Original Article

DOI: 10.7860/JCDR/2022/56112.16652

Cardiovascular Risk among Healthcare Workers in DCH and DCHC Hospitals during COVID-19 Duty: Correlation of Stress Score with Blood Pressure and Lipid Profile

Physiology Section

JAGDISH HUNDEKARI[1], SANJAY WASNIK[2], RAHUL MITTAL[3], LOKENDRA KOT[4]

ABSTRACT

Introduction: Healthcare Workers (HCW's) are at the frontline of the Coronavirus Disease-2019 (COVID-19) pandemic, participating directly in the diagnosis and treatment of coronavirus patients for the past two years. This puts them at a larger risk of causing long-term stress, mental anguish and other negative psychological impacts.

Aim: To evaluate stress score, serum lipid profile and blood pressure in a Dedicated COVID Hospital (DCH) and Dedicated COVID Health Centre (DCHC) among HCWs, and to correlate the perception of psychological stress with serum lipid profile.

Materials and Methods: This was a hospital-based cross-sectional study conducted from the month of March to August 2021. Total 75 HCWs (35 men and 40 women) from DCH and DCHC were included in this study. In these participants, socio-demographic and perceived stress, serum lipid profile was measured. The studied population was divided into two groups: Group A (HCWs in direct contact with COVID-19 patients) and Group B (HCWs not in direct contacts with patients). Stress scores, serum lipid levels, Systolic and Diastolic Blood Pressure (SBP and DBP) of all the participants were measured and compared with that of controls, using Student's t-test. Stress scores of HCWs in direct contact with patients were correlated with SBP and DBP and serum lipid profile by using Pearson correlation coefficient (r).

Results: Stress levels were significantly higher in Group A ($p>0.05$), but serum lipid levels were not significant. Stress levels of Group A were found to correlate strongly with blood Total Cholesterol (TC), ($p<0.001$) serum Triglyceride (TG), ($p<0.01$) High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Very Low Density Lipoprotein (VLDL), LDL/HDL, and SBP and DBP ($p<0.001$).

Conclusion: Stress scores were elevated in HCWs in direct contact with patients (Group A) and these strongly correlate with serum lipid levels and Blood Pressure (BP). The health authorities are responsible for implementation of strategies to manage this psychological stress.

Keywords: Coronavirus disease-2019, Dyslipidaemia, Psychological stress

INTRODUCTION

On 13th March 2020, World Health Organisation (WHO) declared COVID-19 a pandemic disease [1]. In this pandemic, from the last two years, HCWs are on the frontline directly dealing with COVID-19 patients in the context of care, diagnosis and treatment. This puts them at a larger risk of causing long-term stress, mental anguish and other negative psychological impacts. Scarcity of specific treatment and inadequate medical facilities along with increasing number of COVID-19 cases overwhelming workload and lack of personal protection equipment increases the mental burden of HCWs [2,3]. Previous research conducted during the 2003 Severe Acute Respiratory Syndrome (SARS) outbreak revealed that healthcare personnel experienced negative psychological effects. High levels of stress, as well as anxiety and depression symptoms were found among the HCWs associated with uncertainty, stigmatisation, reluctance to work and resignation [4-6]. The emergency nursery department was found to be more likely to develop distress and behavioural detachment in several studies [7-9]. Currently, HCWs who care for these patients are experiencing comparable affects on their mental health as a result of the COVID-19 pandemic. The public health crisis produces an environment of uncertainty and tension, necessitating health personnel's assessment and containment. COVID-19 research has thus far primarily focused on epidemiological studies, prevention, diagnosis and treatment. Few studies have examined the mental health difficulties that HCWs experience during a pandemic [10,11]. Dyslipidaemia is prevalent in all over the world [12]. Researchers had found the relationship between the occupational psychological stress and lipid disorders [13-16]. Prevalence of cardiovascular risk is more in workers doing night shift due to stress induced dyslipidaemia [17,18]. Most of the studies in frontline workers during COVID-19 pandemic was done on perception of anxiety, psychological stress and depression after exposure to physical and mental burden during pandemic but only few literature is available on association between perception of stress and biochemical stress markers during COIVD-19 pandemic.

In the second wave of COIVD-19, patient load as well as mortality was high in comparison to first wave. So, it is important to study the effect of stress on health in DCH. So, this study was conducted to evaluate stress score, serum lipid profile and blood pressure in a DCH and DCHC among HCWs and to correlate the perception of psychological stress with serum lipid profile.

