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Assessment Of Lifestyle Pattern Of Indian Adults Suffering From Covid – 19 In The 'Pre - Covid', 'During Covid' and 'Post – Covid' Phases: An Observational Study Of Patients Aged 51 – 85 Years

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Abstract: **Introduction:** China reported Novel Coronavirus among pneumonia patients on 31 December 2019. COVID 19 disrupted the lifestyles and sleep patterns of the population. Physical activity reduced susceptibility to COVID-19 thereby promoting the immune function and improved sleep quality. **Aim:** To assess the physical activity and sleeping pattern in Indian adults ages 51 – 85 years suffering from COVID – 19 in the 'pre - covid', 'during covid', and 'post – covid' phases. **Methodology:** In each phase of the study, patients were interviewed with a semi-structured telephonic interview and self-constructed questionnaire via Cognito form. The data was collected on demographics, past medical histories, clinical data, inflammatory markers, yoga asanas, breathing, aerobic, strength training exercises and sleeping patterns of the participants. **Results:** Most of the participants were into service (26.2%). The mean age and hospital duration of COVID-19 patients was 61.3 ±7.28 years and 8.3 ±4.0 days. In the 'post-covid' period, yoga asanas and 'during covid' phase, breathing exercises were significantly($p=<0.05$) performed. Aerobic exercises with a sleep duration of >8 hours per day and strength training exercises were significantly ($p=<0.05$) greater in the 'pre-covid' phase. During covid, ferritin levels were better among participants with regular physical activity. The participants slept an average of 4 to 6 hours per day. Sleep duration of <4 - 6 hours resulted in high DBP and > 8 hours resulted in high SBP in the participants. The participants had significantly higher screen time before going to bed in 'pre covid' and 'post covid' phases. **Conclusion:** Physical activity and sleep duration significantly decreased in the 'during covid' phase. A good physical activity during covid' had a positive impact on serum ferritin levels, systolic blood pressure, oxygen saturation, and pulse rate. In the pre- and post-covid phases, participants had significantly higher screen time before going to bed, negatively impacting sleep quality.

Keywords: Physical activity, Exercise, Sleeping pattern, Sleep duration, Lifestyle pattern, COVID – 19, Inflammatory marker, Screen time.

I. INTRODUCTION

In December 2019, the pneumonia outbreak of unknown origin was reported in Wuhan, Hubei Province, China which was epidemiologically linked to the Huanan Seafood Wholesale Market. Bronchoalveolar lavage fluid from patients with pneumonia of unknown origin was injected into human airway epithelial cells. This led to the isolation of a novel coronavirus, SARS-CoV-2, previously named 2019-nCov(Zhu et al., 2020). As per WHO reports, globally, as of 18 June 2021, there have been 1.7 million confirmed cases of COVID-19, including 3.84 lakh deaths, reported to WHO (Cennimo DJ, 2020). Elderly individuals are particularly at risk because of their diminished immune response. The elderly having reduced mucociliary clearance may allow the virus to spread to the gas exchange units of the lung more readily (Nikolaidis et al., 2017). It is well documented in many previous types of research that lack of Physical activity (PA) increases the risk of many Non – communicable diseases with underlying comorbidities. Regular physical activity decreases systemic inflammation which is one of the major contributors when it comes to lung damage caused by COVID- 19 infection. On the whole, consistent with the previously mentioned studies, the results found showed a significant correlation between physical activity and a decrease in the severity of illness among COVID-19 patients(Zahra Tavakol, 2021). All types of yoga asanas (sitting, standing, and lying) and yogic breathing are useful in reducing the risk of contraction of COPD and bronchial asthma (Kaminsky et al., 2017).Yoga can reduce the susceptibility to Acute Respiratory Infections. Standing, prone and supine lying yoga asanas improved chest expansion and functions(Ananthalakshmi, 2018). *Pranayama* reduces the risk of infection, increases the functional capacity of the lungs, and improves sleep quality(Trivedi & Saboo, 2021). It also cures cold, flu, sinus, asthma and is good for tonsils, thyroid, and throat problems (Shashi kant Yadav, 2020). It increases the oxygen saturation in the body and nitric oxide which has anti-inflammatory action(Mahour & Verma, 2017). Aerobic exercise is positively associated with the enhancement of the functional capacity of the immune system. Hence it has become a major part of the prevention therapy of COVID – 19. It increases the number of immune markers which play a major role in human defense against infections (Gonçalves et al., 2020). It helps to increase the number of immunoglobulins (IgA, IgM, IgG), which reduces lung infections, especially IgA. (Mohamed & Taha, 2016). It helps to regulate the levels of C-reactive proteins (de Gonzalo-Calvo et al., 2015). The gas-exchange side of the respiratory system does not adapt to exercise training, "the pump" side of the respiratory system does undergo adaptive changes in response to endurance exercise. Hence as few as 10 consecutive days of endurance exercise training (walking, jogging, dancing, swimming, cardio, etc.) results in significant protection against COVID – 19 (Woods et al., 2020). According to the exercise recommendations particularly for older adults, are strongly recommended 5 – 7 days of aerobic training and 2 – 3 days of muscle-strengthening exercises to promote immune function (Abdelbasset, 2020). Moderate-intensity exercise training is inversely associated with the incidence, duration, and severity of upper respiratory tract infections(Grande et al., 2020). Sleep is a vital process for maintaining homeostasis and the quality of human life. Good sleep quality has an impact on well-being. Research over the last decade has increasingly validated the claim that sleeping patterns have a strong influence on the risk of infectious diseases, the occurrence and progression of a series of diseases(Irwin, 2015). Similarly, in one of the studies (Prather AA, 2016) illustrates that adults who reported having inadequate sleep or disturbed sleeping patterns were also more likely to report a head or chest cold and infection. Excessive screen time is altering sleep and circadian rhythms and strengthening the pathways to poor health, learning, and safety outcomes (eg, obesity, depression, risk-taking) (LeBourgeois et al., 2017). Another study reported that, although sleep quality was influenced by physical activity (Gothe et al., 2020), older adults reported sleep impairment 'during covid'.

