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Impact of Coherent breathing on academic stress levels during COVID-19 Pandemic in king Abdulaziz University students

Salwa R. Elgendy[1] and Ahmed M. Aboeleneen, [1,2]

[1]Department of Physical Therapy, Faculty of Medical Rehabilitation Sciences, King Abdulaziz University, Jeddah, **Saudi Arabia**
[2]Department of basic Sciences, Faculty of Physical Therapy, Cairo University, **Egypt**

***Correspondence:** aaboelenin@kau.edu.sa **Received 04-07-2022, Revised: 19-08-2022, Accepted: 22-08-2022 e-Published: 27-08-2022**

Academic stress is a condition that develops when pressures of academic challenging situations are facing students; expressly during COVID-19 outbreak. Through learning breathing methods, students can manage stress circumstances and attain a high awareness level. Objective: the present study was done to measure the effects of coherent breathing on female and male students' academic stress levels. A pilot study and randomized controlled trail included 100 participant (50 males, 50 females) from King Abdul-Aziz University (KAU), their age ranged from 23 to 25 years old. We evaluated their academic stress levels by Academic Stress Scale "ASS". Once we detected that they have at least slight stress, those students were included and randomly separated to two equal groups, (control and experimental). The control group had their BP, HR and RR recorded at normal breathing. While for the experimental group, we measured their BP, HR and RR before and after the coherent breathing. We had done re-assessment after two weeks of doing this exercise. We instructed them to do it twice a day daily. There was a highly significant reduction in RR in the experimental group after intervention, and there was no significant difference between the academic stress levels pre and post intervention. Coherent breathing has shown a significant change in the ASS in one element, which is the lack of concentration at home/ hostel when studying, between the two studied groups. In addition, for the physiological parameters there was only a highly significant reduction in RR

Keywords: academic stress levels, coherent breathing, COVID-19, students

INTRODUCTION

Stress is a worldwide phenomenon; it is a state that depends on the individual response to intimidating situation physically, psychologically and socially in life adjustments (S. Jasmin Debra, 2016). Thus, it is a procedure that allows an individual to cope with surrounding pressures and challenges (Mariotti A, 2015). Hans Selye (1976) identified stress as a nonspecific response of the body to any demand. Stress, on its own, does not make you ill; it may increase the risk or vulnerability to illness (S. Jasmin Debra, 2016).

Stress can alter the whole body mechanism and cause serious health complications or diseases, for example headaches, upset stomach rashes, sleeplessness, high blood pressure, heart disorders, stroke and dysfunction of the immune system (Behere S, Yadav R, Behere P, 2011 & Hernando A et al. 2016). The main symptoms usually involve one or more of these: gastrointestinal disturbances (GD), respiratory problems (RP), moodiness (M), nervous habits (NH), and cognitive disruption (CD) (Amirkhan et al. 2018).

Academic stress is a condition that develops when pressures of academic challenging situations are facing students. It forces the students to have subjective perception of inability of handling both the environmental demands and the actual resources (Qorry and Primardiana, 2019, AlAteeq, et al. 2020, Islam, et al. 2020, Husky et al. 2020, Odriozola et al. 2020, Tang et al. 2021). The extent of stress differs between both male and female students. Sulaiman et al. (2009) have presented that female students are higher than male in the rate and forms of stress because of their emotional and sensitive nature and approach to their surroundings (Pourrajab et al. 2014).

A Normal breathing procedure has an outstanding effect in dealing with usual anxiety and stress and it promotes relaxation. By learning breathing methods, students can manage stressful circumstances so they can attain a high awareness level, increase their focus, and get less easily distracted. These advantages grant them best performance and magnify overall quality of life (QOL) (Wilkinson et al. 2001)

It is known that stress affects all the body systems, hence QOL. Based on Kingdom of Saudi Arabia (KSA)

visions 2020 & 2030, improving QOL is a target to be reached and this study is considered as being an indirect way for reaching that.

The limbic system roused by the events that stimulate emotions. That contains hippocampus, the amygdale and the entorhinal cortex. The hippocampus includes the main glucocorticoids receptors concentration in the brain. Thus, it is essentially engaged in memory and the neuroendocrine control of stress hormones (Kogan I, Richter-Levin G. 2008). During stress, the hippocampal memory gets affected.

