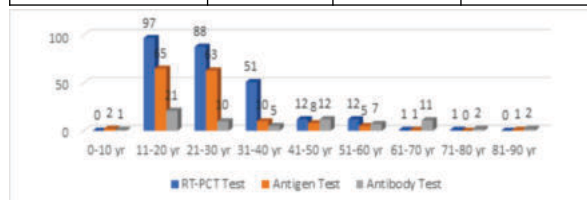
**Figure 2: Comparison of various type of test to detect COVID-19 according to gender.**

In Table no. 3 and Figure no. 2, there is comparison study between Different type of tests and among male and female patients are shown. A total of positive samples detected from RT-PCR Test is 262 and among 262 positive sample, male patients are 180 in number and that of female patients are 82. Similarly, in case of Antigen test, a total of 100 samples belongs to male patients and 55 samples from female patients and the total number of patients is 155. Finally, in Antibody test, among 71 positive samples, 51 samples are from male patients and 20 samples are female patients.

**Table 4 : Comparison Between Various Methods According To Different Aged Group Patients.**

| Aged Group (in years) | RT-PCT Test | Antigen Test | Antibody Test |
|-----------------------|-------------|--------------|---------------|
| 0-10                  | 00          | 02           | 01            |
| 11-20                 | 97          | 65           | 21            |
| 21-30                 | 88          | 63           | 10            |
| 31-40                 | 51          | 10           | 05            |
| 41-50                 | 12          | 08           | 12            |
| 51-60                 | 12          | 05           | 07            |

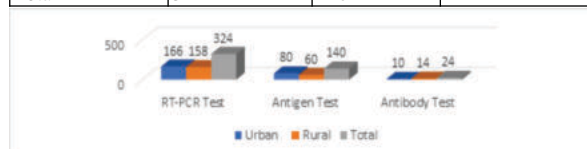
|       |     |     |    |
|-------|-----|-----|----|
| 61-70 | 01  | 01  | 11 |
| 71-80 | 01  | 00  | 02 |
| 81-90 | 00  | 01  | 02 |
| Total | 262 | 155 | 71 |

**Figure 3: Comparison between various methods according to different aged group patients.**

In Table no. 4 and Figure no.3 , Comparison study between different type of tests and gender are shown, and it's shows that between 0 to 10 years aged group patients, the number of samples shows positive result in RT-PCR test, Antigen Test and Antibody test are 0, 2 and 0 respectively. Between 11 to 20 years, the prevalence of sample among RT-PCR test, Antigen Test and Antibody test are 97,65 and 21 respectively. Among aged group between 21 to 30 years, positive result shown in RT-PCT, Antigen and Antibody test are 88,63 and 10 respectively. In case of patients between 31 to 40 years, 51 number of patients shown positive result in RT-PCT Test, 10 patients shows positive result in Antigen Test and 5 shows positive result in Antibody test. Between 41 to 50 years aged group, 12 patients belongs to RT-PCR Test, 8 from Antigen Test and 12 patients from Antibody test. Between 51 to 60 years aged group, 12 patients shows positive result in RT-PCR Test, 5 in Antigen test and 7 patients from Antibody test. Number of patients detect positive in RT-PCR Test, Antigen Test and Antibody test are 1,1 and 11 respectively in aged group between 61 to 70 years old patients. Between 71 to 80 years old group, 1 patients belong to RT-PCR test group, 0 patients from Antigen Test group and 2 patients from Antibody test group. Finally, between 81 to 90 year old patients group, no patients are found in RT-PCT test group, 1 patients belong to Antigen test group and 2 patients from Antibody test group.

**Table 5 : Comparison Of Various Test With Different Region.**

| Region | RT-PCR Test | Antigen Test | Antibody Test |
|--------|-------------|--------------|---------------|
| Urban  | 166         | 80           | 10            |
| Rural  | 158         | 60           | 14            |
| Total  | 324         | 140          | 24            |

**Figure 4: Comparison of various test with different region.**

In table no.5 and Figure no.4 , number of positive samples among different tests and Regions are shown. So, Positive RT-PCT test found in Urban and rural area are 166 and 158. Whereas, in case of Antigen test, 80 positives samples belong to Urban and 60 from Rural region. Finally, 10 positives samples belong to urban area and 14 positive samples from rural area in Antibody test. So, a total of positive samples detected from RT-PCR Test, Antigen Test and Antibody test are 324, 140 and 24 respectively.