Thus, there is a felt need to conduct research in this area and add to the existing lacunae in the database. The study will be a valuable addition to fill the lacunae in the literature regarding the effect of COVID 19 on the various lifestyle risk factors such as physical inactivity, irregular sleeping patterns, and overall well-being of COVID – 19 patients of age group between 51 – 85 years. The objectives of the study were - to assess the lifestyle patterns: yoga asanas, breathing, aerobic, and muscle strengthening exercises, health status, and to evaluate the association between inflammatory markers, physical activity, clinical data, screen time and sleeping duration in COVID – 19 patients during the 'pre - covid', 'during covid', and 'post - covid' phases.

II. METHODOLOGY

A Retrospective / Prospective, Observational, Comparative study was carried out in a sample size of 340 participants (221 males and 119 females) using a purposive sampling technique. The study duration was around 6 months. Ethical clearance was obtained from Hospital– Ethics Committee for Biomedical & Health Research (EC-BHR), Regn. No. EC/NEW/INST/2020/504. Patients admitted to a hospital in Mumbai, Maharashtra and recovered from COVID-19 between the age group of 51 - 85 years selected from the case records and contacted telephonically were the target population for the study. Male and female patients in the age group of 51 – 85 years suffering from COVID- 19, both Symptomatic and Asymptomatic COVID – 19 patients with or without co-morbidities were included in the study. COVID-19 patients on mechanical ventilation, critically ill, were excluded from the study. They were assessed across three phases – 'pre – covid', 'during covid' and 'post – covid' using a semi – structured telephonic interview cum self – constructed questionnaire via Cognito form. The data was collected regarding the lifestyle pattern of COVID-19 patients which included the demographic characteristics, past medical history, clinical data, inflammatory markers, regularity of yoga asanas, breathing exercises, aerobic exercises, strength training exercises, sleeping pattern that included sleep duration and screen time before going to bed across three phases i.e., 'pre – covid', 'during covid' and 'post – covid' respectively. A pilot study was conducted on 20 patients recovered from COVID-19 between the age group of 51 – 85 years old by administering the above self-designed questionnaire. Based on the pilot study, the required changes were implemented in the questionnaire and validated.

2.1. STATISTICAL ANALYSIS

The data was analysed by using the statistical package of social software for Windows (SPSS, Version 20). The analysis of the data included t – tests, Chi – square tests, ANOVA & Pearson's correlation. Statistical significance was defined as p value = <0.05.

