



## Original Article

## Sedentary Lifestyle Associated Hyperventilation Syndrome among Students of Karachi Quarantined Amidst COVID Out Break: A Cross Sectional Survey

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## ABSTRACT

Sedentary activity has been related to poor physical health outcomes in both adults and youth in previous studies. While there is growing evidence of a correlation between sedentary behavior and mental health outcomes, little is known about the risk of hyperventilation syndrome.

**Objective:** To find out the prevalence of hyperventilation syndrome due to sedentary lifestyle among students of Karachi quarantined amidst COVID outbreak. **Methods:** A cross sectional online survey based questionnaire which included IPAQ (International physical activity questionnaire) to assess sedentary behavior and Nijmegen questionnaire to rule out hyperventilation syndrome was used to collect data from 214 students from Karachi, Pakistan.

**Results:** Out of the total 214 subjects, 128(59.5%) developed a sedentary behavior and 86(40%) were found non sedentary. These 128(59.5%) students were further assessed for hyperventilation out of which 114(53%) were found to be positive. **Conclusions:** The study concluded that 53% students of Karachi with sedentary lifestyle developed hyperventilation syndrome amidst COVID outbreak.

## INTRODUCTION

Corona Virus is the novel and much stronger form of the virus SARS (severe acute respiratory syndrome) which occurred as a major outbreak in Hong Kong in March 2003 and is considered as the first global epidemic of the twenty-first century [1]. According to World Health Organization (WHO) more than 20 million people from over 200 countries across the world have been affected by this pandemic, resulting in over 730,000 deaths [2]. As a result, governments worldwide have made extraordinary attempts to control the disease, by ensuring methods for social distancing among general population and prescribing quarantine and isolation for people who have

been tested positive for COVID-19 [2]. As the educational institutes have crowded environments, many countries have instructed to shift the traditional classroom education to online classes to keep the students safe at home yet not wasting their time either as it is not known when the pandemic would end. In 2019, Online education in many countries became compulsory as there was no choice left for the institutes due to the spread of Corona Virus. Although these steps are highly appreciable and vital for reducing the spread of COVID-19, they contributed to unhealthy habits, such as a sedentary lifestyle [2]. Sedentary lifestyle or sedentary behavior is described as

any non-sleep activity using minimum energy expenditure resulting in low energy expenditure comparable to the amount of resting [approximately 1.0 to 1.5 metabolic equivalent (METs)] [3, 4]. This involves activities such as sitting for a variety of reasons (e.g. work, travel), and screen based activities such as computer use, video gaming and watching television for longer period of times [3]. A sedentary lifestyle, including physical inactivity and extended sedentary behavior, has previously been described as problematic under normal circumstances with one third of population physical inactive and 41.5% spending four or more hours a day sitting worldwide [2]. Sedentary lifestyle can lead to mental health problems such as anxiety [5]. Globally it is estimated that the prevalence of anxiety disorders is 7.3 and is commonly found in individuals of around 15-34 years of age. It was also found to be more prevalent in woman than in men [6]. Moreover, an overall negative effect on physical activity intensity was however observed during the pandemic [2, 7]. Sedentary behavior has also been linked to a range of negative health outcomes in a variety of young population in previous studies such as sleep problems, musculoskeletal pain, depression, poor psychological well-being, depression, bipolar disorder and schizophrenia including hyperventilation syndrome (HVS) [8-10]. HVS involves breathing too deeply or too rapidly and it might include pain in the chest, breathlessness if it is ignored and left untreated [10]. The symptoms might also include paresthesia, tightness in the chest and dizziness [11]. In other words, it also means breathing in surplus of metabolic requirements [12, 13]. This is demonstrated by an abnormal and disorganized breathing pattern identified as Tachypnoea [12]. The Nijmegen questionnaire put forward in 1980's is widely used today to diagnose hyperventilation syndrome. This is a 16- item screening technique to identify people who could benefit from breathing retraining. Panic, anxiety attack, anxiety condition, dysfunctional breathing and breathing pattern disorder are alternate words or terminologies used in literature [12]. However, there is insufficient evidence on the relation between sedentary lifestyle and HVS. This study aims to analyze relationship between sedentary lifestyle and Hyperventilation syndrome among students of Karachi quarantined during COVID-19 outbreak.

