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Sharmin Akhtar

ICCR Research Scholar,
Dept. of Sports Science, Punjabi
University Patiala, Punjab,
India

Dibendu Kumar Bej

Assistant Professor, Physical
Education, Dept. of Education,
RIE, NCERT, Bhubaneswar,
Orissa, India

Ajita Dsingh

Faculty & Head, Dept. of Sports
Science, Punjabi University
Patiala, Punjab, India

Assessment of aerobic capacity with blood pressure and oxygen saturation level in Bangladeshi sedentary women: A Correlational study in post COVID-19 contexts

Sharmin Akhtar, Dibendu Kumar Bej and Ajita Dsingh

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Abstract

Background: According to the World Health Organization (WHO), a person is said to lead a sedentary lifestyle if most of their time is spent doing only basic activities like sitting, standing, reading, working on the laptop, housework, and maybe a 30-minute walk.

Objectives: Purpose of the study was to find out the effect and association of aerobic capacity with blood pressure and oxygen saturation level in Bangladeshi sedentary women in post 2nd phase of COVID-19 pandemics.

Procedure: The study population included 21 (35 to 50 years) voluntary, healthy adult women who have reported with normal health and free from chronic diseases. Resting pulse rate, Harvard Step Test (short term), Participants resting BP (Systolic and Diastolic) and SpO₂ saturation level in blood had been measured in the early morning at the day of assessment (Time: 6:30 am Dated: 22/05/22). For assessing the blood pressure standard digital Omoron BP machine made by Omoron Healthcare Manufacturing Vietnam (Model HEM 8712) was used. To measure the levels of oxygen in blood (SpO₂) for the women subject we used standard Pulse oximeters (Dr Trust Pulse Oximeter – 213 (Silver) Product Approved by USFDA, CE, rohs). The oximeter display shows the percentage of oxygen in blood. For someone who's healthy, the normal blood oxygen saturation level will be around 95–100%. To assess HST short term method had been followed (Brouha *et al.*, 1943). For descriptive analysis, mean and standard deviation values were employed. Bivariate Pearson's product-moment correlation coefficient (r) with 95% confidence ($p < 0.05$) was applied to determine relationships between dependent and independent variables. All statistical analyses were performed with the use of SPSS 25 statistical software.

Findings: Sedentary women found with moderate level of VO₂ max with mean value of 27.25ml/kg/min due to the psychological as well as physiological stressor that leads to the lesser side of their fitness level as well as responsible for the negative association ship with the resting pulse rate and %SpO₂ after activity. a high degree significant positive association has been found in between % SpO₂ (At rest) and % SpO₂ after activity ($r = 0.500^*$), Whereas a negative association has been observed in the following parameters i.e., Resting Heart Rate, O₂ saturation level in blood at rest with aerobic capacity i.e., $r = -0.080$ and -0.264 respectively.

Conclusions: Cardiovascular fitness in terms of VO₂ max in sedentary women indeed to be an important health related fitness component which was greatly related to all other physiological variables i.e., resting pulse rate, resting BP and %SpO₂. The Institute of Medicine, recommends an hour per day of moderate to vigorous exercise 4–7 days per week.

Keywords: Sedentarism, O₂ saturation, physical inactivity, hypokinetic diseases, physical fitness

1. Introduction

Background: According to the World Health Organization (WHO), a person is said to lead a sedentary lifestyle if most of their time is spent doing only basic activities like sitting, standing, reading, working on the laptop, housework, and maybe a 30-minute walk. The latest report states that nearly 65 per cent of Indians (especially the urban population) follow a sedentary lifestyle. In Bangladesh it is more than 70% in case of women.

A woman's health, especially, is influenced by several social determinants like income, education, employment, social connections, community and safety. In addition, they also have to care for their family and children. "If we're not used to eating right and working out,

Correspondence

Sharmin Akhtar

ICCR Research Scholar,
Dept. of Sports Science, Punjabi
University Patiala, Punjab,
India

We might gain weight more easily; burn fewer calories; lose muscle strength, experience weak bones; decreased immunity, and effect on blood circulation and hormonal balance. All this increases the risk of chronic degenerative disorders like diabetes, hypertension, cardiac diseases, cancer, respiratory disorders, depression and anxiety etc”.