III. RESULTS AND DISCUSSION

Among 340 patients, the mean age in years was 61.3±7.28. Only 301 patients mentioned the duration of hospital stay; reason being that few patients were home quarantined 'during covid'-19 as they were asymptomatic and also due to limited hospital accommodation. So, 301 patients had the mean duration of hospital stay as 8.33±4.05 days.

table no. 1 baseline characteristics of covid-19 patients

Baseline characteristics (N=340)	**Frequency**	**%**
Gender		
Male	221	65
Female	119	35
Occupation		
Service	89	26.2
Housewife	73	21.5
Student	2	0.6
Retired	73	21.5
Business	83	24.4
Other	20	5.9
Symptomatic COVID-19	-	84.1
Asymptomatic COVID-19	-	15.9

65% were males and 35% were females respectively. The collected data of COVID-19 patients represented by 26.2% doing service, 21.5% were housewives, 0.6% were students, 21.5% were retired people, 24.4% were into business and 5.9% were occupied with other jobs. The collected data represented that 84.1% of COVID-19 patients were Symptomatic and 15.9% were Asymptomatic at the time of hospital admission as shown in table no. 1

table 2. clinical data of covid-19 patients at the time of hospital admission

Clinical data of COVID-19 patients	**Mean±SD**
Systolic blood pressure (mm Hg)	121.7±8.57
Diastolic blood pressure (mm Hg)	79.9±6.09
Oxygen Saturation (%)	94.9±10.07
Pulse Rate (*bpm)	86.0±12.54
Body Temperature *(°F)	99.3±5.62

(°F – degree Fahrenheit, *bpm – beats per minute, *% - percentage)*

The clinical data of 340 COVID – 19 patients was collected to assess their health status. The mean systolic blood pressure was 121.7±8.57 mm Hg, diastolic blood pressure was 79.9±6.09 mm Hg, mean oxygen saturation was 94.9±10.07 %, pulse rate was 86.0±12.54 bpm and mean body temperature was 99.3±5.62 respectively as shown in the table no.2.

According to the study (Al Mahtab et al., 2020), mean oxygen saturation level in COVID-19 patients at the time of hospital admission was 96.7±1.91 %, pulse rate was 81.1±9.5 bpm and mean body temperature was 98.1±1.89 respectively. Another study,(Caillon et al., 2021) demonstrated that the mean systolic blood pressure was 137(124-150) mm Hg and diastolic blood pressure was 78(74-86) mm Hg, pulse rate was 90 (78-110) beats per minute respectively.

table 3. regularity and type of yoga asanas, breathing exercises, aerobic exercises, strength training exercises performed in 'pre - covid', 'during covid' and 'post - covid' phases

Regularity & type of physical activity (N=340)	**'Pre - covid' (%)**	**'During covid' (%)**	**Post – covid (%)**	**p**
Regularity of performance of Yoga	30.3	36.8	37.1	**0.00**
Performance of sitting asanas	27.1	28.2	26.5	**0.00**
Performance of standing asanas	19.7	20.6	28.5	**0.00**
Performance of lying asanas	19.1	25.0	28.5	**0.00**
Regularity of performance of breathing exercise	29.4	52.4	46.2	**0.00**
kapalbhati	26.5	39.1	42.6	**0.00**
Anulom vilom	23.5	46.8	39.4	**0.00**
Adham breathing	7.6	20.3	18.5	**0.01**
Ujjayi	10.6	16.8	13.5	**0.00**
Brahmari	7.6	16.2	15.6	**0.00**
Bhastrika	11.5	18.2	15.6	**0.00**
Regularity of performance of Aerobic exercises	48	8	44	**0.000**
Walking	32.4	4.1	24.4	**0.000**
Jogging	6.8	0	6.5	**0.000**
Running	0.3	0	0.3	**0.000**
Cycling	1.2	0	1.2	**0.000**
Treadmill	0.3	0	0.3	**0.000**
Regularity of performance of Strength training	55	5	40	**0.000**