**DISCUSSION:**

Corono virus spread rapidly world wide and affect human civilization. In our present study, we different aspects through which we can detect the effect of Coronavirus in our region. A total of 488 positive samples were identified from various aged group, different gender and different region.

Table no.2 and Figure no.1 & 2 , shows that the prevalence of various variant of Corona Virus that infected and found that Alpha variant (64.75%) have high prevalence followed by Delta variant (26.23%). The number of positive patients infected by Alpha variant was 316 followed by Delta variant which had 126. Also, Beta and Gamma Variant 22 patients each and the percentage was 4.51% each. According to **Pragya D. Yadav et al. in December 2021(13)**, the prevalence of variant that detected among all positives cases was Delta variant followed by Kappa, Alpha and B.1.36, and the percentage was

65.82%, 9.96%, 6.83% and 4.68%, respectively in 41 the study population. They concluded that Delta variant infected the children group maximum. Also, study conducted by **Nivedita Gupta et al, in September 2021(14)** concluded that majority of the breakthrough COVID-19 clinical cases were infected with the Delta variant, and only 9.8% cases required hospitalization, while fatality was observed in only 0.4% cases. So, both the above studies opposed our present study. But the study conducted by **Jayanthi Shastri et al, in September 2021(15)**, resemble with our present study they concluded that the B.1.1.7 (Alpha) variant has been detected in Mumbai, India during February 2021. Subsequently, we retrieved 43 sequences from specimens of 51 COVID-19 cases from Mumbai. The sequence analysis revealed that the cases were mainly affected with Alpha variant which suggests its role in community transmission of SARS-CoV-2 in Mumbai, India.

In table no.3-5 and Figure no.2-4, it showed that the comparison study between RT-PCR test and Antigen Test according to gender, different aged group and Location. The prevalence of male patients was high as compared with female patient in RT-PCR test than Antigen Test. A total of 180 male patients was found in RT-PCR Test whereas 82 were female patients in RT-PCR Test when compared with Antigen test a total of 100 male patients and 55 female patients were found. The prevalence of RT-PCR test and Antigen Test was higher in aged group between 11-20 yr followed by 21-30 yr and 31-40 yr and the values were 97 and 65, 88 and 63, 51 and 10 respectively. Also, the prevalence to identified positive sample for both RT-PCR and Antigen Test in Urban and Rural area was 166 and 80, 158 and 60 respectively. So, in our present study, we found that the prevalence of both male and female patients was high. Also, number of patients was high in young aged group patients and finally urban region infected more. These data indicate the prevalence was high when the test conducted under RT-PCR. According to **Mónica Peña et al. in April 2021(16)** conducted a study compared a SARS-CoV-2 rapid antigen test (RAT) and RT-PCR in 842 asymptomatic individuals from Tarapacá, Chile. A sensitivity of 69.86%, specificity of 99.61%, PPV of 94.44% and NPV of 97.22% with Ct values (Ct > 27) that were significantly higher among individuals with false-negative RAT were reported. The result resemble with the study in rural area where RT-PCR not able to performed. So, the result resemble with our study in respect of rural area. But according to **Werner Leber et al. in July 2021(17)**, the prevalence of Antigen test was high than that of RT-PCR Test and they conducted a study and found that Of the 2,562 symptomatic patients, 1,037 were suspected of COVID-19 and 826 (79.7%) patients tested RT-PCR positive. So, again in rural area Antigen test was higher prevalence. Study conducted by **Alexander Krüttgen et al. in February 2021(18)** concluded that sensitivity and specificity of the antigen assay is inferior to the PCR assay. However, the antigen assay may be a quick and easy to perform alternative for differentiation of individuals contagious for SARS-CoV-2 from non-contagious individuals.