Physical inactivity has been identified as the fourth leading risk factor for global mortality (6% of deaths globally). This follows high blood pressure (13%), tobacco use (9%) and high blood glucose (6%). Overweight and obesity are responsible for 5% of global mortality [1]. Levels of physical inactivity are rising in many countries with major implications

for the general health of people worldwide and for the prevalence of NCDs such as cardiovascular disease, diabetes and cancer and their risk factors such as raised blood pressure, raised blood sugar and overweight. Physical inactivity is estimated as being the principal cause for approximately 21–25% of breast and colon cancer burden, 27% of diabetes and approximately 30% of ischaemic heart disease burden [1]. In addition, NCDs now account for nearly half of the overall global burden of disease. It is estimated currently that of every 10 deaths, 6 are attributable to non-communicable conditions [2].

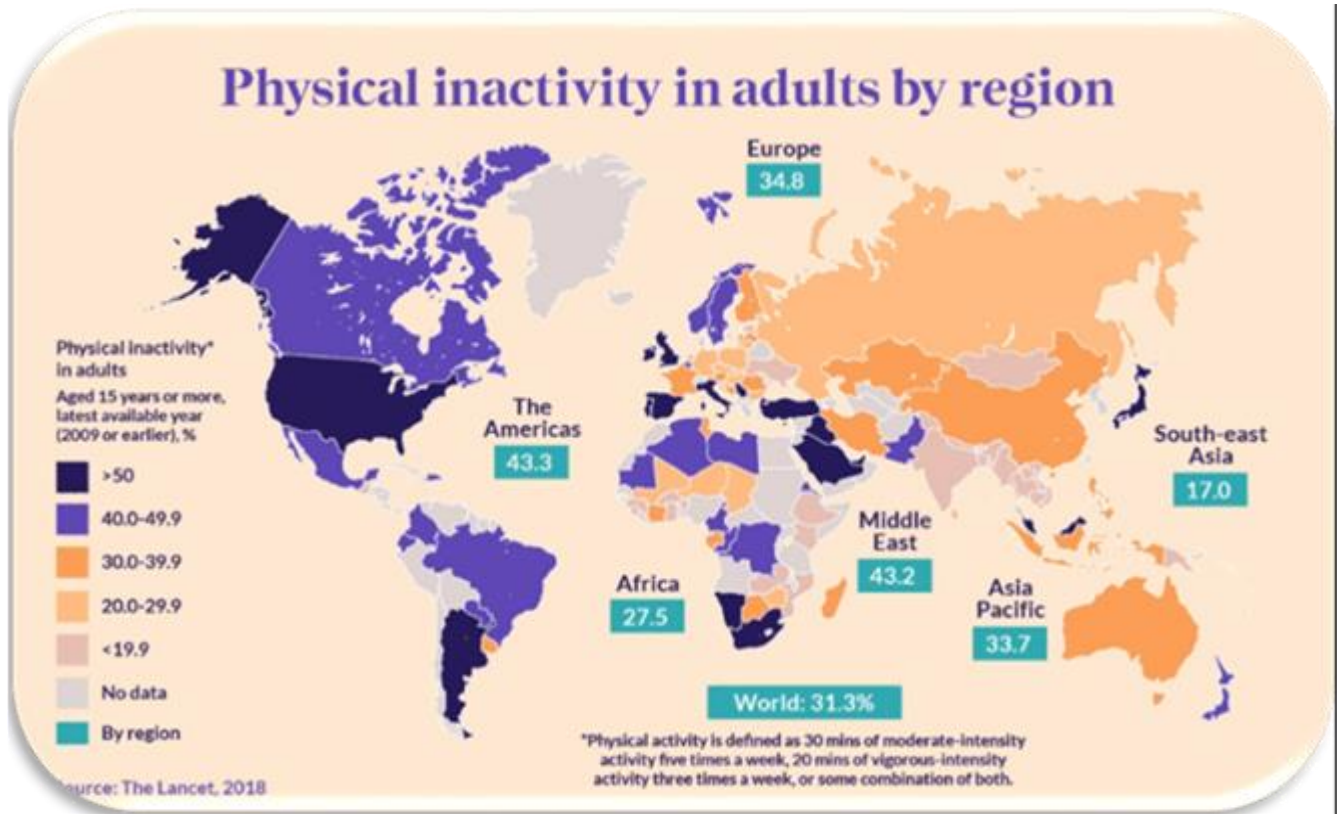


Fig 1: Graphical depiction of physical inactivity level through-out the universe (Lancet, 2018) [19]

A normal level of oxygen is usually 95% or higher. Some people with chronic lung disease or sleep apnea can have normal levels around 90%. The “SpO2” reading on a pulse oximeter shows the percentage of oxygen in someone's blood. Some COVID-19 patients may show no symptoms at all. You should start oxygen therapy on any COVID-19 patient with an oxygen saturation below 90 percent, even if they show no physical signs of a low oxygen level. If the patient has any warning signs of low oxygen levels, start oxygen therapy immediately.