The data represented the regularity of performance of yoga asanas and its types among 340 COVID-19 patients in 'pre - covid', 'during covid' and 'post – covid' phases as shown in Table. No. 3.
30.3% of patients performed yoga regularly in 'pre - covid', 36.8% performed 'during covid' and 37.1% performed in 'post – covid' phase. Out of 340 patients, 27.1% performed sitting asanas in 'pre - covid', 28.2% performed sitting asanas 'during covid' and 26.5% performed sitting asanas in 'post – covid' phase. 19.7% performed standing asanas in 'pre - covid', 20.6% performed standing asanas 'during covid' and 28.5% performed standing asanas in 'post – covid' phase. 19.1% performed lying asanas in 'pre - covid', 25% performed lying asanas 'during covid' and 28.5% performed lying asanas in 'post – covid' phase. When Pearson's chi square test was used, it was observed that there was significant difference in the regularity of performance of yoga asanas (p value = <0.05) in 'pre - covid' Vs 'during covid' Vs 'post – covid' phases. The regularity of performance of yoga asanas was significantly higher (p value = <0.05) in 'post – covid' phase followed by 'during covid' and significantly lower in 'pre - covid' phase. The regularity of performance of sitting asanas was significantly higher (p value = <0.05) 'during covid' phase followed by 'pre - covid' than in 'post – covid' phase. The regularity of performance of standing asanas was significantly higher (p value = <0.05) in 'post - covid' phase followed by 'during covid' than 'pre - covid' phase. The regularity of performance of lying asanas was significantly higher (p value = <0.05) in 'post - covid' phase followed by 'during covid'.

The data represented the regularity of performance of breathing exercises and its specific types among 340 COVID-19 patients in 'pre - covid', 'during covid' and 'post – covid' phases. 29.4% of patients performed breathing exercises regularly in 'pre - covid', 52.4% performed 'during covid' and 46.2% performed in 'post – covid' phase. Out of 340 patients, 26.5% performed kapalbhati in 'pre - covid', 39.1% performed in 'during covid' and 42.6% performed in 'post – covid' phase. 23.5% performed Anulom vilom in 'pre - covid', 46.8% performed in 'during covid' and 39.4% performed in 'post – covid' phase. 7.6% performed Adham breathing in 'pre - covid', 20.3% performed in 'during covid' and 18.5% performed in 'post – covid' phase. 10.6% performed Ujjayi in 'pre - covid', 16.8% performed in 'during covid' and 13.5% performed in 'post – covid' phase. 7.6% performed brahmari in 'pre - covid', 16.2% performed in 'during covid' and 15.6% performed in 'post – covid' phase. 11.5% performed bhastrika in 'pre - covid', 18.2% performed in 'during covid' and 15.6% performed in 'post – covid' phase. When Pearson's chi square test was used, it was observed that there was significant difference in the regularity of performance of breathing exercises (p value = <0.05) in 'pre - covid' Vs 'during covid' Vs 'post – covid' phases. Breathing exercises were performed regularly 'during covid' followed by 'post - covid' phase as compared to 'pre - covid' phase. The regularity of performance of kapalbhati was significantly higher (p value = <0.05) in 'post - covid' phase as compared to 'during covid' and 'pre - covid' phase. The regularity of performance of Anulom vilom was significantly higher (p value = <0.05) 'during covid' phase as compared to 'pre - covid' and 'post – covid' phase. The regularity of performance of Adham breathing, Ujjayi, Brahmari and Bhastrika was significantly higher (p value = <0.05) 'during covid' phase as compared to 'post - covid' and 'pre - covid' phase.

The data represented the regularity of performance of aerobic exercises among 340 COVID-19 patients in 'pre - covid', 'during covid' and 'post – covid' phases. 48% of patients performed aerobic exercises regularly in 'pre - covid', 8% performed 'during covid' and 44% performed in 'post – covid' phase.
Out of 340 patients, walking was the most performed aerobic exercise. 32.4% performed walking in 'pre - covid', 4.1% performed walking 'during covid' and 24.4% performed walking in 'post – covid' phase. 6.8% performed jogging in 'pre - covid', 0.9% performed jogging 'during covid' and 6.5% performed jogging in 'post – covid' phase. 0.3% performed running in 'pre - covid', and in 'post – covid' phase. 1.2% performed cycling in 'pre - covid', and 'post – covid' phase. 0.3% performed Treadmill in 'pre - covid', and in 'post – covid' phase. 0.3% performed stretching in 'post – covid' phase. When Pearson's chi square test was used, it was observed that there was significant difference in the regularity of performance of aerobic exercises (p value = <0.05) in 'pre - covid' Vs 'during covid' Vs 'post – covid' phases. Aerobic exercises were regularly performed in 'pre - covid' phase followed by 'post – covid' phase as compared to 'during covid' phase. The regularity of performance of walking was significantly higher in pre - covid phase as compared to 'during covid' and 'post – covid' phase. The regularity of performance of jogging was significantly higher (p value = <0.05) in 'pre - covid' phase as compared to 'during covid' and 'post – covid' phase. The regularity of performance of running and treadmill, cycling was significantly higher (p value = <0.05) in 'pre - covid' and 'post - covid' phase as compared to no activity 'during covid' phase.

