ISSN - 2320-6039 (Print) ● ISSN - 2320-608X (Electronic)

Volume10 / Number 2 / April-June 2022

INTERNATIONAL JOURNAL OF PHYSIOLOGY

Website: www.ijop.co.in

International Journal of Physiology

Print-ISSN: 2320-6039 Electronic-ISSN: 2320-608X Frequency: Quarterly

Website:www.ijop.co.in

Published at

Institute of Medico-legal Publications

Logix Office Tower, Unit No. 1704, Logix City Centre Mall,
Sector- 32, Noida - 201 301 (Uttar Pradesh)

International Journal of Physiology

www.ijop.net

CONTENTS

Volume 10, Number 2 **April-June 2022**

Critical Flicker Fusion Frequency and Visual Reaction Time in Six Different Colors in Students with Different Grade of the Perceived Stress

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Introduction

Perceived stress is the thoughts or feelings one has about their level of experienced stress. The onset of fatigue and perceived stress could be detrimental to the cognitive functioning and ability. Visual reaction time indicates the sensory motor coordination and critical flicker fusion frequency indicates detrimental to the cognitive functioning and ability. In this study the levels of perceived stress and their effect on visual reaction time and critical fusion frequency is measured.

Methods: A total of 75 apparently healthy students in the age group of 18-40 years students were included in the study. The perceived stress scores were measured using the questionnaire and participants were divided into mild (group I) and moderate stress group (group II). The visual reaction time recording was done using different color like red, green, blue, yellow, purple and aqua. Critical flicker fusion frequency was also measured.

Results: The average visual reaction time for red, green and blue was less when compared to purple, yellow and aqua. The mean reaction time for red color in mild stress group I (392 ± 44 msec) was more when compared to group II (379 ± 40 msec). similar findings were found in all other colors except purple were mean reaction time same in both the group. There was no difference in the CFFF between the groups.

Conclusion: It found that sensory coordination in the mild stress group was diminished when compared to participants in moderate stress group. There are no changes in cognitive ability (CFFF) between the groups.

Keywords: *Color visual reaction time, Critical flicker fusion frequency, Moderate stress.*

Introduction

Stress is an inevitable part of the progressive growth of an individual. Students are exposed to various activities in their schedules which are sometimes perceived as stressors. Their involvement of activities like mobile usage, gaming, use of digital media for their studies and entertainment could add on to the stress. Continuous multimedia usage leads to long lasting functional stimulation leading to fatigue. The onset of fatigue and perceived stress could be detrimental to the cognitive functioning and ability. **Perceived stress** is the thoughts or

feelings one has about their level of experienced stress.

Perception of colors depends on the electrical activity in the retina and the integrity of optic nerve. The color perception time varies for different colors. According to the trichromatic theory of color vision the three types of cones: red, green and blue forms the primary colors of the vision[1]. Stimulation of red and green cones forms yellow, stimulation of blue and green forms aqua and stimulation of red and blue forms magenta color.

Visual reaction time is time taken for the time interval between the stimulus presentation and motor response given by an individual. It is an indirect indicator of sensory motor coordination of an individual and thus it also indicates the activity of the central nervous system[2]. The time interval also indicates how quickly person a person can identify the spot of light, decision making and also cognitive ability to perform appropriate motor activity.

Critical fusion flicker frequency is the parameter is which is considered as a parameter to measure the cognitive ability of an individual[3]. It is equated to the studies similar to evoked potentials measuring the effect of stimulus on cognition[4]. When the flickering light with increasing frequency is subjected to an individual, it measures the frequency of the light at which an individual can no more as a see flicker of light. It is measured in hertz.

In this study the levels of perceived stress and their effect on visual reaction time and critical fusion frequency is measured.

Materials and Methods

The study was done in Xavier University School Medicine, Aruba during September 2021 to January 2022. The Institutional scientific and ethical committee clearance was obtained. A total of 75 apparently healthy students in the age group of 18-40 years students were included in the study. The participants with history of color blindness, smoking, alcohol or any cardiovascular disease were excluded from the study.

Any student with history of medications which could impair cognitive performance were also excluded from the study. Participation in the test was voluntary and informed written consent was taken from every participant.

Demographic data, such as age, gender, body mass index, body fat percentage, vitals were collected from the students.

Perceived stress scale (PSS) testing

Standardized questionnaires were used in the study namely PSS -10 to measure the stress levels among the participants. The questionnaire consists of 10 items to be answered in the 5- point Likert scale[5]. Participants were asked to answer the questions fairly and quickly. Individual scores on the PSS range from 0-40 with higher scores indicating higher perceived stress. Based on the PSS scores the participants were grouped into group I - mild stress (0-13), group II – moderate stress (14-26) and group III – (high perceived stress 27-40).

Critical flicker fusion frequency (CFFF) testing

The CFFF testing was done by using a standard electronic module and protocols[3]**.** The CFFF device consists of red light flickering at frequencies

ranging from 1 Hz to 100 Hz. The examination was conducted in a dimly lit room with the subject sitting 80 cm away from the module. The red light was presented against a white background, and the frequency of the flicker was gradually increased from 10 Hz until the subject reported that the presented light was perceived no more flickering or as "steady" single light. Two such reading was taken and best one was chosen as CFFF for analysis.

Visual reaction time (VRT) testing

VRT testing was done using a standard electronic module and protocol. The VRT device consists of source of light or stimulus presenter and the software in the computer. The person responds to the stimulus by clicking the mouse using dominant hand as soon as he sees visual stimulus. The VRT was measured in milliseconds (msec). The recording was done using different color like red, green, blue, yellow, purple and aqua. Any reaction time less than 150 or more 650 milliseconds was ignored asked to repeat. Three reading was taken for each color and average of the three readings were taken for analysis.

Statistical Analysis

All the data were fed into the computer and analyzed by using the Statistical Package for Social Science (SPSS) software, version 25.0 (IBM, Armonk, NY, USA). The continuous variables like age, BMI, body fat percentage, Vitals, PSS, CFFF, and VRT of different colors were presented as mean and standard deviations. Student's t-tests were conducted for comparing CFFF, VRT between different mild and moderate stress groups (PSS group I and group II). The statistical analysis was performed at a 0.05 level of significance.

Results

Description of Demographic parameters

Total participants were 50 with the average age of 25.2 ± 8.3 years. The baseline parameters like Body mass index (BMI), pulse, blood pressure is mentioned in the table 1. The mean PSS in the participants was 16.3 ± 7.3 in all the participants. The mean CFFF in the participants were 26.8 ± 5.3 Hz.