Normal limits of vital signs: systolic blood pressure 120–90 mmHg, pulse rate 60–100/min, respiration rate 12–16/min, body temperature 36.0 °C – 37.1 °C, and oxygen saturation >94%. Low perfusion index includes scores 0–5; high perfusion index includes scores >5.

The amount of sedentary behaviour grows with wealth of societies and the level of urban development. Inactivity is more common among women than men and this tendency increases with age. Up to one third of adults and four fifths of the youth do not achieve the recommended level of physical activity. The amount of time spent in front of computer screen or TV goes up systematically, and this has a negative impact on quality of life related to health, combined with lack of

physical activity. Additionally, the lack of physical activity is the fourth leading cause of deaths in the world.

Contemporary strategies disseminating physical activity and research concepts in this area focus on several key areas, where an individual can spend their energy using their own muscles. Four types of physical activity are distinguished: activity related to professional work, activity related to movement throughout the day, activity related to household duties, and recreational activity performed in the leisure time. Concept of quality of life has become widespread in the perspective of socioeconomic and cultural development. It is a multidimensional construct different studies take into account its different aspects.

Previous studies have shown a positive relationship between physical activity and various indicators of the quality of life, but they mainly concerned older adults or chronically ill individuals, most of them concerned only health-related quality of life. So, from the above perspective, the prime purpose of the study was to assess the association of aerobic capacity with blood pressure and oxygen saturation level in Bangladeshi sedentary women in post COVID-19 contexts. We hypothesized that aerobic capacity in terms of VO₂ max would be linked to changes in in both physiological measures

(i.e., BP and O₂ saturation).

2. Purpose of the study

The basic aim of the study was to find out the effect and association of aerobic capacity with blood pressure and oxygen saturation level in Bangladeshi sedentary women in post 2nd phase of COVID-19 pandemics.

3. Material and methods

3.1 Participants

The study population included 21 (35 to 50 years) voluntary, healthy adult women who have reported with normal health and free from chronic diseases. Their mean age was 40.5 ± 2.20 years, range: 16-20 years; body weight: 61.88 ± 5.58 kg. The subjects were informed beforehand about the purpose of the study and filled consent form for the said topic. Participants have been leading a sedentary lifestyle, most of their time had been spent doing only basic activities like doing household activities, sitting, standing, reading, watching TV, and maybe a 30-minute walk.

3.2 Study design

Purposive sampling technique has been followed to serve the objectives of the present status-based study. Adequate no of trails had been provided as well as demonstrated by the scholar to the women participants before commencement of the Harvard Step Test (short term). Before and after the completion of activity O₂ saturation level had been assessed. Participants BP (Systolic and Diastolic) measured in the early morning at the day of assessment (On 6:30 am Dated: 22/05/22).

Table 1: List of Physiological variables

Sl. No.	Variables	Measuring unit
1.	VO ₂ max	ml/kg/min
2.	Blood Pressure	mm of Hg
3.	SpO ₂	Percentage (%)
4.	Resting Pulse Rate	Beats / min

3.3 Instrumentation

1. A Step or platform of 16 inches high
2. Weighing scale
3. Stop watch Casio HS-80TW-1DF - S055
4. Mobile Metronome (Android mobile version 1.2.4)
5. Digital Omoron BP machine made by Omoron Healthcare Manufacturing Vietnam (Model HEM 8712)
6. Dr Trust Pulse Oximeter – 213 Oximeter (Silver) Product Approved by USFDA, CE, rohs.