One of the studies conducted by (Yamada et al., 2020) demonstrated that 'during covid'– 19, walking was the most practised aerobic exercise among the residents and the daily walking distance decreased by 20.3% 'during covid'

Home based low- moderate intensity strength training exercises like gyming, lunges, crunches, push ups, abbs, were performed by 55% COVID-19 patients in 'pre - covid' phase, and 40% in 'post – covid' phase. There was significant decline (p value = <0.05) in the low intensity or body bearing exercises in 'during covid' phase which was around 5%. When Chi – square test was used, it was observed that there was significant difference (p value = <0.05) in the regularity of performance of strength training exercises across three phases. It indicated that low- moderate intensity strength training exercises were performed significantly higher in 'pre - covid' phase. There was significant decline in 'during covid' and 'post – covid' phases.

table 4. association of regularity of performance of yoga asanas with inflammatory markers of covid-19 patients in 'during covid' phase

(**CRP –C reactive protein, *PCT – procalcitonin, *bpm –beats per minute, °F – degree Fahrenheit)*

PA regularity and clinical data inflammatory markers in 'during covid' phase	**Yoga regularity & inflammatory markers and clinical data**		**Breathing exercises regularity & inflammatory markers and clinical data**		**Aerobic exercises regularity & inflammatory markers and clinical data**		**Strength training regularity & inflammatory markers and clinical data**	
'During covid' - Male (N=221) Female (N=119)								
	Mean±SD	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Ferritin (mg/l)	22.2±17.6	**0.03**	31.8 ±25.0	**0.01**	17.6±56.3	**0.00**	0.00±0.00	0.68
D – dimer (ng/ml)	25.8±66.9	0.17	23.0 ±63.0	0.33	16.9±55.3	0.53	0.00±0.00	0.46
***CRP (mg/l)**	2.57±9.74	**0.05**	2.92±10.2	**0.03**	4.83±13.03	0.63	0.00±0.00	0.49
***PCT Procalcitonin (ng/ml)**	0.02±0.92	0.89	0.02±0.10	0.56	0.01±0.05	0.15	0.00±0.00	0.60
Interleukin 6 (pg/ml)	1.08±3.45	0.39	0.91±3.23	0.90	0.87±2.78	0.94	0.00±0.00	0.58
Systolic blood pressure (mm Hg)	120.6 ±8.40	0.20	120.3±7.17	**0.00**	121.1±5.82	0.76	117.5±5.0	0.33
Diastolic blood pressure (mm Hg)	80.4 ±4.61	0.65	79.9±4.43	0.92	79.8±5.30	0.93	82.0±6.27	0.45
Oxygen saturation (%)	95.3±11.34	**0.00**	93.2 ±15.6	**0.04**	92.9±4.91	0.37	98.0±0.81	0.55
Pulse rate *(bpm)	83.4 ±7.39	0.60	83.0 ±11.5	**0.00**	83.3±6.2	0.36	87.0±3.46	0.81
Body Temperature *(°F)	-	-	99.5±1.37	0.54	100.4±1.42	0.39	98.2±0.50	0.71

The collected data represents significant difference (p value = <0.05) in the inflammatory markers namely ferritin, CRP, and IL – 6 levels in 'pre - covid' Vs 'during covid' Vs 'post – covid' phases. This indicated that COVID-19 patients who performed yoga asanas regularly had good ferritin levels (mg/l) and good CRP levels in 'during covid' phase. When regularity of performance of yoga asanas was associated with clinical data, significant difference was seen in the oxygen saturation levels (p value = <0.05). It was

observed that the COVID-19 patients who performed yoga asanas regularly had good oxygen saturation levels in 'during covid' phase as shown in table no.4.