Table 1: The descriptive parameters of the study population

Parameters	Mean ± SD
Age (years)	25.1 ± 8.3
Body mass index in (kg/m2)	24.7 ± 5.3
Body fat (%)	20.9 ± 7.0
Pulse (beats per minute)	87 ± 20
Systolic blood pressure (mm Hg)	125.6 ± 22.8
Diastolic blood pressure (mm Hg)	80.8 ± 14.7
Body temperature (in oC)	36.3 ± 1.3

Comparison of mean VRT with primary and secondary colors

Visual reaction time for 6 different colors. The mean visual reaction time increases for different color in this order: red < green < blue < purple < yellow < aqua. Red, green, blue is considered as the primary colors and purple, yellow and aqua are considered as the secondary colors. The mean VRT for the primary and secondary colors was 385 ± 37 msec and 398 ± 37 msec respectively with a statistically significant difference (p= 0.002).

PSS scores and groups

The participants were grouped into group I - mild stress (0-13) and group II – moderate stress (14-26). The total; number of participants in group I and group II were 19 and 31 respectively. The mean PSS scores in group I was 7.75 ± 3.47 and group II was 19.56 ± 3.43, with a statistically significant difference (p= 0.000). The baseline characteristics of group I and Group II is mentioned in the table 1. The baseline characteristics of the participants are matching, there is no statistical difference between group I and group II.

Table 2: The descriptive parameters of the study population

Parameters	Group I	Group II	
Age (years)	25.8 ± 5.31	24.75 ± 5.98	0.667
Body mass index in (kg/m^2)	24.87 ± 4.11	24.55 ± 3.96	0.874
Body fat (%)	19.85 ± 7.36	21.38 ± 6.13	0.311
Pulse (bpm)	88 ± 15	86 ± 15	0.930
Systolic blood pressure (mm Hg)	124.4 ± 14.59	126.25 ± 13.60	0.715
Diastolic blood pressure (mm Hg)	79.62 ± 13.02	80.87 ± 6.37	0.698
Body temperature	36.3 ± 0.25	36.2 ± 0.54	0.693

Comparison of CFFF in groups

The mean CFFF in group I was 26.37 ± 4.71, and group II was 26.95 ± 3.03 with a p value of 0.417.

Comparison of Color reaction time in group I and group II

The mean reaction time in the group I and group II were compared using t test. There is increase in the reaction time in group I when compared to group II in all the colors except purple (Table 3). The reaction time for primary color and secondary colors were lower for the group II when compared to group I.

Table 3: Comparison of Visual reaction time for different colors between group I and Group II.

Parameters	Group I VRT (msec)	Group II VRT (msec)	p value
Red	392 ± 44	379 ± 40	0.315
Green	391 ± 35	380 ± 32	0.237
Blue	391 ± 49	387 ± 32	0.723
Purple	399 ± 40	400 ± 33	0.908
Orange	401 ± 40	393 ± 39	0.630
Aqua	405 ±43	397 ± 32	0.486

Discussion

The perceived stress scale (PSS) is a 10-item self-report measure designed to assess "the degree to which situations in one's life are appraised as stressful"[6]. The mean PSS is suggestive that the participants in the study is in the moderate stress. This moderate stress is termed as 'eustress' because this amount of stress in inevitable or essential for survival. Most of the participants are students and they are spending significant amount of time in the academics, acquired new knowledge and skills which could contribute to the moderate stress/ eustress.

The visual reaction time for different colors of light like red, green, blue which are considered as primary colors and purple, orange, yellow is considered as secondary colors. The reaction time is lower for primary colors when compared to the secondary colors. And these differences can be explained in according to corpuscular theory which explains that light with higher wavelength carries less energy. In visible spectrum red light has highest wavelength and carry the lowest amount of energy. And the combination of colors, since combination of different wavelengths, they stimulate two different types of cones and hence takes more time to produce the response. In consistent with our findings, a study by Amini et al 2019, it is reported that there was difference in the simple visual reaction time for the four different colors like red, green, yellow and blue light[7].

The participants reacted quickly to the primary colors when compared to the secondary colors. This could be because the signal processing time in the S-cone system is slightly longer than the other cone systems. Hence further stimulation of the system needed to lead to the delayed perception of blue and purple hues and hence increased reaction time. And moreover, since there is already fatigue due to digital eye syndrome due to mobile usage, there could be further delay in the transmission of

impulses and thus processing of the colours[8].

Group I was with mild stress, the stress not enough to cope up with the everyday activities in life whereas Group II participants had eustress. Participants with mild stress reacted slower when compared to the moderate stress. This slowing is suggestive that their ability to respond to the stimuli was sluggish. In moderate stress, the participants to respond to the given scenario more quickly and appropriately. The cognitive reactivity is better whenever eustress. These findings are similar to the study Bak et al 2022, where the participants with stress reacted better for a task accuracy and behavior task. Further, it is described that the abilities of performing tasks under a positive stress condition (eustress) can be more enhanced than that under extreme conditions (negative stress called distress). This explicitly means that the members of the eustress group work faster and more efficiently[10,11].

CFFF measures the cognitive ability of the individual and it is one of the indicators of visual perception and decision-making capabilities. It also indicates the integrity and functioning of visual system from retina to cortex. The CFFF is considered to be a better indicator of psychomotor performance, attention and concentration. Its measurement does not depend on level of education or language[9]. Curran et al 2000, have explained in their study that CFFF has been used in the early detection of the Alzheimer's disease. The short-term memory loss in Alzheimer's subjects is enhanced with the 10 Hz flicker[12]. There was no significant difference in the CFFF among the two groups, which is suggestive of the fact the cognitive task is not much affected between the mild stress and eustress subjects.

Conclusion and Acknowledgement

It is concluded that the stress levels among the participants moderate. These moderate stresses are required to cope up with the daily activity and survival. The moderate stress individuals react better when compared to mild stress. There is no difference in the CFFF between the moderate to severe stress.

We sincerely thank all the participants and faculty of the XUSOM, Aruba, in participating in this study.

Ethical Clearance- Obtained from (XUSOM) Institutional ethical review board.

Source of Funding- Self

Conflict of Interest – Nil

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 DOI Number: 10.37506/ijop.v10i2.3251

Trigeminal Neuralgia in a Couple: Case Report

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Abstract

Objective: To discuss a case report of Trigeminal Neuralgia (TN) in a couple.