3.4 Procedure

Before the data collection women were informed about the tests to be performed i.e., BP testing, HST performance, pulse rate and O₂ saturation level measuring. Adequate no of trails has been provided as well as demonstrated by the scholar to the women participants before performing the Harvard Step Test (short term). For the assessment of VO₂ max of women participants, HST conducted where standard bench height, metronome and procedure had been followed where the rate of 30 steps per minute sustained for five minutes or until exhaustion (Brouha *et al.* 1943)^[3].

Participants BP (Systolic and Diastolic) has been assessed on morning 6:30 am at the day of assessment (22/05/22). For assessing the blood pressure standard digital Omoron BP machine made by Omoron Healthcare Manufacturing Vietnam (Model HEM 8712) was used.

Before and after the completion of activity O₂ saturation level (SpO₂) had been assessed. To measure the levels of oxygen in blood (SpO₂) for the women subject we used standard Pulse oximeters (Dr Trust Pulse Oximeter – 213 (Silver) Product Approved by USFDA, CE, rohs). The oximeter display shows the percentage of oxygen in blood. For someone who’s healthy, the normal blood oxygen saturation level will be around 95–100%. The resting pulse rate and weight of the women participants were taken by following standard procedure.



Fig 2: Digital Omoron BP machine for blood pressure assessment of sedentary women



Fig 3: Pulse Oximeter for the assessment of % SpO₂ of sedentary women

3.5 Statistical analysis

For descriptive analysis, mean and standard deviation values were employed. Bivariate Pearson’s product-moment correlation coefficient (r) with 95% confidence (*p* < 0.05) was applied to determine relationships between dependent and independent variables. All statistical analyses were performed with the use of SPSS 25 statistical software.

4. Results and discussion

Table 2: Depiction of Mean values (Physiological parameters)

Descriptive statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Heart Rate (resting) Beats / min	21	49.00	112.00	82.67	16.74
Diastolic BP (resting) mm of Hg	21	56.00	90.00	69.81	8.65
Systolic BP (resting) mm of Hg	21	93.00	136.00	111.81	10.55
O ₂ Saturation (at rest) (%)	21	96.00	99.00	97.57	0.98
O ₂ Saturation (after activity) (%)	21	95.00	99.00	97.57	0.98
VO ₂ max ml/kg/min	21	9.73	39.79	27.25	10.14

