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Effect of Moderate Exercise Training on Vitals and Peak VO_2 in Different Age Categories of Adults in COVID-19 Pandemic

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ABSTRACT

Objective: To determine the effect of moderate exercise training on vitals i-e., Blood pressure (Systolic and diastolic), Pulse Rate (PR), Respiratory Rate (RR) and Peak VO_2 in different age categories of adults during COVID-19 pandemic.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: This study was carried out at a tertiary cardiac care center from Feb 2021 to May 2021.

***Methodology*:** It was a descriptive cross sectional study conducted generally for 6 months in tertiary care center. A total of 104 participants were included and divided into three groups i-e., Young adults (17-30 years), Middle age adults (31-45 years) and Old age (>45 years) Participants were selected through non-probability convenient sampling technique and allocated in groups based on their age. Participant, after meeting inclusion criteria were supervised during moderate exercise training which includes walking for 23 minutes, cycling for 23 minutes and stepping for 5 minutes. Participants were assessed Pre and Post through Manual sphygmomanometer for BP, NMQ for muscle discomfort. Borg scale was used to assess exertional level and 6 Minute Walk test to assess Peak VO2.

***Results*:** Post intervention between the groups showed the significant effect on all three assessment factors of VO_2, Borg Scale and SBP with Kruskal Wallis test ($p<0.05$). Post intervention within the group showed significant effect on all three assessment factors of SBP,DBP,PR,RR,VO2 and Borg RPE scale with Friedman test ($p<0.05$). Post assessment of muscle discomfort shows highest frequency i-e 13.8(4%) in shoulder, thigh, upper and lower back region.

***Conclusion*:** This study reported that disturbed vitals and reduced VO2 due to inactivity because of COVID-19 pandemic. Post COVID-19 affects can be recovered through 6 weeks of moderate training. Furthermore, this study reported that participants belonging to old age showed maximum improvement in vitals in response to training while showed maximum muscle discomfort frequency in shoulder, thigh, lower and upper back

Keywords: COVID-19, Moderate training, Muscle discomfort, Vitals.

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INTRODUCTION

The Coronavirus disease (COVID-19) crisis started in China, in December 2019 and spread throughout the world, so far it has caused a lot of mortality worldwide. People developed pneumonia with a new infectious agent. This virus travels from infected person to a healthy person.[1] This pandemic has forced people to stay in their homes, which lead to a sedentary life style. This has reduced the capacity of vitals and reduced neuromuscular strength. There is no specific effective treatment of COVID-19. It is manageable through conservative treatment or supportive care e.g. fluid maintenance, level of saturated oxygen should be above 92% and in severe cases ventilation can be helpful in managing the COVID-19 patient.[2] In Pakistan, first case was reported in Karachi on February, 25, 2020. From March till April 24, 2020 there were 11,155 cases with the death rate of 2.26% .[3] Along with the physical illness, COVID-19 patients and their families' health care workers and their families developed mental issues such as anxiety, insomnia, stress and depression. In patients of coronavirus depression was 75%, anxiety and stress were 71% and insomnia was 68%, their families suffered with 46% depression and 49% anxiety, stress 42% and insomnia 48%. Frontline health care workers experienced depression, anxiety and insomnia (30% to 40%), as they

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are more prone to handling stress. Their stress level was 27%, while their families and friends suffered with 29% depression, 31% insomnia and 33% anxiety.[4] As these patients stayed on ventilator in ICU for long duration, this can generate neuromuscular weak-ness, resulting in increased morbidity and mortality. The dependence on ventilator can also cause atrophy of lungs leading to atelectasis. Deep venous throm-bosis, embolism and orthostatic hypertension is very com-mon in ICU patients. Moreover, ICU patients are at great risk of developing acquired neuromuscular dis-orders such as polyneuropathy or myopathy.[5] When a patient is unconscious or unable to move their limbs then passive range of motion is done by physi-otherapist. Evidence suggests that passive range of motion(PROM) should be done for 20 minutes in which flexion and extension of both upper and lower limb is done with 10 repetitions.[6]. Postural drainage is positioning of lungs for the drainage of mucus with the help of gravity. Positioning along with percussions and vibration is helpful in movement of secretion.[7]. Reduc-tion in physical activity reduced our energy expen-diture resulting in decreased physical fitness. This can cause complications of cardiopulmonary in every age group.[8] Moderate physical activity will not only prevent NCDs but also strengthen the musculoskeletal system and also prevent joint diseases like arthritis.[9].