Background: The world is witnessing Covid 19 since March 2020 as a Pandemic as per World Health Organisation. Covid 19 was primarily presented with Respiratory symptoms. Though, it also affects the other systems, especially the Nervous System which is getting reported with many Neurological signs. Presenting TN in a couple is a rare and unusual entity.

Methods: We discuss the clinical manifestations of Trigeminal Neuralgia in a couple at some stage in Covid 19 Era. We also review the possible Pathophysiology and Differential Diagnosis of the disease as per the Literature.

Results: Patient Y was a 41 years old male who presented with increased tooth sensitivity to temperature, progressively stabbing pain increased in the right V3 of Trigeminal Zone with no other Neurological Manifestations.

Patient X was a 33 years old female who had Tinnitus progressed with a toothache and stabbing pain in the right V3 of the Trigeminal Zone with no other Neurological Manifestations.

Both had no History of Covid 19 clinical symptoms in the recent past. Both were diagnosed with TN probable post-viral infection and treated with steroids following which the symptoms improved.

Conclusions: Trigeminal Neuralgia is likely due to SARS-CoV-2. Still, we must undergo more studies to find the pathophysiology of this Covid 19 infection.

Keywords: *Trigeminal Neuralgia, Covid 19, Demyelination, Post viral Infection, Neurological Manifestations, steroids.*

Introduction

In Wuhan, China, a case of Atypical Pneumonia was reported due to unknown Etiology in December 2019. In January 2020, World Health Organisation announced it as 2019 – Novel Coronavirus (2019 – nCoV) [1]. In March 2020, WHO declared 2019 – nCoV as a Pandemic[2].

Respiratory Symptoms are dominant in 2019 – Novel CoronaVirus. Other Symptoms like Headache, Dizziness, Abdominal pain, Diarrhoea, Anosmia, and Dysgeusia were also reported in the clinical course of the disease [3,4].

In SARS -2002 and MERS 2012, coronavirus was found to be a Neurotropic Virus [3,4]. Either by a hematogenous or retrograde axonal pathway through certain Cranial nerves, Coronavirus can extend towards the CNS. Coronavirus penetrates our cells through Angiotensin-Converting Enzyme

Receptor 2 (ACE2). It was stated that Endothelium, Glial cells, and Neurons express Angiotensin Converting Enzyme Receptor, as it is the probable target for Coronavirus [5].

In March 2020, an Italian Neurologist's warned the world to look for poorly defined Neurological conditions in Covid 19 patients [6].

Though Headache was found in the 2019 nCoV, studies on the characterisation of the pain were also done and it depends on Duration, Lateralization, Location, Pain quality, and Headache Intensity [7]. Trigeminal Neuralgia was presented as a sole clinical manifestation of Covid 19 [8]. After a Covid 19 Vaccination, it was reported that a Patient developed a case of TN [9].

Case Report

Patient Y was a 41 years old male with increased tooth sensitivity to temperature, progressively stabbing pain increased in the right V3 of Trigeminal Zone for one week with no other Neurological Manifestations in August 2021. Blood investigations were normal. He has had a history of Diabetes Mellitus for 3 years on regular treatment under control. MRI Brian showed Multiple Tiny Oval Shaped Hyperintensities in Right TemporoParietal and Left FrontoParietal Sub Cortical Lobe. Probable Small Foci of Demyelination. He had no History of Covid 19 clinical symptoms in the recent past. The patient was diagnosed with TN post-viral infection and treated with steroids by which the symptoms improved. He was vaccinated with doses of Covishield in January and February 2021.

Patient X was a 33 years old female who had Tinnitus progressed with a toothache and stabbing pain in the right V3 of the Trigeminal Zone for 3 days with no other Neurological Manifestations in November 2021. Blood Investigations and MRI brain were reported as normal. She had no History of Covid 19 clinical symptoms in the recent past. The patient was diagnosed with TN probable post-viral infection and treated with steroids following which the symptoms were relieved. She was vaccinated with two doses of Covishield in Feb and March 2021.

The onset of Clinical Symptoms between Patient X and Y was around three months. Both the patients were treated with steroids and the symptoms improved clinically. Covid Antibody IgG was positive for Patient X & Y and Covid Antibody IgM was negative for Patient X & Y.

Discussion

Couples with particular illnesses are at increased risk of diseasing themselves, at least 70% increased risk for asthma, depression, and peptic ulcer disease. This is an indication that shared environmental risk factors are on top of any genetic or distant exposure or shared activities about seeking health care [10].

This clinical case among the couple explains the possible care issues surrounding the cases of conjugal neurological disease and the possibility of finding joint environmental risk aspects.

The possible mechanism behind Headache associated with Covid 19 could be the invasion of the virus to the Trigeminal Nerve endings in the Nasal Cavity [11].

ACE produces Angiotensin II which acts on Angiotensin II Receptor Type 1 (AT1R) all over the body, which is involved in the pathogenesis

of Cardiovascular disease, Vasoconstriction, and Oxidative Stress [12]. On the other side, Angiotensin II is hydrolysed into Ang 1-7 by ACE 2. Ang 1-7 inhibits ACE/Ang II/AT1R axis by counteracting its effect which includes Cardiovascular protection, Vasodilation, Anti-Oxidative Stress, and Antinociception. Thus ACE2 inhibits the action of Ang II and also causes the opposite effects [13].

2019 nCoV enters our body through ACE2, which was identified as a host receptor. This causes the unbalance in the actions of ACE and ACE2, as 2019 nCoV causes the internalization of ACE2 by downregulating its function [14].

The angiotensin system is also present in the Trigeminal Ganglia of Human and Rat [15].

ACE2 is also found in the endothelial cells, by producing inflammation. Indirect Trigeminal activation caused by ACE2 and proinflammatory cytokines during the Covid 19 can lead to pain [16].

Conclusion

Trigeminal Neuralgia must not be underestimated as just another type of Headache. Post pandemic of Covid 19, all the Nonrespiratory symptoms have to be evaluated along with its Pathophysiology.