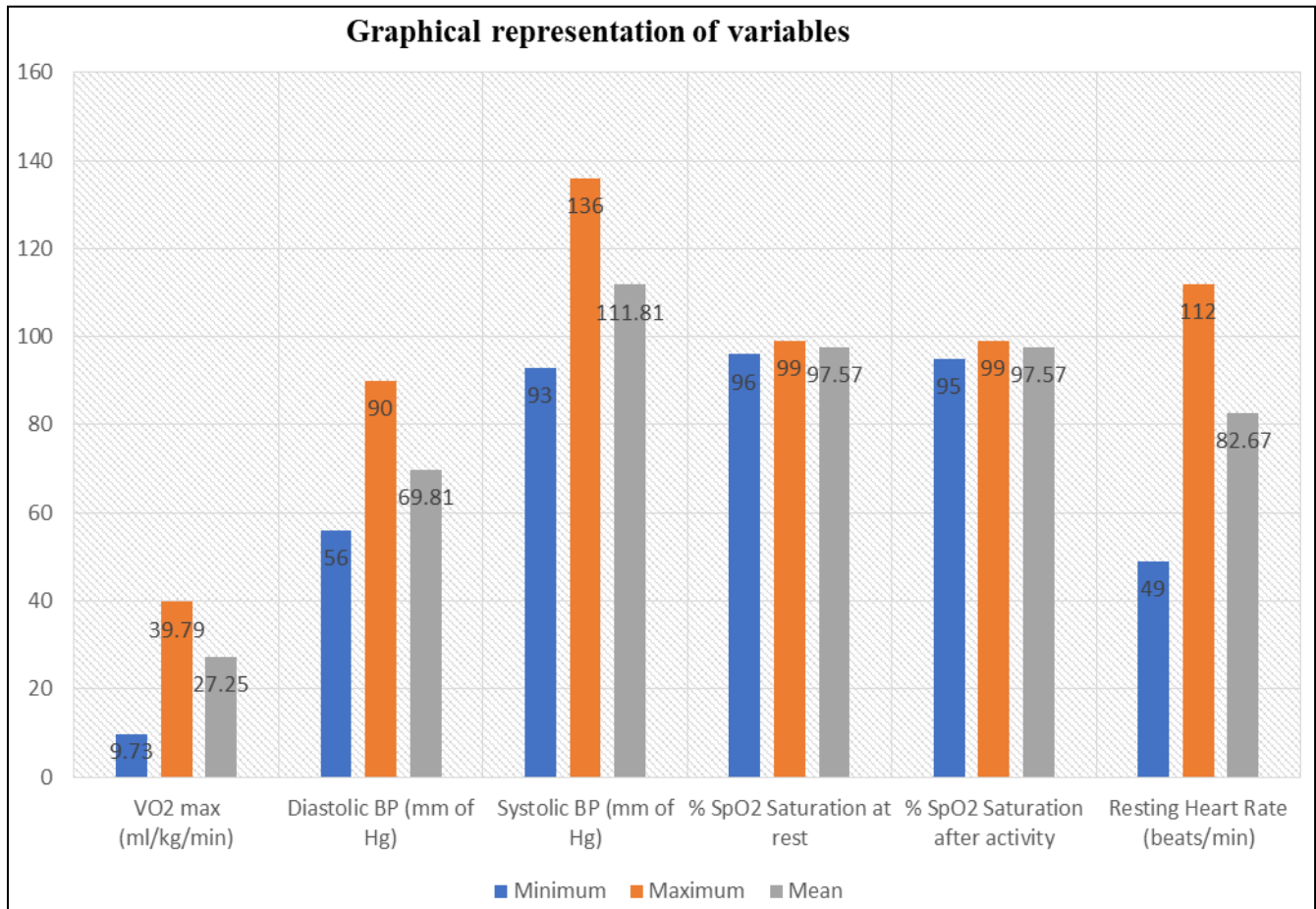
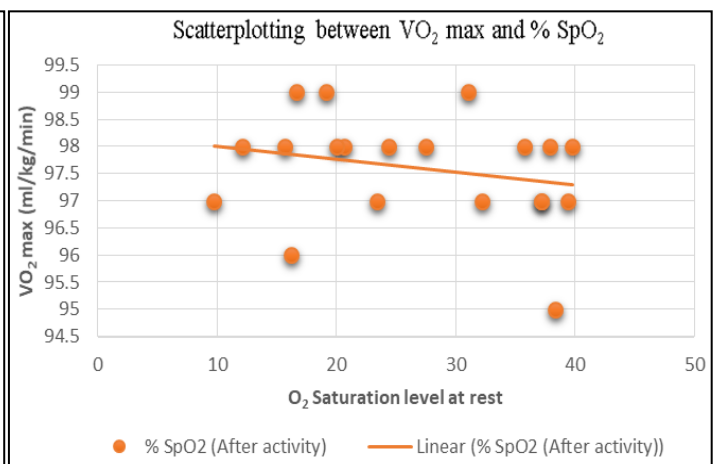
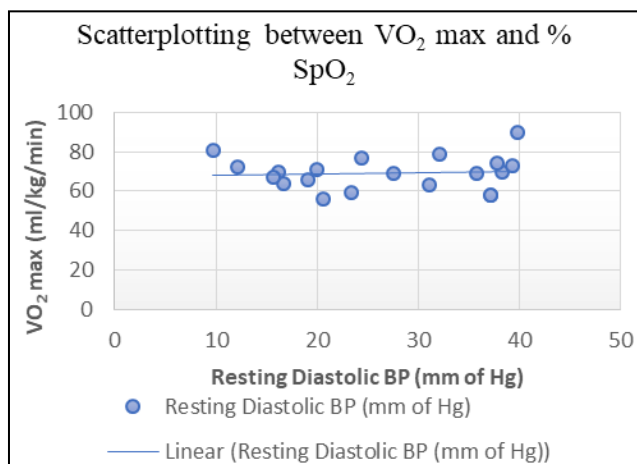


Fig 4: Graphical representations of descriptive values for different physiological variables

Table 3: Coefficient of correlation among the VO₂ max and various physiological variables