## METHODS

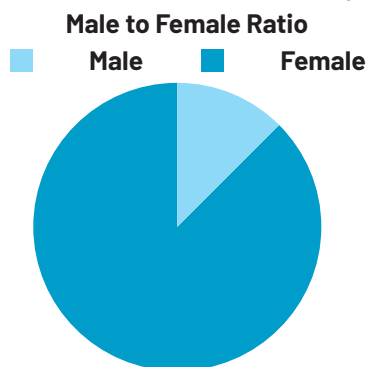
A cross sectional survey based online research was conducted over a period of 4 months from September 2020 to December 2020, the study was conducted on males and females between the age of 15 to 26 living in Karachi, sample size was calculated using slovin formula and sample of 214 was selected from based of non-probability convenient sampling. The participation was entirely

voluntary and based on following inclusion criteria; who have signed consent form and are currently enrolled as regular students in degree program or higher secondary education. Any young adult suffering from any kind of respiratory condition, psychiatric disease or any other medical condition were excluded from the study. Participants having medical condition like asthma, chronic obstructive pulmonary disease, pulmonary edema, were excluded from study as these diseases cause hyperventilation. Also, participants taking medication that may induce hyperventilation were excluded from the study. A survey was designed to complete in 4-5 minutes which included 3 sections. Section A was about demographic details which contained six questions on name, gender, age, city, email address and last question phrased "How much time did you overall spend sitting each day in the past 7 days" with options a. less than 4 hours, b. 4-8 hours, c. 8-11 hours, d. more than 11 hours. Section B and C contained measurement tools i.e. IPAQ (International physical activity questionnaire) to assess sedentary behavior of an individual and hyperventilation syndrome was analyzed using Nijmegen Questionnaire in the last section. The IPAQ consists of 11 questions representing domain activities over the previous 7 days while Nijmegen Questionnaire was based on 16 symptoms. The form was circulated online through several online platforms and the data were collected through non-probability convenient based sampling. Students of both genders between 15-25 years of age who were living a sedentary lifestyle in Karachi during lockdown in COVID-19 were included in this study. Nijmegen questionnaire containing 16 symptoms is a standardized self-administered reported outcome measure which is widely used for ruling out hyperventilation syndrome. It can be rated on a five-point ordinal scale (0=NEVER, 1=RARE, 2=SOMETIMES, 3=OFTEN, 4=VERY OFTEN) according to the frequency of occurrence. If the score is 24 out of 64, HVS will be considered positive [14]. IPAQ is an internationally standardized self-report questionnaire that is used as a measuring tool for individuals between 15-69 years of age to measure and estimate the physical activity and sedentary behavior [15, 16]. We categorized sedentary behavior in 2 categories. A score of less than 15 was named non-sedentary and a score of 16-30 was considered positive for sedentary behavior. Collected data were analyzed using SPSS version 22.0 statistical software. The demographic profile of the participants is presented in form of frequency and percentage. The results were displayed in the form of cross tabulation, graphs and tables. Chi-square test was applied to assess the association of age and gender with sedentary lifestyle and hyperventilation syndrome. Correlation between sedentary lifestyle and hyperventilation syndrome was also

observed using Spearman's correlation coefficient test.

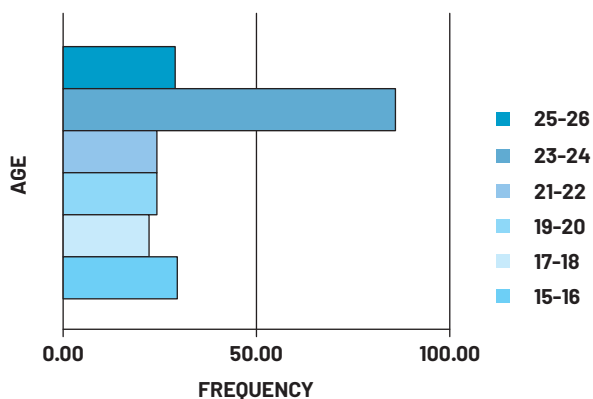
## RESULTS

There was a total of 214 participants among which 27(13%) were males and 187(87.0%) were females(Figure 1).



**Figure 1:** Representing Male to Female ratio

Figure 2 shows age range of participants. 86 participants were from age 23-24, 29 were of age 15-16, 29 were of age 25-26, 24 were of age 19-20 and 21-22 and 22 were of age 17-18.



**Figure 2:** Distribution of ages by graphical representation

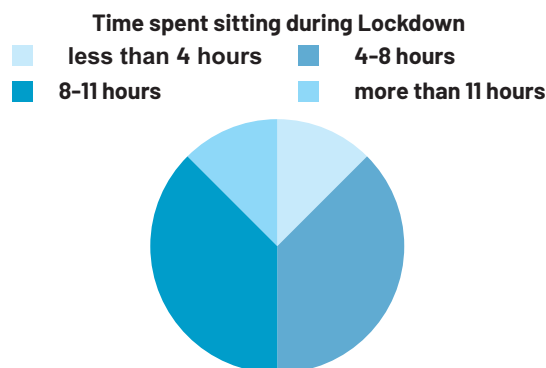
90.9% of students enrolled were from Karachi who were included in this research study and 9.1% were from another city that were excluded. Frequency (N) and percentage (%) of both sedentary lifestyle and hyperventilation syndrome was assessed (Table 1). 59.5% of our population was found sedentary out of which 53% had hyperventilation syndrome.