Conflict of Interest Statement : None

Source of Funding : Nil

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 DOI Number: 10.37506/ijop.v10i2.3252

Assessment of Post – COVID 19 Sequelae: A Retrospective Study

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Abstract

Background: COVID–19 is an acute respiratory illness caused by SARS–CoV–2. COVID-19 created a major impact on physical, cognitive, mental health and social status in patients with SARS–CoV–2. **Aim and Objective**: To assess the post COVID sequelae in COVID19 recovered individuals. To assess the functional limitations using post COVID functional status scale after 4weeks of onset of illness. **Materials and Methods**: Subjects were selected from compiled list of Triage OP from Chengalpattu Medical College and Hospital. The semi structured questionnaire enclosed with Socio – demographic details, physical and socio – psychological domains based on COVID-19 Yorkshire Rehabilitation Screening tool (C19-YRS) were assessed and the impact of each domain was graded using a Likert scale. Post – COVID 19 functional status scale (PCFS) to assess functional limitations was also sent through Google form and the details were collected. **Analysis:** Collected data was analyzed using Microsoft Excel with descriptive statistics. **Result:** 1044 individuals participated in the study. On Assessment of post COVID sequelae fatigue was major symptom reported followed by cough and other neuropsychiatric symptoms. 53.4% of COVID recovered individuals had functional limitations and 2.4% of these individuals had severe functional limitations and they require assistance for daily living. **Conclusion:** Most COVID–19 recovered individuals had persistence of some clinical symptoms. From PCFS it was observed that 23% individuals had moderate to severe functional limitations, therefore early detection and rehabilitation measures are recommended.

Key words: *Fatigue, Functional limitations, Post COVID functional status, Post COVID symptoms.*

Introduction

The novel Corona virus disease 2019 (COVID-19) is an acute respiratory illness caused due to Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). SARS-CoV-2 belongs to a family of single-stranded RNA viruses called corona viruses. Due to high attack rate and case fatality rate, World Health Organization (WHO) has declared this outbreak as a global pandemic. [1]

Common symptoms of COVID-19 include cough, fever, dyspnea, musculoskeletal symptoms (myalgia, joint pain and fatigue), gastrointestinal symptoms and anosmia/dysgeusia. There is a high

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incidence of Pneumonia, pulmonary embolism, myocardial damage/myocarditis and neurological complications, in critically ill patients with COVID-19[2].

COVID-19 has a major impact on physical, cognitive, mental and social health status, in COVID patients even with mild disease presentation. In previous corona virus outbreaks of severe acute respiratory syndrome (SARS) in 2002 and Middle East respiratory syndrome (MERS) in 2012, post discharge symptoms were observed which was similar to the post discharge symptoms of COVID–19. A meta analysis of 28 follow up studies found that one fourth of the individuals who have recovered from SARS and MERS had reduced lung function and exercise capacity at 6 months after discharge from the hospital. Likewise mental health problems such as Post traumatic stress disorder (PTSD), depression, anxiety, and reduced quality of life were also observed in one third of the recovered individuals at 1 year after discharge [3]. So, it is necessary to follow-up these COVID 19 recovered individuals and perform assessments for functional limitations to detect early the disabilities and initiate appropriate management towards their physical, psychological and social realm.

Hence this study was done to assess the post COVID sequelae in COVID recovered individuals and to assess the functional limitations using post COVID functional status scale after 4weeks of onset of illness.

Materials and Methodology

The retrospective cross sectional study was conducted at Chengalpattu Medical College, Chengalpattu during the period of January and February 2021, after ethical clearance on COVID 19 recovered individuals**,** who were infected during COVID I wave**.**1044 individuals after 4 weeks of onset of illness, aged between 18 to 60 years of both genders responded and participated in the study.

The semi structured questionnaire was developed based on the COVID-19 Yorkshire Rehabilitation Screening tool [4] and post COVID – 19 Functional Status (PCFS) Scale [5] in both English /Tamil, Likert scale was included along with semi structured questionnaire to grade the severity of post COVID symptoms and sent to individuals through WhatsApp / telephone who had attended triage OP earlier.

Post COVID symptoms were expressed as physical and socio – psychological domains. Physical domains included in this questionnaire were breathlessness, cough, palpitations, chest pain, loss of appetite, weight loss and fatigue whereas socio – psychological domains included were trouble sleeping, panic, irritability and anger, difficulty in doing routine activities / physical exercise, recollecting recent incidents, ability to relax or to initiate the daily activities. Each domain was graded using Likert scale to assess the post COVID symptoms in recovered COVID–19 individuals. Likert scale was graded from 0 to 10. Severity of post Covid symptoms were graded as Grade 0 to 4 represents mild, grade 5 to 7 as moderate and grade 8 to 10 as severe.

POST COVID 19 FUNCTIONAL STATUS SCALE was also used to grade the functional limitations using Likert scale [5]**.**

Grade 0 – No functional limitations

Grade 1 – Negligible functional limitations

Grade 2 – Slight functional limitations

Grade 3 – Moderate functional limitations

Grade 4 – Severe functional limitations

The completed data was collected and tabulated for analysis with descriptive statistics using Microsoft excel.

Results

Among 1044 recovered COVID 19 individuals 515 were males and 529 were females with the mean age of 37.30 ± 13.02. These individuals were between 4 weeks to 15 weeks after the onset of COVID illness. Post COVID symptoms were analyzed and results were tabulated.

Table I: Post COVID symptoms, duration and grading of severity of the symptoms using Likert scale in recovered COVID 19.

Post COVID symptoms	n (1044)	Duration weeks	Mild (0 to 4) (n)	Moderate (5 to 7) (n)	Severe (8 to 10) (n)
Fatigue	778	9	353	402	23
Cough	744	8	635	85	24
Difficulty to recall incident memories	554	4	450	104	0
Trouble sleeping	506	15	266	230	10
Difficulty in routine day to day	485	8	246	239	0
Loss of appetite	383	9	332	51	0
Difficulty in breathing	369	6	309	60	0
Difficulty to relax	337	7	205	132	0
Difficulty in doing exercise	235	5	133	86	16
Headache	199	8	163	16	20
Irritability and anger	157	4	125	32	0
Obvious weight loss	126	5	111	15	0
Panic	101	4	24	63	14
Palpitations	90	2	90	0	0
Chest pain	14	1	14	0	0

Table I represents the grading of severity, duration and prevalence of post COVID symptoms. This study found that all individuals who have recovered from COVID–19 had at least one symptom even after 4 weeks of illness 74.5% individuals reported fatigue followed by cough in 71.26% during post COVID period.