In 2015 H. Miura, studied the comparison of effect of exercise on arterial stiffness between the healthy older female population and older female suffering with cardiovascular disease. They concluded that exercise has a little effect on diseased older female as compare to healthy older female.[10]

This study was aimed to determine the effect of moderate exercise training on vitals i-e., Blood pressure (Systolic and diastolic), Pulse Rate (PR), Respiratory Rate (RR) and Peak VO2 in different age categories of adults during COVID-19 pandemic. Presently, there was limited data on moderate intensity exercise covering all age categories in single study. This study also provided information about the discomfort of muscle due to exercise, whose power has been reduced in the pandemic era.

METHODOLOGY

Our study was carried out at tertiary care center Rawalpindi for six months and was a descriptive cross sectional study.

Sample Size: The sample size was calculated from sample size calculator (open EPi), n=102 divided into three groups each having n=34 participants.

Inclusion Criteria: Both males and females, cognitively intact, age categories (Young adult 17 -30 years, Middle age adults 31 to 45 years, old Age Above 45 years), SBP>120 mm Hg or DBP>80 mm Hg, and who had no physical limitations that precluded exercise participation were recruited from the general population from Pakistan in COVID 19, no regular exercise since MARCH 2020 (start of COVID 19) 3 months at least.

Exclusion criteria: comprised of uncontrolled hyper-tension, major joint impairment, and bone fracture in the last 6 months, asthmatic patient.

After approval of the study by the institution`s research ethics committee, the data was gathered from patients after seeking written informed consent. Demographic information like age, gender, profession, height and weight and telephone numbers were recorded. Non-probability convenient sampling was used for sample selection. The participants underwent walking/jogging/running sessions for 23 minutes, cycling for 23 minutes and stepping for 5 minutes. The protocol was performed in 50 minutes sessions thrice a week. Data was collected by data collection tool pre and post in every session. Muscle discomfort was recorded after 6 weeks of intervention. Participants who showed raised blood pressure more than 180mmHg, after exercise were excluded from study and total remaining participants were 83. Data collection procedure is shown in Figure-1.

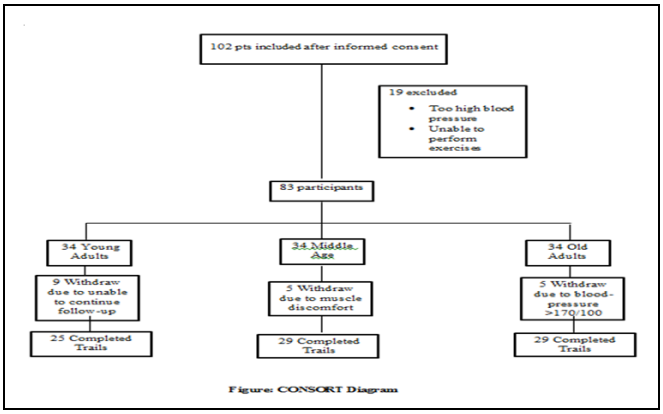

Figure-1: CONSORT diagram

Data was recorded on data collection proforma. Data was entered into SPSS version 21 for statistical analysis and based on normality of data parametric and non-parametric test were applied. The p-value <0.05 was considered significant by taking 95% CI & 5% margin of error. The change (delta) in each

measurement before and after training was assessed by using a Kruskal Willis Test and One Way ANOVA between the groups and Friedman test was used to assess measurement within the group.

Categorical variables like gender were measured in frequency percentage and continuous variables were reported as mean ± SD and statistical test (chi square was applied to find association between categorical variables).

RESULTS

A total 83 number of participants fulfilling inclusion criteria were analyzed. They were divided into three groups on the bases of age.