Several studies showed that stress can cause hippocampus functional and structural changes and these structural changes contain atrophy and neurogenesis disorders. In addition, it causes elevation in plasma cortisol, leads to lowered number of both dendritic branches, neurons, and the neurogenesis in the hippocampus tissue, as well as structural changes in synaptic terminals (Yaribeygi H, 2017

It's well established that the cardiovascular activity fluctuates during the day, possibly because of alterations in response to sleep/wake, body movements, postural variations, and/or because of endogenous circadian swings in vascular tone, catecholamines, pulse rates and heart rate variability (HRV) (Scheer FAJL et al. 2019).

Stress, whether acute or chronic, has a harmful effect on the functions of the cardiovascular system (CVS). Acute stress can cause ventricular arrhythmias and subsequent myocardial infarction. Also it give arise to the adrenaline excretion through the adrenal medulla that increases platelets so it prompted thrombosis that is associated with blood pressure surge. As well, it can cause coronary artery spasm by releasing neuropeptide Y at a greater sympathetic stimulation (Esler M. 2017 &Yaribeygi H et al. 2017).

The autonomic nervous system (ANS) has sympathetic and parasympathetic nerves, which are very important in the maintenance of cardiovascular variables within homeostatic boundaries (Deuchars SA et al. 2018). HR is organized mainly by the sinoatrial node, through myelinated vagal input to the heart which is led by the parasympathetic for inhibitory effect. However the sympathetic is controlling atrio-ventricular node for the stimulatory effect (de Looff PC et al. 2018).

As we age or during chronic stress the equilibrium between the two branches shifts with increased sympathetic nerve activity which causes increase in the contractile activity and reduction of vagal cardiac tone which causes reduction in the ability to decrease contractile activity and HR (BaireyMerz CN, Elboudwarej O, and Mehta P., 2015).

Endothelial control of vasomotor function plays an essential role in systemic cardiovascular homeostasis, blood pressure regulation, and regulates vascular tone. Spieker et al. 2002, displayed that if mental stresses last for three minutes induces a sustained endothelial dysfunction (Puzserova A and Bernatova I, 2016). Several studies have evidence that psychological stress reduces the microcirculation in the coronary arteries by an endothelium dependent mechanism and increases the cardiac muscle infarction threat (Dakak et al. 1995). Stress has crucial effect on blood pressure (BP) and it can activate the sympathetic nervous system to increase vasoconstriction (Yaribeygi H et al. 2017).

Stress makes respiratory responses changes that affect ventilation, which come before changes in metabolic procedures. These changes appear by variations of the end-tidal CO_2 during expiration (partial pressure of carbon dioxide) (in mm Hg) and drop of arterial CO_2 levels. It is a characteristic of hyperventilation. This mild hyperventilation occurs when the rate or tidal volume of breathing eliminates excessive amount of formed CO_2, which cause inequality (Comroe, 1974). Depending on the degree of this inequality subsequently, CO_2 tension and the associated hydrogen ion concentration are not maintained and different physiological and psychological changes may emerge (Suess WM et al. 1980).

Owing to psychosocial stress at work, hyperventilation will occur thus producing respiratory alkalosis (rise in plasma pH above 7.45). This interloping in acid–base balance activates a series of systemic physiological responses that have negative effects in muscle- tissue health since neurons are extremely sensitive to elevated pH; there is increased motor unit neurons depolarization or excitation.Consequently, leading to induced muscle tension, muscle spasm, and higher responses to catecholamines (Schleifer LM et al. 2002).

The stress-induced hyperventilation imposes a biomechanical load that is specific to the neck/shoulder region (Schleifer LM et al. 2002). The muscle tension stimulation is relatively low by psychological situations than the muscle tension produced by physical demands. Therefore, with stress there is a lack of relaxation that is considered a primary major health problem because of the high force and frequency of muscle contraction (Ritvanen T1 et al. 2003).