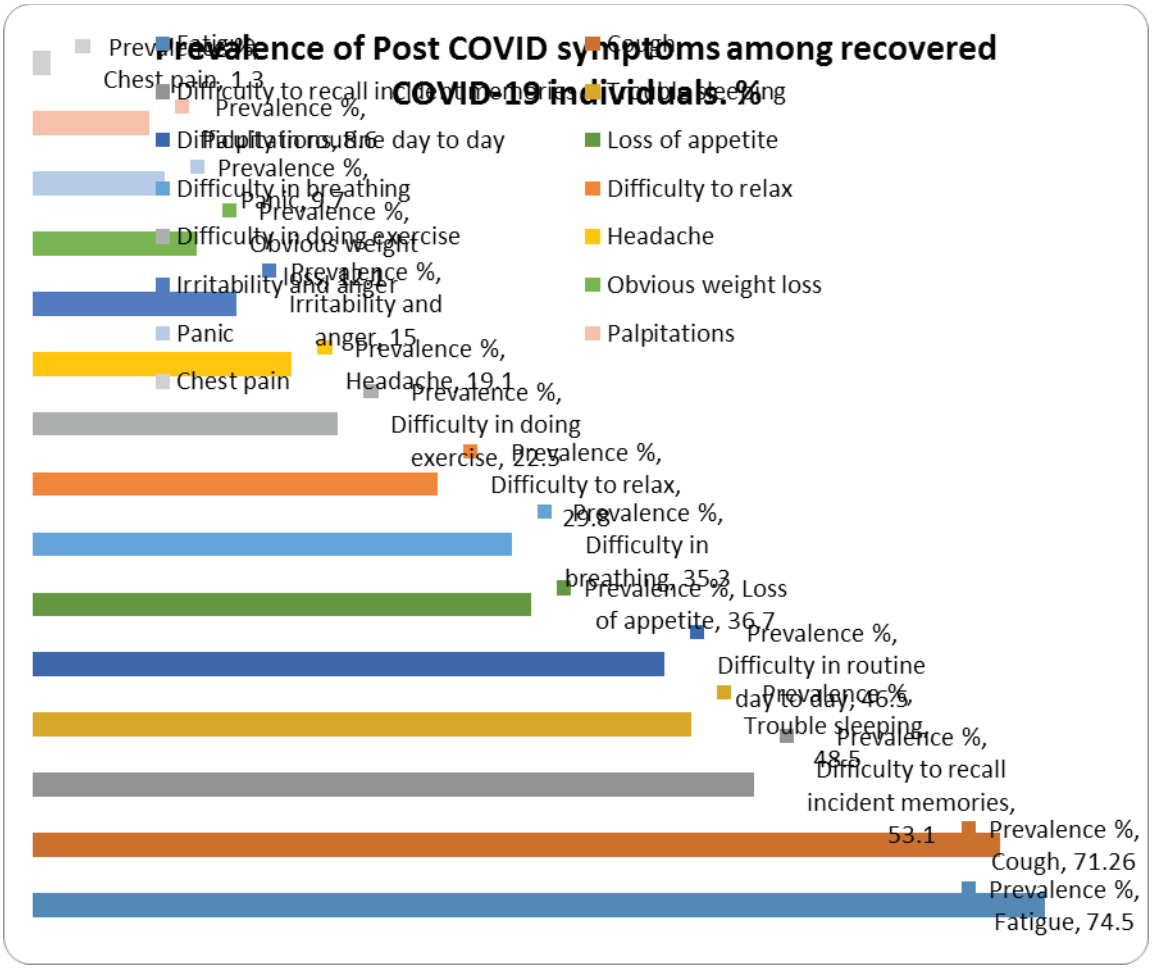

Figure I shows the prevalence of post COVID symptoms among individuals who recovered from COVID-19

Table II: Functional status of Post COVID – 19 individuals

Post COVID Functional Status (PCFS) scale	n (%)
Grade 0 No functional limitations	487 (46.6)
Grade 1 Negligible functional limitations	311 (29.8)
Grade 2 Slight functional limitations	6 (0.6)
Grade 3 Moderate functional limitations	215 (20.6)
Grade 4 Severe functional limitations	25 (2.4)

Table II represents the functional status of post COVID 19 individuals. Here 46.6% of the recovered COVID-19 individuals had no functional limitations whereas 53.4% of Covid recovered individuals had functional limitations. Out of 53.4%, 2.4% of the recovered COVID-19 individuals had severe functional limitation needs assistance for daily living.

Discussion

Individuals recovered from COVID 19 had a wide range of clinical manifestations involving physical, cognitive and psychological domains. In our study, out of 1044 recovered post COVID individuals, 778 individuals (74.5%) reported fatigue as a most common symptom persisting even after recovery from illness. Similar result was reported by Tansey et al after SARS in 2003[6] and also consistent with study of Lara et al [7], who reported fatigue along with neuropsychiatric symptoms. An Italian follow up study also reports the same finding with 143 individuals reporting fatigue after 7 weeks of post discharge. Wang et al results were in contrast with our study where 86% of patients were symptom free for 3 to 4 weeks after discharge in Wuhan [8].

Fatigue might occur due to changes in central, psychological and peripheral factors [19]. Delorme et al and Guedj et al suggested that fatigue occurs probably due to cerebral hypometabolism which was observed through neuroimaging studies among COVID 19 individuals [21, 22]. Ferrandi et al states that COVID 19 has an impact on skeletal muscle either directly or indirectly by cytokines which disrupts the muscle metabolism [23, 24] and therefore contributing to fatigue.

Persistent cough is the second common symptom observed in 744 individuals post COVID 19 (71.26%) probably due to laryngeal hypersensitivity which involves both central and peripheral component contributing to hypersensitivity and neuroinflammation[11]. Post COVID cough is usually associated with fatigue and breathlessness [12].

35.3% of the individuals reported breathlessness probably due to increased cardiac metabolism and myocardial oxygen demand [16] and fatigue may also contribute to it.

554 individuals (53.1%) reported short term memory loss and 199 individuals (19.1%) reported headache after COVID recovery. It may occur due to SARS–CoV–2 which enters through nasal route and reaches olfactory bulb [9] causing release the various pro inflammatory cytokines such as Interleukine-6 (IL-6), Interleukin–12p40 (IL-12p40), Interleukin–15 (IL-15), tumor necrosis factor alpha (TNF-α), chemokine (C-X-C motif) ligand 9 (CXCL9) and chemokine (C-X-C motif) ligand 10 (CXCL10) in the nervous system[10].