Yoga as a complementary intervention for populations suffering from diseases with an inflammatory component could downregulate pro-inflammatory markers by significantly decreasing interleukin-1 (IL-1) beta, as well as IL-6 and tumour necrosis factor (TNF)-alpha. In short people who performed yoga asanas regularly had better IL – 6, IL – 1 and TNF alpha levels (Nagarathna et al., 2020).

When Pearson's chi square test was used to obtain the association between breathing exercise regularity and inflammatory markers, it was observed that there was significant difference (p value = <0.05) observed in ferritin and CRP levels in during– covid phase. The ferritin levels and CRP levels of the participants who performed breathing exercises regularly were much better in 'during covid' phase as shown in the table no. 4. When Pearson's chi – square test was used to obtain association between breathing exercise regularity and clinical data of COVID-19 patients, significant differences (p value = <0.05) were observed in the systolic blood pressure, oxygen saturation, pulse rate and body temperature. The mean systolic blood pressure and oxygen saturation levels of the participants who performed breathing exercises regularly were significantly good in 'during covid' phase. The mean pulse rate of the participants who performed breathing exercises regularly was significantly better in 'during covid' phase.

When Pearson's chi – square test was used to obtain the association between aerobic activity regularity and inflammatory markers, it was revealed that there was significant difference (p value = < 0.05) observed in the ferritin levels. There was no significant difference observed in other inflammatory markers. The participants who performed aerobic exercises regularly had better ferritin levels in 'during covid' phase. When Pearson's chi square test was used to obtain association between aerobic exercise regularity and clinical data of COVID-19 patients, no significant difference was observed in any of the clinical parameters.

When Pearson's chi – square test was used to obtain the association between Strength training activity regularity and clinical data, inflammatory markers, there was no significant difference observed in the regularity of strength training exercises and inflammatory markers of COVID-19 patients.