Group A=25 (17-30 years), Group B=29 (31-45 years) and Group C = 29 (>45 years). The males in Group A were 6(24%), In Group B were 15(51.7%) and in Group C were 11 (37.9%). Similarly the females in Group A were 19 (76%), in Group B were 14(48.3%) and in Group C were 18(62.1%). On the basis of Height and weight of participants BMI was calculated in Group A 4(16%) were underweight, 16(64%) were normal, 5(20%) were overweight and there were no obese, In Group B there was no underweight, 14(48.3%) were normal, 14 (48.3%) were overweight and 1(3.4%) were obese, while in Group C there were no underweight, 13 (44.8%) were normal, 14(48.3%) were overweight and 2 (6.9%) were obese.

Nordic Musculoskeletal Scale Score between groups in Pre assessment show maximum frequency of neck pain reported in Group C 8(27.6%), highest shoulder pain is also recorded in Group C, likewise upper back pain, Elbow pain, wrist, lower back, hips/thigh, knee and ankle/feet with highest frequency is reported in Group C with 5(17.2)%, 2(6.90%), 3(10.3%), 11(37.9%), 9(31%), 9(31%) and 3 (10.3%) respectively. Similarly, Nordic Musculos kele-tal Scale Score between groups in Post assessment of neck, shoulders, upper back, elbow, wrist/hand, lower back, hips/thigh, knee and ankle/feet reported highest frequency in Group C with 3(10.3%), 4(13.8%), 4(13.8%), 2(6.9%), 1(3.4%), 4(13.8%), 4(13.8%), 2(6.9%) and 1(3.4%) respectively.

Pre and Post treatment analysis within the group for SBP , DBP, RR, PR, Peak VO2 and Borg RPE Rating scale showed the significant results, from week 1 to 6 weeks with p-value reported <0.05 on all respective days of week, as shown in Table-I & II.

Table-I: Association of SBP, DBP, RR, PR, Peak VO2 and Borg RPE Score Among Different Age Groups at 1st Week

Variable(week1)	Group A (17-30yrs) Mean±SD	Group B (31-45yrs) Mean±SD	Group C (>45 yrs) Mean±SD	*p*-value
SBP (mm Hg)				
Pre Training	121.60±4.7	122.06±4.9	136.8±10.0	<0.0001
Post Training	127.6±14.51	124.4±9.8	141.5±30.85	<0.0001
DBP (mmHg)				
Pre Training	80.80±4.0	81.72±4.6	85.51±9.8	0.013
Post Training	81.6±12.8	82.4±7.3	92.7±18.6	0.040
RR				
Pre Training	15.6±1.3	14.9±1.46	16.1±2.16	0.058
Post Training	28.9±4.1	27.9±3.37	32.4±6.12	0.013
PR				
Pre Training	76.0±8.3	86.8±10.2	80.8±10.3	<0.0001
Post Training	94.32±12.5	101.3±15.2	98.1±21.4	0.227
Peak VO2 (ml/kg/min)				
Pre Training	15.0±0.9	13.7±1.12	12.06±1.16	<0.0001
Borg RPE Score Scale				
Pre Training	5.6±1.13	5.72±0.75	6.4±0.86	0.008

SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, RR= Respiratory Rate, PR=Pulse Rate, RPE=Rating of Perceived Exertion, mmHg=millimeter of mercury, SD=Standard Deviation

Table-II: Association of SBP, DBP, RR, PR, Peak VO2 and Borg RPE Score Among Different Age Groups at 6th Week

Variable (Week 6)	Group A (17-30yrs) Mean±SD	Group B (31-45yrs) Mean±SD	Group C (>45 yrs) Mean±SD	*p*-value
SBP (mmHg)				
Pre Training	111.2±6.65	108.6±4.41	118.6±9.9	<0.0001
Post Training	110.0±6,45	107.0±6.1	121±11.75	<0.0001
DBP (mmHg)				
Pre Training	66.8±8.5	64.8±5.08	70.6±9.2	0.042
Post Training	65.6±7.68	65.1±6.33	75.1±9.8	<0.0001
RR				
Pre Training	14.4±1.4	13.7±0.8	14.8±1.37	0.002
Post Training	24.4±3.0	22.3±2.6	24.7±4.7	0.031
PR				
Pre Training	73.0±3.2	77.8±6.4	76.1±8.8	0.015
Post Training	89.0±7.5	88.6±6.7	87.0±13.9	0.350
Peak VO2 (ml/kg/min)				
Pre Training	17.3±1.11	16.1±1.31	15.3±2.28	<0.0001
Borg RPE Score Scale				
Pre Training	2.26±1.09	1.91±1.07	3.5±1.13	<0.0001

SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, RR= Respiratory Rate, PR=Pulse Rate, RPE=Rating of Perceived Exertion, mmHg=millimeter of mercury, SD=Standard Deviation

DISCUSSION

The goal of present study was to check the effect of moderate exercise training on vitals (BP, RR etc.) and Peak VO2 in different age categories of adult in COVID-19. The current study data showed decrease in vitals and improvement in Peak VO2. This study also reported Nordic Musculoskeletal scale (NMQ), which showed the frequency muscle discomfort due to exercise in old age adults(>45 years). After 6 weeks of

training for three alternate days, the participants were evaluated by taking Pre and Post readings.

Exercise has great effect at physiological level and it not only reduced the death rate due to cardio-vascular diseases but it also prevented it from develo-ping again.[11] Exercise has more beneficial effect with the cessation of smoking and increase in health diet, it also reduces cancer risk in population.[12] This study reports similar effect in BP as in previous studies, maximum improvement in between group analysis of BP has shown by Old age adults, while within group, each group showed statistically substan-tial (p<0.05) result after the intervention for 6 weeks.

Aerobic sub-maximal exercise effect according to the BMI of each person in term of recovering their RR. According to a study exercise program should be design according to BMI of each individual to reduce fatigue and in encouraging physical activity.[13] The current study also shows improvement in RR after 6 weeks of training, regardless of any association to BMI.

The comparison between adolescent male and female VO2 in response to moderate to high intensity exercise. In this study he concluded that female shows slower response in VO2 improvement as compare to male adolescent is due to different cardiopulmonary mechanism between genders.[14] In another study, WJ Tucker et al studied the effect of exercise on Peak VO2 in heart failure patients, which has improved peak VO2 in these patients. According to this study 10% raise in intensity of exercise can produce 1.0 ml/kg/min raise in peak VO2.[15] In the current study VO2 has improved within 6 week of moderate training and young age group showed maximum progress in contrast to middle and old age.

A descriptive cross-sectional study was conduc-ted on factors associated with muscle discomfort and assessed through NMQ; Muscle discomfort depends on BMI of a person. Participant with ideal BMI showed less muscle discomfort during exercise as compare to obese.[16] Similarly, a RCT was conducted among diabe-tic population. Assessment was done at baseline and 8 weeks of intervention, after that he concluded that compared to aerobic training, resistance training sho-wed reduction in muscle discomfort but there was no change in neuropathic pain.[17]. The current study also shows similar results, muscle discomfort depends on BMI as well as age factor. Aerobic exercise improves immunity in COVID-19 patients. It also prevents COVID-19 or lessens its development from mild to severe and improves vitals .[18]. In a systematic review reported that patients with COVID-19 has shown improvement in VO2 by performing aerobic exercise for 20-60 minutes on alternate days of a week.[19] . The current study also reports that through 3 session of an aerobic exercise in a week for 50 minutes can improve the Borg Scale and peak VO2.

LIMITATIONS OF STUDY

The major limitation in this study was that we weren`t able to measure HR due to unavailability of equipment. Another limitation was that we didn't follow trials for 6 weeks.

CONCLUSION

Due to COVID-19 pandemic, many people were bound in their homes and have developed sedentary lifestyle, which has reduced the working capacity of individuals. This study concluded that in order to maintain healthy lifestyle, 6 weeks of moderate training for 50 minutes 3 times a week can reduce Blood Pressure and Pulse Rate have improved peak VO2 and RPE in all age group. Moreover there was no significant effect on muscle discomfort.

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Conflict of Interest: None.

Author,s Contribution

Following authors have made substantial contributions to the manuscript as under:

NS: Manuscript writing, concept and proof reading

AS: Intellectual contribution, concept and final approval

FM: Analysis, manuscript writing and proof reading

HA: Formatting, critical review and data collection/entry

MS: Review of article, formatting and critical review

SA: Data collection, data entry and review of article

MM: Study design, concept and critical review

A: Intellectual contribution, concept and final approval

NA: Data collection, data entry and review of article

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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