Individuals also reported exercise intolerance (22.5%), palpitations (8.6%) and chest pain (1.3%) which might be due to involvement of cardiovascular system. COVID-19 causes myocarditis, myocardial infarction or cardiac failure probably by binding with the ACE2 receptors in the heart and altering its signaling pathway.

Gastro intestinal symptoms such as vomiting, abdominal pain, diarrhea, loss of appetite were also common among post COVID – 19 symptoms [17].

Individuals also reported symptoms related to Post traumatic stress such as disturbed sleep (48.5%), irritability and anger (15%), panic or anxiety (9.7%) and feeling difficulty to do routine day to day activities (46.5%) or relax (29.8 %) which may lead to functional limitations among recovered COVID19 individuals. Similar results were observed by Li et al, who states that isolation from family and friends during hospitalization and quarantine and stigma associated with the disease may likely contribute to mental illness [18].

Further functional status of COVID-19 recovered individuals was assessed using PCFS scale. It is used to evaluate the consequences and functional limitation among recovered COVID individuals. From this scale we observed that 487 (46.6%) individuals had no functional limitations (grade 0) that they can perform day to day activities and don't had any psychological symptoms. 311 (29.8%) individuals had negligible functional limitations (grade 1) and 6% had mild limitations (grade 2) in routine activities, due to persistent of symptoms. Individuals with moderate (20.6%) limitations were found to have difficulty to do even their routine activities and it may be due to gradual increase in post COVID symptoms causing impaired quality of life. Severe functional limitations were observed in 25 (2.4%) individuals who were highly symptomatic may be due to co-morbidities requiring assistance for daily living [26, 27].

Conclusion

Most of the individuals who recovered from COVID–19 had some post COVID manifestations such as fatigue, cough, breathlessness and neuropsychological symptoms. Post COVID individuals who had moderate and severe functional limitations needs rehabilitation. Therefore early detection and rehabilitation measure such as close monitoring of each post COVID individuals, control of co-morbidities, yoga and meditation, respiratory physiotherapy, functional and psychological support will help to reduce post COVID clinical manifestations and improve their quality of life.

Acknowledgement Nil

Conflict of interest Nil

Source of funding Nil

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 DOI Number:10.37506/ijop.v10i2.3253

Comparative Study Of Physical Fitness Index And Predicted VO2max among Rural And Urban Female Students

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Abstract

Background: Physical fitness index (PFI) measures fitness for muscular work and ability to recover from work. It assess cardiopulmonary efficiency. Vo2 max refers to maximum amount of oxygen that an individual can utilize during intense exercise and is best indicator of cardiovascular fitness and aerobic endurance. PFI and Vo2 max are dependent on height, weight, BMI. Differences in anthropometry among urban and rural subjects due to different environmental, social, nutritional and life style habits can affect PFI and Vo2 max. Thus present study is intended to compare PFI and predicted Vo2 max among rural and urban female students**.**

Materials and Methods: 50 participants of age group 18-20 years, 25 sedentary female subjects from each of rural and urban sectors of 1st year MBBS were taken by random sampling. PFI was determined by modified Harvard step test and Vo2 max was determined by Indirect Queens college step test. Mean PFI was higher in rural group compared to urban group (p= 0.48). Mean Vo2 max was similar in both the groups (p=0.99). PFI was positively correlated with Vo2 max in both the groups ($p<0.05$).

Conclusion: Rural female students do not have a statistically significant higher value of PFI and Vo2 max than urban female students.

Keyword: *Female subjects, Harvard step test PFI, Queen's College Test, Vo2 max*

Introduction

Physical fitness is a key factor for day to day activities and to lead a healthy life.[1] It is defined as ability to carry out daily tasks with vigour and alertness without undue fatigue and with ample energy to enjoy leisure pursuits, to meet unusual situations and unforeseen emergencies.[2] It is influenced by age, gender, environmental and lifestyle factors like eating habits, physical activity and they might determine cardiovascular health.[3] Physical fitness has many advantages like increase in level of activity, tolerance and social behavior. Physically fit individuals can easily adapt to stressful conditions. Physical fitness has three components – static fitness (absence of disease),

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dynamic fitness (ability to perform strenuous work) and motor skills fitness.[4] Of these dynamic fitness is very important and is measured by Harvard step test, which is widely used fitness tool to assess physical performance capacity of an individual.[5]

VO2 max refers to maximum amount of O2 that an individual can utilize during strenuous exercise and is an internationally accepted parameter to evaluate cardiorespiratory fitness and aerobic endurance.[6] Determination of cardiorespiratory fitness in terms of VO2max is restricted to laboratory due to its exhausting and difficult protocol.[7] Queen's college test is simplest procedure to evaluate VO2 max in large number of population specially in absence of well-equipped laboratory.[4,8,9]

Both PFI and VO2 max are dependent on anthropometric parameters like height, weight and body mass index (BMI).[1] Studies mentioned that there is differences in anthropometric values among urban and rural female students due to differences in their environmental, social, life style habits (dietary, physical activity) which can in turn effect PFI and VO2 max.[1] Thus our current study is aimed at comparing and correlating physical fitness levels with Vo2max in rural and urban female students in different social, nutritional, environmental and cultural conditions.

Objective

1) To assess physical fitness index using Harvard step test among rural and urban female students.

2) To assess VO2max by indirect Queen's college step test among rural and urban female students.

3) To compare and correlate physical fitness index and VO2max among rural and urban female students.

Materials and Methods

The study was done on 50 sedentary female students of age group 18-20 years, 25 subjects from each of rural and urban sectors of 1st year MBBS were taken by simple random sampling, after obtaining approval from ethical committee of the institute. The detailed procedure was explained and demonstrated to the students. Study was conducted in May- June 2021, Department of Physiology, BMCRI, Bangalore.

Study Design: Cross sectional study

Study setting: Department of Physiology, BMCRI, Bangalore.

Inclusion Criteria:

1) Healthy sedentary female students of 1st yr MBBS

2) Age group: 18 – 20yrs

Exclusion criteria:

1) H/o any disorders like Diabetes mellitus, Hypertension, Bronchial asthma, Cardiovascular diseases.

2) H/o alcohol, smoking, any recent major surgery.

3) H/o of anaemia, musculoskeletal abnormalities.

Measurement of physical parameters:

Height and weight of the subjects were measured

by stadiometer and standard weighing scale.