In table no.3-5 and Figure no.2-4, it's shows that the comparison study between RT-PCT test and Antibody test according to gender, different aged group and location and we found that male patients were high both under RT-PCT and Antibody test group. But, if we compared between them, 180 male patients showed positive test from RT-PCR Test and whereas only 51 male patients were under Antibody test group. The number of female patients was 82 and 20 in RT-PCR Test group and Antibody Test Group respectively. A total of 262 present in RT-PCR Test group and only 71 patients in Antibody test group. When compared with different aged group, the maximum number of positive patients found aged group between 11-20 yr for both the test group and the number was 97 and 21 respectively and minimum number of patients found between 0 to 10 years for the both the groups and number of positive patients was nil also between 81 to 90 year aged group for RT-PCR test group, the number was nil. So, for RT-PCR Test group, two different aged group patients had minimum number of positive patients, i.e. between 0 to 10 year and 81 to 90 year and for Antibody test group only one aged group had minimum number of positive patients i.e., 0 to 10 year. Finally, the number of positive patients found in urban region was 166 and 10 for RT-PCR and Antibody test group respectively. And for rural region, the value was 158 and 14 for RT-PCR Test group and Antibody Test group respectively. According to **Özgür Aslan et al, in December 2020(19)**, they recommend antibody testing in close contact tracing as well as in real-time polymerase chain reaction negative symptomatic subjects. Standardization is important as positive values show significant

variations among antibody tests. Also, according to **Juanjuan Zhao et al, in November 2020(20)** conducted study included 173 patients with SARS-CoV-2 infection. concluded that Antibody detection offers vital clinical information during the course of SARS-CoV-2 infection. The findings provide strong empirical support for the routine application of serological testing in the diagnosis and management of COVID-19 patients. Both the studies opposed with our present study as they support Antibody test whereas according to our present study RT-PCR Test better test to diagnosed COVID-19.

## CONCLUSION:

In our present study which was conducted in Department of Microbiology, Index Medical College and Research Center, Indore (M.P.) and total of 14358 total samples were collected and out of that 488 samples were positives which included the patients between 0 to 90 year old patients from different religion, region, caste and races. The time period between our study was conducted was between 2020 to 2022.

- Four types of variants were identified as Alpha, Beta, Gamma and Delta. Among all, Alpha variant had high prevalence of positive samples followed by Delta variant and then Beta and Gamma Variant. The number of positives samples included 64.75% Alpha Variant, 26.23% Delta variant and 4.51% each for Beta and Gamma Variant.
- Comparison study also conducted between RT-PCR and Antigen Test among gender, different aged group and region. And it's found that a total of 262 patients placed in RT-PCR test group and 155 patients were in Antigen test group. Among different aged group, the prevalence for RT-PCR test and Antigen test group was higher in aged group between 11 to 20 years followed by 21 to 30 years and 31 to 40 years. So, Prevalence of both the test group was higher in young aged group than the older one. In case of region among both the test group, the prevalence of RT-PCR test group was higher than that of Antigen test group. The number of positive samples in Urban region was 166 and 80 for RT-PCR Test and Antigen Test group respectively followed by rural region had 158 and 60 positive samples for RT-PCR Test and Antigen test group.
- Comparison between RT-PCR Test and Antibody Test also conducted and found that the prevalence much higher in RT-PCR test when compared among gender. 180 males patients and 82 females patients were included in RT-PCT Test group whereas 51 male patients and 20 female patients were included in Antibody test group. Prevalence of RT-PCR test was higher in Young aged group between 10 to 40 years whereas in case of Antibody test group the prevalence of positive patients were detected in 11 to 20 years followed by 41 to 50 years and 61-70 years. So, the prevalence for Antibody test group was higher in older aged group when compared with RT-PCR test group patients. Also, a total of 10 and 14 positive samples were identified in urban and rural region for Antibody test group which was lower than that of RT-PCR test group and the prevalence is 166 and 158 for urban and rural area respectively.

So, in our present study the success rate of RT-PCR test was higher than that of Antigen Test and Antibody test. The best method to identified Coronavirus was RT-PCR Test. But in India, during pandemic there were less or few hospitals and diagnostic center approved by Government of India, that's why, the result detected after many days of collection and during that period many patients either die or in extreme serious conditions. Proper and appropriate action must be taken by the Governments to increased the testing in various medical colleges, hospitals and diagnosed centers for fast and accurate detection of corona. Rapid and appropriate action should be taken for the detection of Corona virus and followed by treatments and precaution.

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