**Table 1:** Distribution of responses of the questionnaire

Questions	Not at all	Less than 1 hour	1-2 Hour	3-4 Hour	More than 4 hour
	N (%)	N (%)	N (%)	N (%)	N (%)
Watching TV	31(14.4)	33(15.3)	67(31.2)	49(22.8)	34(15.8)
Watching Videos/DVDS	24(11.2)	37(17.2)	67(31.2)	52(24.2)	34(15.8)
Computer for fun	49(22.8)	39(18.1)	84(39.1)	27(12.6)	15(7.0)
Computer for homework	39(18.1)	51(23.7)	89(41.4)	26(12.1)	9(4.2)
Doing Homework	56(26.0)	54(25.1)	76(35.3)	18(8.4)	10(4.7)
Reading for fun	48(22.3)	89(41.4)	56(26.0)	14(6.5)	7(3.3)
Being tutored	86(40.0)	49(22.8)	47(21.9)	23(10.7)	9(4.2)
Travel	48(22.3)	99(46.0)	52(24.2)	11(5.1)	4(1.9)
Crafts & Hobbies	61(28.4)	65(30.2)	55(25.6)	26(12.1)	7(3.3)
Sitting around	19(8.8)	32(14.9)	53(24.7)	48(22.3)	62(28.8)

Questions	Not at all	Less than 1 hour	1-2 Hour	3-4 Hour	More than 4 hour
	N (%)	N (%)	N (%)	N (%)	N (%)
Chest Pain	66(30.7)	53(24.7)	43(20.0)	19(8.8)	0(0)
Felling Tense	18(8.4)	43(20.0)	85(39.5)	28(13.0)	7(3.3)
Blurred Vision	60(27.9)	27(12.6)	70(32.6)	21(9.8)	3(1.4)
Dizzy Spells	50(23.3)	60(27.9)	55(25.6)	12(5.6)	4(1.9)
Feeling Confused	30(14.0)	52(24.2)	76(35.3)	17(7.9)	6(2.8)
Faster Or Deeper Breathing	49(22.8)	56(26.0)	59(27.4)	15(7.0)	2(9)
Shortness Of Breath	68(31.6)	43(20.0)	53(24.7)	14(6.5)	3(1.4)
Tight Feeling in Chest	72(33.5)	61(28.4)	42(19.5)	5(2.3)	1(5)
Bloated Feeling in Stomach	45(20.9)	55(25.6)	51(23.7)	22(10.2)	8(3.7)
Tingling Fingers	66(30.7)	58(27.0)	37(17.2)	14(6.5)	6(2.8)
Unable To Breathe Deeply	64(29.8)	52(24.2)	50(23.3)	7(3.3)	8(3.7)
Stiff Fingers or Arms	68(31.6)	47(21.9)	43(20.0)	8(3.7)	15(7.0)
Tight Feeling Around Mouth	83(38.6)	45(20.9)	37(17.2)	5(2.3)	11(5.1)
Cold Hands or Feet	36(16.7)	57(26.5)	67(31.2)	9(4.2)	12(5.6)
Palpitation ( pounding heart)	54(25.1)	46(21.4)	44(20.5)	23(10.7)	14(6.5)
Feeling Of Anxiety	32(14.9)	43(20.0)	53(24.7)	37(17.2)	16(7.4)

Results of the study show a majority number of students spent more time sitting during lockdown with 33(15%) sitting for less than 4 hours a day, 75(35%) for 4-8 hours, 85 (40%) for 8-11 hours and 21(10%) spent more than 11 hours sitting each day(Figure 3).



**Figure 3:** Graphical representation of time spent sitting during lockdown

Table 2 shows prevalence of hyperventilation syndrome in participants. 62 (28.2%) were negative while 114 (53.0%) were positive.

**Table 2:** Prevalence of hyperventilation syndrome

Hyperventilation syndrome (HVS)	Frequency (%)
Negative	62 (28.2)
Positive	114 (53.0)
Total	176 (81.9)

Figure 4 shows prevalence of Hyperventilation Syndrome (HVS) in graphical manner.



**Figure 4:** Graphical representation of prevalence of

hyperventilation syndrome

Chi-square test was applied to assess the association of age and gender with sedentary lifestyle and hyperventilation syndrome. A p-value of < 0.05 was considered statistically significant (Table 3).