BMI of all subjects were computed by following equation

BMI = Weight (kg)/ Height (m) ^{2}

Test procedure:

Subjects are instructed to restrain from eating, drinking, doing physical activities atleast for 2hrs before performing experiment. Each subject was allowed to take rest in a recumbent position, 10 minutes before and in between the procedures (Harvard step test and Queen's college test)

Determination of Physical Fitness Index (PFI)[3]

Subjects were instructed to perform Modified Harvard step test (step up and step down at a constant pace) on a 16.25 inch stool[10] at a rate of 22 steps/min (rate detected by metronome) and exercise was continued up to 3 min.

Recovery pulse rate was counted at 1 to 1.5 min post exercise.

PFI score was calculated using formula

PFI = Duration of exercise (180 sec) x 100 / 5.5 x pulse count (1-1.5 min of recovery pulse)

Queen college step test for measurement of VO2max[4]:

V02max was measured by indirect queen's college step test. Subjects were instructed to step up and down on a 16.25 inch stool for 3 min at rate of 24 beats /min (rate dictated by metronome). After 3 min of exercise recovery pulse was recorded for 5 -20 sec (15 sec) duration.

VO2max is calculated using formula

VO2max (ml/kg/min) = 65.81-[0.1847 x Heart rate (5- 20 sec)]

Statistical Analysis

Data is presented as mean + SD. Independent t test is used to determine significant difference between two groups. Pearson's coefficient is used to correlate different parameters with VO2max and PFI in both groups. P value of < 0.05 as statistically significant.

Results

Table 1 shows comparison of physical parameters of Urban and Rural female students

Parameters	Rural	Urban	p value
Age (yrs.)	19.04 ± 0.61	18.72±0.73	0.1
Body weight	54.92±8.04	56.99±8.66	0.38
Height	159.44±8.879	158.2±6.12	0.57
BMI	21.59±2.61	22.72±2.76	0.14

Table 2 comparison of mean PFI & VO2max scores in Urban and Rural female students

Category	Rural	Urban	p value
PFI	62.4±15.97	59.95±1.19	0.48
VO2max	59.3±15.4	59.96±1.48	0.99

Table 3 correlation of anthropometric parameters and VO2 max with PFI in urban and rural female students

Group	Parameter	r value	p value
Rural	PFI &Wt	0.025	0.90
	PFI& Ht	0.226	0.82
	PFI &BMI	0.053	0.80
	PFI &VO2	0.522	0.007*
Urban	PFI &Wt	0.36	0.07
	PFI& Ht	0.136	0.51
	PFI &BMI	0.357	0.079
	PFI &VO2	0.502	0.01*

*Indicates statistically significant values ($p<0.05$)

Discussion

In our study we intended to compare physical fitness index and predicted VO2 max among rural and urban female students.

Physical parameters (Age, Ht, Wt, BMI) did not show significant differences between urban and rural female students (Table 1)

In our study on comparing PFI and VO2 max among two groups, we did not find any statistically significant differences (Table 2)

Our findings are consistent with study done by Banibrata Das etal, who also found no statistical higher values of physical fitness index and VO2 values in rural students when compared with urban students. This could be attributed due to differences in their different lifestyles and daily life schedules. There may be changes in their nutrition as well. Among urban females there is greater awareness of fitness levels and health consciousness compared to rural females. All above facts may result in differences in their anthropometry and in turn on PFI and also VO2 max, but in our study, we did not find statistically significant difference in PFI when compared between two groups.

Also from table 3 we found out that PFI was positively and significantly correlated with VO2 max in both urban and rural groups ($p<0.05$).

Limitation

Our study involved small sample size of age group limited to 18-20 years. Study in other age groups and involving large sample size may show difference in PFI.

Conclusion

Rural female students do not have a statistical higher significant value of PFI and Vo2 max score than urban female students.

Acknowledgment: I am grateful to all the participants of the study for their kind cooperation. and also to my Guide Dr Girija B for her support and encouragement. I am also thankful to Department of Physiology BMCRI for the support and encouragement for the study

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from Institutional Ethical Committee

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Association between ABO & RH Blood Group Phenotype with Covid-19 Infection

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Abstract

Introduction: Covid-19, conjointly referred to as severe acute metabolism syndrome appeared in December 2019 by a new Corona virus. The virus originated from Wuhan, the capital of China's Hubei Province and unfold everywhere the globe and have become a worldwide pandemic due to lack of cure. The number of cases increased as a result of human to human transmission, overseas travelers and direct contact with infected people made up the majority of cases.1-2-3. The study's goal was to determine whether there was an association between ABO and Rh blood group phenotypes with COVID-19 infection.

Objective - To study the association of ABO Blood Group and COVID-19 infection. To study the association of Rh factor and COVID-19 infection.

Material Method: This retrospective study was conducted after the approval college research committee of Teerthanker Mahaveer medical college and research center. The study period of this study is from 12 March 2021 to 12 March 2022. The current research included 3000 Covid-19 patients confirmed by RTPCR test and admitted in the Teerthanker Mahaveer University Hospital, Moradabad. Covid -19 positive patient's age, gender, ABO blood group, Rh factor and personal data was collected from the medical record department.

Result: The most common blood group affected was B+ (1,119, 37.3%) followed by O+ (729, 24.3%), A+ (653, 21.8%), AB+ (330, 11.0%), B- (77, 2.6%), O- (36, 1.2%), A-(36, 1.2%) and AB- (20, 0.7%).

Interpretation & Conclusion: The findings of this study are the blood group that was more affected was B positive and least numbers of patients are of blood group AB negative.

Keyword: *ABO blood group, coronavirus disease, Rh factor.*

Introduction

4,800,875 people have died so far from the corona virus as of 01, October 2021 in 206 nations, regions or territories.[4]According to the World health Organization the virus primarily spreads between people through close contact. This COVID-19 virus is a metastatic type that can be transferred from on infected person to a healthy one through droplet

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infection. This virus can be spread by inhaling or just chatting.[2,4]

This virus has different type of affects on different people:

Usual indication:- High temperature, dizziness, breathlessness, cough, fatigue, ageusia and anosmia.[5]Less ordinary indication:- Coughing, migraine, joint pain, nausea, dermatitis on skin, browning of fingers or toes, reddish or angry eyes. [5]Consequential indication:- Breathing difficulties or dyspnea, aphasia or chest pain are all possible symptoms. People who are already normal and have mild indication should manage their problems at private. It means the average of 5-6 days for symptoms usually appear once a person has been exposed to the virus. It may, however, need 14 days.[5]

As a precautionary measure against the Corona virus, India's government imposed a 21-day nationwide lockdown on March 24, 2020. As the first lockdown's expiration date approached, state governments and other advisory groups requested that the lockdown be extended because it had slowed the Pandemic's development rate. Preventive measures including social distancing, quarantine and isolation procedures had been implemented. When adequate pharmacological drugs failed to treat, these preventive strategies were found to be successful.[6-7]

Scientists worked to understand several corona virus variants circulating in India.