The frequency of stress amongst students is described as 63% at King Saud University (Abdulghani HM et al. 2011), and 53% at King Faisal University (Abdel Rahman AG et al. 2013). Another study that was done at faculty of medicine at King Saud bin Abdulaziz university for health sciences, stated that the incidence of all stress levels between students was 53.2% (n: 140). A mild stress was found in 61 students (23.2%), while moderate stress was seen in 35 students (13.3%), finally severe stress was noted in 44 students (16.7%) (Almojali AI et al. 2017).

Punita P et al. (2016) reported that there is some gender differences had been found in self-perception of physical health and stress effect of specific academic activities. Female students compared to males have taken place in the category of high to severe stress. As for males, their perception of stress was more of moderate and high.

In consideration of BP and HR, there were differences

between male and female students. The readings were high among females, though not significant. Hence, it could be concluded that females had more derangement in CV health compared to males. The observed gender difference may be because those female students perceived stress higher than males. Remarkable interpersonal sensitivity was seen more often in female students, they demonstrated more stress effects in communication with the faculty staff and patients (Backović D. V et al. 2012).

Coherent breathing is a deep breathing technique; suppresses the secretion of stress hormones by two ways: first, through ANS balancing by parasympathetic system stimulation. Secondly, through releasing of relaxation hormones to correct the determined state of sympathetic dominance. It similarly provides a form of diaphragmatic exercise. This self- regulatory procedure may result in enhanced health and seeming wellness by providing a mind, body balance state (Baker NC. 2012).

In December 2019, a novel corona virus (COVID-19) arose from China and spread worldwide. The media identified it as a special threat, as it made people panic and stressed. To control the outbreak of this infection, countries used isolation methods to isolate cities and neighborhoods, which may add more mental stress (Jiloha RC., 2020).

MATERIALS AND METHODS

Subjects

The study was carried out on one hundred healthy male and female medical students at KAU. Their age ranged from 23 to 25 years old. Students were separated to two groups, 50 as control and 50 as experimental.

Inclusion Criteria

- Male and female students
- Age ranged between 23– 25 years old
- 4th year students (same courses & exams)

Exclusion Criteria

- Skeletal deformities
- Chronic medical diseases
- Psychological disturbances
- Psychiatric disorders

Study design

A pilot study and randomized control trail was applied at King Abdulaziz University, Jeddah, Saudi Arabia, during the academic year 2019-2020.

Procedure

After general medical examination revealing that all participants were free from any medical conditions. We evaluated their academic stress levels by "Academic stress scale". Self-administered questionnaire was distributed in paper-based forms. It included thirty-seven questions, and according to their answers, once we detected that they have at least slight stress, those students were included and randomly separated to two equal groups (control and experimental). For both groups we measured their parameters by 32921 SMART AUTOMATIC DIGITAL B.P. MONITOR with adult cuff) in sitting position, by placing the cuff two inches above the cubital fossa.

The control group were left to breathe normally, while the experimental group were instructed to apply coherent breathing technique. On the other hand, RR was counted by the researchers. Measurements for the control group for BP, RR and HR were taken at normal breathing. While for the experimental group, this was done before and after the coherent breathing and the same person took all measures. At the same day and we teach them coherent breathing and it was done either in sitting or in lying down in comfortable, supported position with closed eyes and mouth, with breathing throughout the nose, at five breaths per minute (bpm).With five minutes twice a day (5 mins in the morning and 5 mins in the evening). Breathing must be slow, gentle, comfortable and not forced in any way (Brown RP, Gerbarg PL, 2012). Then they were instructed to do this exercise every day for two weeks. We also give them a voice of the exercise steps to follow and we give them an instruction paper if they ever faced some obstacles during doing the exercise.

RESULTS AND DISCUSSION

Data were analyzed using SPSS version 20.0. (Armonk, NY: IBM Corp.) Qualitative data were defined by numbers and %. The Kolmogorov-Smirnov test was applied for verifying normality of distribution. Quantitative data were defined by means and standard deviations. Significance was defined at 5%. ($P > 0.05$: non-significant (NS), < 0.05: significant (S), < 0.01: highly significant (HS).

Demographics data analysis revealed that there were no significant differences between the experimental and control groups in their age and BMI ($P > 0.05$). We excluded any medical disease or deformities. Thus, the study groups were comparable.