Correlations						
	VO ₂ max (ml/kg/min)	Resting Heart Rate (bpm)	Resting Diastolic BP (mm of Hg)	Resting Systolic BP (mm of Hg)	% SpO ₂ (At rest)	% SpO ₂ (After activity)
VO ₂ max (ml/kg/min)	1	-.080	.130	.155	.015	-.264
Resting Heart Rate (bpm)	-.080	1	-.015	-.367	-.046	-.095
Resting Diastolic BP (mm of Hg)	.130	-.015	1	.500*	.002	-.099
Resting Systolic BP (mm of Hg)	.155	-.367	.500*	1	-.144	.161
% SpO ₂ (At rest)	.015	-.046	.002	-.144	1	.478*
% SpO ₂ (After activity)	-.264	-.095	-.099	.161	.478*	1
N	21	21	21	21	21	21

*. Correlation is significant at the 0.05 level (2-tailed)



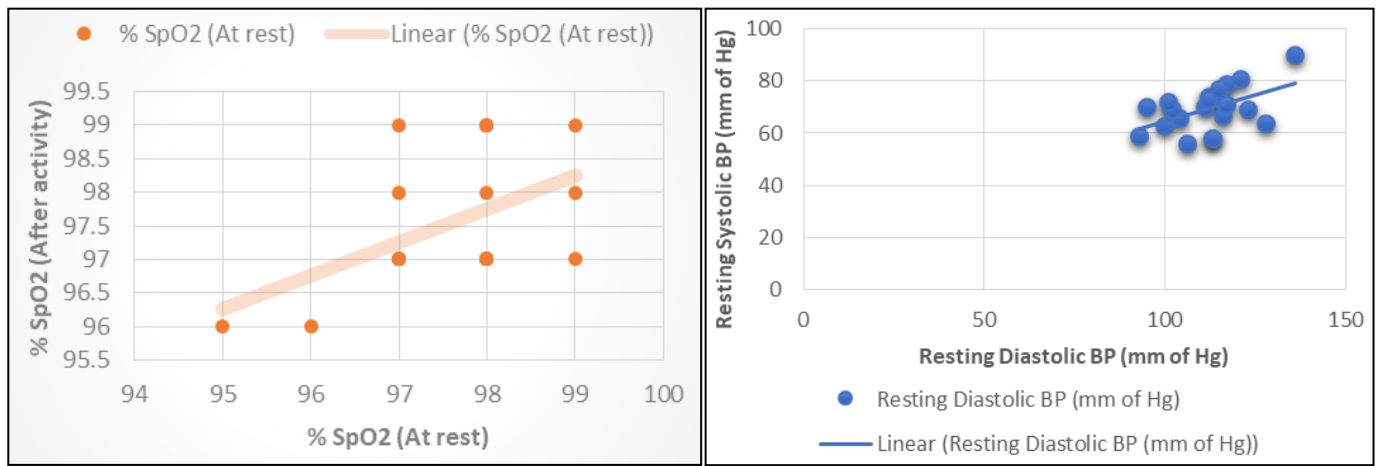


Fig 5: Scatterplot ting of physiological variables with VO_2 max

From the results of the study, Sedentary women a high degree significant positive association has been found in between % SpO_2 (At rest) and % SpO_2 after activity ($r = 0.500^*$), Whereas a negative association has been observed in the following parameters i.e., Resting Heart Rate, O_2 saturation level in blood at rest with aerobic capacity i.e., $r = -0.080$ and -0.264 respectively.

Sedentary women participants observed mean VO_2 max of 27.25ml/kg/min which is medium indicator of their aerobic capacity. During the COVID-19 pandemic specifically women of Bangladesh region did not step out from their residence due to that the various physiological and psychological stressor activated among them which may be leading to this type of result. The Institute of Medicine, for example, recommends an hour per day of moderate to vigorous exercise 4–7 days per week [4]. This level of exercise has the potential to alter the ways in which people think, feel, and conduct their lives on multiple levels. These effects could most likely to be seen in sedentary people who undertake a regular exercise program. In general, experimental studies of exercise have found improvements in various aspects of quality of life [5] including general functioning [6–10] and depression and anxiety symptoms [11–12].