The World Health Organization has observed four variations of concern: B.1.17, B.1.351 P2, and B.1.617. Alpha, Beta, Gamma and Delta will be their public labels. SARS-CoV-2 has a sub-lineage that was discovered in India and is now known as "Kappa".[8]

The state has been ravaged by a second wave of COVID-19. On 9/5/2021, our country had approximately 4lakh communicable diseases.

Several recent investigations have connected genetic differences in angiotensin-converting 1 enzyme and glutathione S-transferase T1 to corona virus contamination or fatality.[9]

The variable production of ACE-2 in the airway is one of many molecular level theories postulated for the differing occurrence of the disease or sensitivity to serious disease. The ABO carbohydrate moieties of Landsteiner were transmitted biologically but prior study has revealed the link among ABO blood type, cardiac disease and cancer but also classification or vulnerability toward certain viruses like the sever acute respiratory syndrome corona virus.[10]

Previous research has found that a person's ABO blood group affect their genetic vulnerability to viral infections like influenza, Ebola or sever acute syndromes of respiratory system affected by corona virus 2.[11-12]

The ABO blood group system given by K.Landsteiner in 1901, many scientists since then have given various possibilities and linkage of the blood group to diseases and viruses.[13]

On a large percentage of individuals both types of allergens (A and B) were found on the surface of red blood corpuscles. These antigens are responsible for the majority of blood transfusion reactions. Due

to the manner in which agglutinogens are transferred from one generation to another, people may neither have any of these agglutinogens or they may have one or both on these cells.[13]

When transfusion of blood takes place from one individual to another, the presence and lack of these 2 agglutinogens is typically used to classify donors and recipients into four primary ABO grouping systems. [13]

The ABO blood grouping system has been connected to a variety of human ailments, particularly cardiac, oncological, infectious or non-infectious issues, according to numerous researches.[14-15]

Corona virus disease and ABO blood group have been linked in a few studies. The A, B and AB blood types are all risk factors for transmission; however the O blood group is linked to a decrease incidence in the majority of populations analyzed. [10,16]

When compared to ABO, Rh (D) phenotypes are linked to a small number of illnesses. Rh has a role in type compatibility and immunological response, just like ABO.[17]

The study's goal was to determine whether there was an association between ABO and Rh blood group phenotypes with COVID-19 infection.

Study Method

Study design: Retrospective study

Study period: 12 March 2021- 12 March 2022

Inclusion Criteria: Patients admitted with COVID-19 infection confirmed by RT-PCR test.(17)

Exclusion Criteria: Any history of smoking.(5)

The current research included 3000 patients with Covid-19 who were admitted to the Teerthanker Mahaveer University Hospital in Moradabad and were confirmed by RTPCR test. Covid -19 positive patient's age, gender, ABO blood group, Rh factor and personal data were acquired from the medical record department after clearance by the College Research Committee and the medical superintendant of TMU Hospital. After that the data was analyzed.

Statistical Analysis

SPSS and MedCalc Software were used for the data analysis.

Result

Table1: Distribution of the patients on the basis of blood group and Rh (n=3,000)

Blood Group/Rh factor	Frequency	Percent
A-	36	1.2%
A+	653	21.8%
AB-	20	0.7%
AB+	330	11.0%
B-	77	2.6%
B+	1,119	37.3%
O-	36	1.2%
O+	729	24.3%

The most common blood group affected was B+ (1,119, 37.3%) followed by O+ (729, 24.3%), A+ (653, 21.8%), AB+ (330, 11.0%), B- (77, 2.6%), O- (36, 1.2%), A-(36, 1.2%) and AB- (20, 0.7%).

Discussion

Zhao J colleagues discovered in a study published in 2020 that blood group A had a heightened incidence of severe acute respiratory illness, while blood groups O had a reduced risk.[18]

In the year 2020, Ad'hiah AH et al did a study with 300 confirmed cases. They came to the conclusion the individuals with the ABO blood type and those with type A blood group were more vulnerable of becoming infected, as compared with type AB.[19]

According to Fan Q et al in 2021, blood group A individuals diagnosed with Severe acute respiratory had a greater mortality rate than normal participants.[20]

The interface among spike proteins and Angiotensin converting enzyme 2 receptors was normally inhibited by antibody type A, which indicates that type O blood group, is shielded towards infections and death rates from COVID 19. The function of ABO antibody just on interface between both the corona spike proteins as well as the Angiotensin converting enzyme 2 receptor remains unknown. The spikes of protein of the viral genome transmit A, B, AB glycan antigen, which is dependent on the blood type of the vector for virus replication and infection transmission to new hosts. As the O type of blood group has both type of antibodies (A and B) so there are less chances for the infections with A, B and AB antigens.[21] The ABO antibody titers also have a preventive role. Those disparities in data on the correlation among blood types and corona infection might attribute to strains of SARS-CoV-2 having varied pathogenesis and differences in the studied population. [22]

Study done by Ravuri S et al, suggested that individual who had B blood group, they were more infected with the corona virus as compared to rest of all blood groups.[22]

Study done in 2021 by Rana R et al, according to their research blood group A, B & Rh positive were more prone to the infection while blood group O, AB and Rh negative have a higher resistance for COVID-19 infection.[23]

Research done in 2020 by Almadhi MA et al, they observed that blood group B had more chance of corona illness than blood group AB.[24]

In the present research, we found that people with blood group B was more at risk to COVID-19 illness, whereas subject with blood group AB was the least sensitive for the infection.

The source of connection and higher frequency of covid-19 disease in people with Blood Group B is unclear. [22,25]

Conclusion

In our study we found that blood group was affected most B positive and least number of patients affected are of AB negative blood group.

Limitation in the present clinical study is that there is a likelihood that different pre-existing sickness could have increase severity of corona virus infection we did not exclude the pre-existing sickness in corona virus patients.

Financial support & sponsorship: None

Conflict of Interest: None.

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