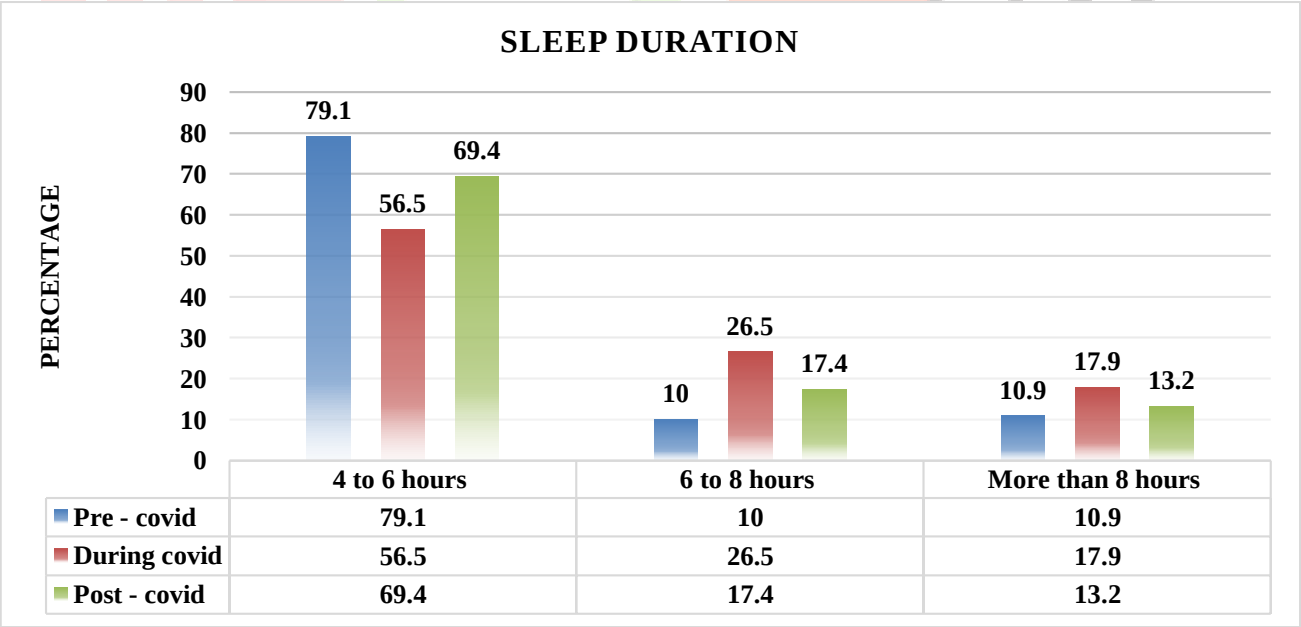

figure 1. sleep duration of covid-19 patients in 'pre - covid', 'during covid' and 'post – covid' phases

The collected data represented the sleep duration of COVID-19 patients in 'pre - covid', 'during covid' and 'post – covid' phases. 79.1% in 'pre - covid', 56.5% 'during covid' and 69.4% in 'post – covid' reported to sleep for 4 to 6 hours per day. 10% in 'pre - covid', 26.5% 'during covid' and 17.4% in 'post – covid' reported to sleep for 6 to 8 hours per day.10.9% in 'pre - covid', 17.9% 'during covid' and 13.2% in 'post – covid' reported to sleep for more than 8 hours per day as shown in figure no. 1.

table 5. association of sleep duration with clinical data and inflammatory markers of covid-19 patients in 'during covid' phase

Sleep duration & inflammatory markers and clinical data in 'during covid' phase	4-6hrs	6-8 hrs	>8hrs	p
During Covid				
Ferritin (mg/l)	6.11±34.1	9.96±43.2	5.27±29.7	0.61
D – dimer (ng/ml)	20.2±61.42	22.6±61.45	11.86±46.13	0.46
***CRP (mg/l)**	2.25±8.90	5.17±14.00	4.49±13.11	0.20
***PCT Procalcitonin (ng/ml)**	0.03±0.11	0.02±0.08	0.02±0.08	0.70
Interleukin 6 (pg/ml)	0.58±2.50	0.85±3.05	1.45±3.86	0.22
Systolic blood pressure (mm Hg)	119.6±5.08	121.5±8.21	124.5±12.3	**0.04**
Diastolic blood pressure (mm Hg)	82.6±9.16	79.8±5.65	78.4±4.96	**0.01**
Oxygen saturation (%)	96.0±3.19	94.9±9.94	94.0±14.4	0.69
Pulse rate (*bpm)	89.2±13.8	85.8±12.8	84.5±7.65	0.22
Body temperature (*°F)	99.9±1.20	99.3±6.27	99.1±1.83	0.81

*(*CRP – C – reactive protein, *PCT – procalcitonin, *bpm – beats per minute, *°F- degree Fahrenheit)*

When ANOVA test was used to obtain an association between sleep duration and inflammatory parameters, it revealed that there was no significant difference observed in 'during covid' phase.
(Hall et al., 2015) conducted a prospective cohort study which revealed that the IL-6 and TNF-α levels were higher in participants who reported sleep durations < 6 or > 8 hours per night (compared to 7 hours). A similar but nonsignificant trend was found for CRP.

When ANOVA test was used to obtain an association between sleep duration and clinical data of COVID-19 patients 'during covid', it was revealed that, there was significant difference (p value = <0.05) observed in the systolic as well as diastolic blood pressure indicating that the COVID-19 patients who had a proper sleep of 6 – 8 hours per day had better blood pressure The mean systolic blood pressure was 121.5±8.21 mm Hg and diastolic blood pressure was 79.8±5.65 mm Hg 'during covid' as shown in the table no.5. The participants who slept for more than 8 hours had significantly higher systolic blood pressure and the participants who slept for 4 –6 hours per day have significantly higher diastolic blood pressure. There was no significant difference observed in oxygen saturation, pulse rate and body temperature across 'pre - covid', 'during covid' and 'post - covid' phases.