2nd phase of pandemic caused more sever damages then the 1st phase. In this phase of pandemic economic, life, psychological, social as well as personal relationship got disturbed. People were suffered with so many hypokinetic diseases like obesity, diabetes, back pain, arthritis, asthma and more specifically hypertension which led to imbalance O_2 saturation level in blood. The mean % SpO_2 level at rest as well as after mild activity for sedentary women showed a mean of 97.57% which was quite normal as they had not moved to outside of their home for a quite long period and followed all the healthy practices as guided by Government and Ministry of Health, Bangladesh as well as taken all the doses of vaccination with AstraZeneca. This type of result may be due to most of the time of women is spent doing only basic activities like sitting, standing, reading, working on the laptop, housework, and maybe a 30-minute walk. The latest report states that nearly 75 per cent of Bangladeshi (especially the urban population) follow a sedentary lifestyle. A normal level of oxygen is usually 95% or higher. Some people with chronic lung disease or sleep apnoea can have normal levels around 90%.

Some COVID-19 patients may show no symptoms at all. Though we should start oxygen therapy on any COVID-19 patient with an oxygen saturation below 90%, even if they show no physical signs of a low oxygen level. If the patient

has any warning signs of low oxygen levels, start oxygen therapy immediately.

Mean Resting pulse rate for the participants found quite high i.e., 82.67 beats/min which was negatively associated with their aerobic capacity ($r = -0.080$) which indicated that women those who were observing sedentary lifestyle was quite in stress about the current post pandemic scenario of their family as well as country. Physiological as well as psychological stress factors might be the prime causes of this kind of negative result and restlessness.

Physical activity is commonly considered important, as the needs of a modern lifestyle can be fulfilled in this manner. It serves to fulfil the biologically conditioned need to undertake movement activities and forms one of the dimensions of everyday activity. It affects health and efficient everyday activity; it can also reduce health care costs.

Women participants showed an average systolic B.P. of 111.81 mm of Hg, which was quite lesser than the normal value of 120 mm of Hg. Systolic B.P. was positively associated with the VO_2 max but not significantly.

The World Health Organization (WHO) acknowledges physical inactivity as a global public health burden, representing the fourth-leading risk factor for global death, above high-blood pressure, smoking, and high-blood glycaemia [13]. Evidence of the positive effects of physical activity in the prevention of many chronic diseases has been chiefly demonstrated [14], with long-term improvements in physical fitness, overall health benefits, as well as protection from premature death [15]. Additionally, the protective properties of high physical fitness levels on health are manifest independently of age, sex, fatness, smoking, alcohol consumption, and other clinical factors, and are directly associated with high levels of physical activity [16]. The recommendations of the American College of Sports Medicine (ACSM) to decrease/maintain a healthy body weight and enhance cardiovascular fitness include 75 to 150 min of weekly exercise [17]. In case of Bangladeshi women most of them were not performed any moderate to strenuous physical activity only brisk walk max to max for 10min which had not improve their cardiovascular fitness level. ACSM also recommends adding at least two days of full-body muscle-strengthening activities [17]. However, reports on physical activity trends in Europe show a plateau in sport and physical activity participation in the past few years, especially in women [18]. Recently, another report published the worldwide trends of insufficient physical activity from 2001 to 2016, where Latin America and the Caribbean women reached the highest physical inactivity levels in 2016 (43.7%) [18]. In

addition, nowadays, job occupations enclose a high prevalence of sedentary tasks, which contributes to the increase inactive time^[19] and, thus, a low-calorie expenditure. Therefore, several strategies to reduce overall sedentary time and improve body composition and health through physical activity programs have been aimed in the community of employees (especially in women) over the last few years^[20-22]. Previous studies have recognized several barriers associated with inactivity behaviour in women at midlife, such as low income, time constraints, or education^[24-26].

5. Conclusions

In conclusion, cardiovascular fitness in terms of VO_2 max in sedentary women indeed to be an important health related fitness component which was greatly related to all other physiological variables i.e., resting pulse rate, resting B.P. and % SpO_2 . In post COVID-19 pandemic era 2nd phase, sedentary women found with moderate level of VO_2 max with mean value of 27.25ml/kg/min due to the psychological as well as physiological stressor that leads to the lesser side of their fitness level as well as responsible for the negative association ship with the resting pulse rate and % SpO_2 after activity. The Institute of Medicine, recommends an hour per day of moderate to vigorous exercise 4–7 days per week. There is incontrovertible evidence that regular physical activity contributes to the primary and secondary prevention of several chronic diseases and is associated with a reduced risk of premature death. Therefore, Participants who engage in exercise at levels above those recommended in the guidelines are likely to gain further health benefits. Health promotion programs should target people of all ages, since the risk of chronic disease starts in childhood and increases with age.

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