No significant difference was seen between the experimental and control groups for both HR and BP before or after the intervention. Conversely, a high significant reduction in RR of experimental group after the intervention was seen (table 1). And no significant difference was noted between the two studied groups concerning lack of concentration at home/ hostel when studying before the intervention, while there is a significant difference found after intervention ($p=0.044$) (table 2).

Table 1: Clinical characteristics of the two studied groups

		Experimental (N=50)	Control (N=50)	T	P
SBP (mmHg) Mean ± SD	Pre	119.88 ± 5.79	124.0 ± 14.18	.762	.459
	Post	117.0 ± 6.23	116.63 ± 5.53	1.27	.901
	Paired t-test	.080	.149	**T**	**P**
DBP (mmHg) Mean ± SD	Pre	75.75 ± 7.09	79.5 ± 11.71	.775	.451
	Post	75.25 ± 6.76	79.0 ± 3.07	1.43	.175
	Paired t-test	.759	.910	**T**	**P**
HR (beat/min) Mean ± SD	Pre	78.88 ± 10.51	74.5 ± 11.25	.804	.435
	Post	76.0 ± 11.43	77.63 ± 6.02	.356	.727
	Paired t-test	.193	.560	**T**	**P**
RR (breath/min) Mean ± SD	Pre	21.5 ± 3.51	19.25 ± 3.85	1.23	.241
	Post	16.63 ± 3.5	17.75 ± 2.49	.740	.471
	Paired t-test	**.000****	.740		

SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate, RR: respiratory rate, SD: standard deviation, **highly significant

Table 2: Academic stress scale results for both groups

Pre-assessment	**Experimental**		**Control**	
	N	%	N	%
No stress at all	10	20	5	10
Slight stress	10	20	10	20
A lot of stress	10	20	25	50
Extreme stress	20	40	10	20
Post-assessment	N	%	N	%
No stress at all	10	20	7	14
Slight stress	11	22	5	10
A lot of stress	13	26	27	54
Extreme stress	16	32	11	22

As academic stress between students has become an interesting issue in many European and North American countries in addition to Asian countries. It includes anxiety and stress that emerge from learning and education challenges (Al-Mashhadani A. M. A, 2019). Additionally, Olejnik dan Holschuh, (2007) described academic stress as a reaction to the amount of duties that the students need to do.

There was no previous study using coherent breathing was done to detect its effects on physiological body responses. Conversely, in this study, the highly significant change of RR might be due to the depth of breathing that result in stronger parasympathetic emphasis (Elliot, S., & Edmonson, D, 2005).

Considering the academic stress scale, a significant difference in lack of concentration at home/hostel during studying was found after intervention. (Baker, N.C, 2012, Fu et al. 2021).

Whereas for the state anxiety & perceived stress, Nancy Coyne Baker, (2012) used coherent breathing in one of the groups. The results showed reduction in both of them, but it was greater for the coherent group in post-test trait anxiety score indicating that coherent breathing has positive benefits.

It would be logical to believe that the outbreak of COVID-19 virus would greatly affected the physiological parameters. Cuiyan Wang et al. (2020), had a survey on the general public in China and found that above half of the responders scored their psychological influence as moderate-to-severe, and around one-third expressed as moderate-to-severe anxiety. Moreover, 8.1% stated moderate to severe stress & 84.7% were also anxious about their family members. As well around 75.1% were females with particular physical symptoms (e.g. myalgia, dizziness, coryza).

CONCLUSION

In this study, a highly significant change in the academic stress scale in one element, which is the lack of concentration at home when studying was noted between both groups. In addition to a highly significant reduction in the RR.

Limitations:

The reason for the unexpected little changes in our results could be due to COVID-19 crisis that lead to shorter study duration and the decrease in the number of participants.

The results of this study considered the following recommendations;

1-Larger sample size.

2-Applying this intervention during exam periods.

3-Comparing male vs female students.

4-Applying coherent breathing technique for all medical students & interns.

Further research for studying long-term effects of

coherent breathing on academic stress levels.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

SRE participated in the study with the responsibility in protocol drafting, reference search, data collection and analysis and manuscript writing. AMA participated in data collection, statistical analysis of data and revising the manuscript. All authors read and approved the final version.

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