**Table 3:** Chi-Square Test

	IPAQ (International Physical Activity Questionnaire)				NIJMEGAN Questionnaire			
	Non sedentary	Sedentary	Total	p-value	Negative	Positive	Total	p-value
<b>Gender</b>								
Male	18	9	27	0.003	13	61	27	0.003
Female	68	119	187		49	08	187	
<b>Gender</b>								
15-16	15	14	29	0.704	5	14	29	0.226
17-18	7	15	22		7	11	22	
19-20	9	15	24		7	15	24	
21-22	11	13	24		8	9	24	
23-24	32	54	86		25	49	86	
25-26	12	17	29		10	16	29	
Total	86	128	214		62	114	214	

p-value < 0.05 taken as statistically significant

Correlation between sedentary lifestyle and hyperventilation syndrome was also observed. A strong correlation was found between sedentary lifestyle and risk of hyperventilation syndrome. Spearman's correlation coefficient test was used where 'rho' was 0.765 indicating a positive linear relationship between both variables. A p-value of < 0.01 was taken as statistically significant (Table 4).

**Table 4:** Correlation between sedentary lifestyle and hyperventilation syndrome

	Hyperventilation syndrome (HVS)	Sedentary Lifestyle (S)
(HVS) Spearman's rho	1	0.765**
Sig (2-tailed)	-	0.000
N	214	214
(S) Spearman's rho	0.765**	1
Sig (2-tailed)	0.000	-
N	214	214

\*\* Correlation is significant at the 0.01 level (2-tailed)

## DISCUSSION

According to the results of this study 128(59.5%) students including male and female developed a sedentary lifestyle during lockdown and 86(40%) remained non-sedentary. This was assessed using IPAQ (International Physical Activity Questionnaire) which is a standardized measuring tool used to measure and estimate the physical activity and sedentary behavior [15, 16]. 128 students who were found living a sedentary lifestyle were further assessed for the risk of hyperventilation syndrome due to sedentary behavior. It was found that out of 128 students 114(53%) showed symptoms of positive hyperventilation syndrome while results of 62 (28.2%) came negative for

hyperventilation syndrome (as shown in table 2). According to the results of this research study students spent more time sitting than doing physical activities. This finding was hypothesized by some studies during beginning of COVID pandemic. A study by Margaritis I hypothesized that during pandemic overall physical activity will decrease and sedentary behavior increase causing exposure risk factors known for its relation to insufficient physical activity [17]. The results are similar to finding of other studies, A study conducted by Romero-Blanco C et al., to evaluate students' physical activity and sedentary behavior before and during the coronavirus lockdown. Using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) showed increase in both weekly physical activity and sitting time During lockdown. However, group analysis indicated difference in relation to gender, year of study, BMI, alcohol consumption, tobacco use, symptoms of anxiety/depression, Mediterranean diet, living situation and stage of change [18]. The initial hypothesis was partially verified in this research i.e. the amount of time spent sitting and sedentary behavior of students have increased during lockdown as sedentary behavior patterns are influenced by the environment in which a person lives. However, as our data weren't distributed in both genders equally, we cannot claim if female students had a more sedentary behavior than male students during COVID-19 lockdown or vice versa. Further research is needed to study this relation [19]. The current body of evidence on the relationship between sedentary behavior and hyperventilation syndrome is limited according to the literature review, although studies are present associating sedentary behavior with other medical conditions including psychosis [20], depression [21], physical activity [5, 17], stress and anxiety [22]. Anxiety and panic attack are the terms used in the literature referring hyperventilation syndrome [12]. A study conducted by Motiejunaite et al., to assess the possible relationship between HVS and previous acute COVID-19 infection through a large-scale cross-sectional single center study using a systemic Nijmegen questionnaire and a standardized lung function test by dividing population according to HVS diagnosis, defined as a Nijmegen score of > 23/64. The occurrence of previous COVID-19 infection was compared according to the Nijmegen score after adjustment for potential confounders by multivariate logistic regression. The results of this large-scale, cross-sectional study suggest an association between HVS diagnosis and a history of COVID-19 disease in patients who were not hospitalized [23]. In this study association of sedentary behavior and hyperventilation with age and gender was determined using Chi square test (as shown in Table 3). The results show a strong relationship of gender with sedentary lifestyle and hyperventilation

syndrome (p-value 0.003). Similar results are found in literature as a study conducted by Taverne *et al.*, where post COVID patients were clinically evaluated for 3 months also observed female predominance in idiopathic hyperventilation syndrome [24]. No relation of age was found with sedentary lifestyle and hyperventilation syndrome.

## CONCLUSIONS

In conclusion, this study provides evidence that the COVID-19 pandemic and resulting lockdown have led to a significant increase in sedentary behavior among young students in Karachi. The findings also suggest that sedentary behavior is strongly associated with hyperventilation syndrome, with over half of the students who developed a sedentary lifestyle during lockdown showing symptoms of the condition.

## Conflicts of Interest

The authors declare no conflict of interest.

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