According to study by (Lyu, 2020) in longitudinal analyses, longer wake after sleep onset, longer total sleep time and lower sleep efficiency were associated with higher risk of systolic non-dipping.

table 6. association of sleep duration with yoga asana, breathing exercise, aerobic exercise and strength training exercises performance regularity and screen time before going to bed of covid-19 patients 'pre - covid', 'during covid' and 'post – covid' phases

Regularity of type of exercise and screen time	Sleep duration (%)											
	'Pre – covid'				'During covid'				'Post – covid'			
	4-6hrs	6-8 hrs	>8 hrs	p	4-6hrs	6-8 hrs	>8 hrs	p	4-6hrs	6-8 hrs	>8 hrs	p
Yoga asanas	44.1	30.5	16.2	**0.03**	63.2	31.8	14.8	**0.00**	67.8	34.3	11.1	**0.00**
Breathing exercises	35.3	30.9	13.5	0.06	78.2	46.9	32.8	**0.00**	71.2	45.8	15.6	**0.00**
Aerobic exercises	35.3	29	40.5	0.30	3.4	5.7	6.6	0.65	22	28.8	33.3	0.42
Strength training exercises	6.1	2.9	3.1	0.62	1.1	1.8	0.0	0.58	1.7	2.4	0.0	0.60
Screen time												
< 15 mins	5	12.6	1.5	**0.00**	17.1	11.8	3.5	**0.00**	5.9	7.6	1.8	**0.00**
15 mins – 1 hour	4.4	54.4	12.1		8.5	26.5	11.2		10.6	43.8	17.9	
>1 hour	0.6	12.1	3.5		0.0	18.2	3.2		0.9	17.9	4.7	

When Pearson's chi – square test was used, it was revealed that, in 'pre - covid', 'during covid' and 'post - covid' phase, there was significant difference (p value = <0.05) observed between sleep duration and yoga regularity indicating that the COVID-19 patients who performed yoga asanas regularly, slept for 4 – 6 hours per day as shown in the table no.6

In one of the studies, the yoga program was for older adults. Subjects in the yoga group received 60 min yoga training daily for 1 month and until the end of 6 months. The results of the study by (Hariprasad VR, 2013) indicated that 6 weeks of yoga exercise resulted in improved physical and mental health and considerable amelioration of the total score of sleep quality in the elderly.

When Pearson's chi – square test was used, it was revealed that, in during – covid, 'post - covid' phase, there was significant difference (p value =<0.05) observed between sleep duration and breathing exercises regularity indicating that the COVID-19 patients who performed breathing exercises regularly, slept for 4 – 6 hours per day. There was no significant difference observed in 'pre - covid' phase and duration of the sleep.

When Pearson's chi – square test was used, it was revealed that, in 'pre - covid', during – covid, 'post - covid' phases, there was no significant difference observed between sleep duration and aerobic exercises, strength training regularity.
When ANOVA was used to obtain association between sleep duration and screen time before going to bed in COVID-19 patients across 'pre - covid', 'during covid' and 'post – covid' phases showed significant difference (p value = <0.05).

As shown in table no 6; it was observed that the participants who slept for 4 – 6 hours, 6 – 8 hours and >8 hours per day had screen time of 15 minutes to one hour in 'pre - covid' phase. The participants who slept for 4 – 6 hours per day had screen time of less than 15 minutes and the participants who slept for 6 – 8 hours and > 8 hours per day had screen time of 15 minutes to one hour in 'during covid' phase. The participants who slept for 4 – 6 hours, 6 – 8 hours and > 8 hours per day had screen time of 15 minutes to one hour in 'post – covid' phase.

The study by (Christensen et al., 2016) concluded that exposure to smartphone screens, particularly around bedtime, may negatively impact sleep whereas poor sleep may lead to increased screen time.

IV. CONCLUSION

Yoga asanas (sitting asanas) were performed majorly in the 'post – covid' phase, breathing exercises (Anulom vilom, Adham breathing, Ujjayi, Brahmari and Bhastrika) were performed in 'during covid' phase, aerobic exercises (walking) and strength training exercises (gyming and calisthenics) were majorly performed in 'pre - covid' phase. There was a significant decline in the physical activity in the 'during covid' phase. A good physical activity pattern 'during covid' had a positive effect on the serum ferritin levels and systolic blood pressure, oxygen saturation and pulse rate of COVID-19 patients. The sleep duration was majorly affected in 'during covid' phase. The participants had significantly higher amount of screen time (15 minutes to 1 hour per day) before going to bed which had overall negative impact on the sleep duration in 'pre – covid' and 'post – covid' phases.

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