MATERIALS AND METHODS

The present hospital-based cross-sectional study was conducted (from March to August 2021), after Institutional Ethical Committee (IEC) approval was obtained (GMC Ratlam/2020/IEC/approval/2019 dated 14/12/2020).

Inclusion criteria: HCWs (n=75) between age group 25-40 years and doing morning shift duties in DCH and DCHC since at least one year were included in the study.

Exclusion criteria: Known case of diabetes, hypertension, individuals under treatment with glucocorticoids, psychotropic drugs, with Hypothalamic Pituitary Adrenal (HPA) axis alterations or a previous

diagnosis of mental health disorders, dyslipidaemia, central obesity, cardiovascular diseases were excluded from the present study.

Study Procedure

After obtaining written informed consent from all participants, they were divided into two groups. Group A (n=40) HCWs in direct contact with COVID-19 patients and Group B (n=35) HCWs not in direct contact with patients.

Stress scores of all subjects were evaluated using Depression, Anxiety and Stress Scale-21 (DASS-21 scale) [19]. It comprises of seven questions and subitems which are rated as normal, mild, moderate, severe and extremely severe. Each parameter was scored in a self-rated Likart scale for 0 (Did not apply to me) to 3 (Applied to me to some degree, considerable degree and very much) for the past one week.

All participants were called in the next morning at 8:00 am. Subjects were allowed to take rest for 10 minutes before recording blood pressure and heart rate. Blood pressure was tested in supine with digital sphygmomanometer. The next day morning venous blood was drawn from these individuals after 12 hours of fasting to measure serum TG, TC, LDL-C and HDL-C. TC and HDL-C by using Dimension RxLMax (Siemens). Using Friedwelds formula [20], LDL-C was calculated. HDL-C was measured using the calorimetric enzymatic method.

STATISTICAL ANALYSIS

Using student's t-test, statistical analysis was performed in 2 parts- In first part, stress scores, cardiovascular risk factors and morning serum lipid level of Group A and Group B were compared. In second part, stress scores of HCWs in direct contact with patients were correlated with SBP, DBP and serum lipid profile by using Pearson correlation coefficient (r). The value of the Pearson correlation coefficient (r) ranges from +1 to -1. Where 1 is the positive correlation, 0 is no correlation, and -1 is the negative correlation. Statistical software used for statistical analysis was Epi Info.

RESULTS

A total of 75 HCWs were recruited for this study. Group A included 40 healthcare workers in direct contact with COVID-19 patients and Group B included 35 HCWs not in direct contact with patients working in the same DCH and DCHC hospital. Both groups together consist of 35 men and 40 women. The [Table/Fig-1] shows demographic profile of HCWs. The [Table/Fig-2] shows significant elevation of stress levels in Group A as compared to Group B (p=0.003). Lipid profile was found to be increased non significantly in Group A workers. Both SBP and DBP were increased non significantly in Group A.

Parameters	Group A (n=40)	Group B (n=35)
Age (mean±SD, years)	34±6	36±4
Gender	**n (%)**	**n (%)**
Male	22 (55%)	13 (37%)
Female	18 (45%)	22 (63%)
Marital status		
Married	26 (65%)	25 (71%)
Unmarried	14 (35%)	10 (29%)
BMI (kg/m^2) (mean±SD)	27±3	25±5
Education		
Graduate	30 (75%)	17 (49%)
Postgraduate	10 (25%)	18 (51%)
Past COVID-19 infection	Nil	Nil
Shift duty	Morning shift (8:00 am-2:00 pm)	Morning shift (9:00 am-5:00 pm)

[Table/Fig-1]: Demographic profile.

Variables	Mean±SD		p-value
	Group A	Group B	
TC (mg/dL)	230.35±22.12	168.66±34.77	0.029
TG (mg/dL)	165.30±26.33	143.65±66.57	0.344
HDL (mg/dL)	39.75±4.17	44.10±6.60	0.857
LDL (mg/dL)	165.40±25.79	105.48±24.41	0.101
LDL/HDL	4.19±0.74	2.44±0.77	0.899
VLDL (mg/dL)	72.85±13.91	28.08±14.41	0.239
Systolic BP (mmHg)	135.90±5.80	114.50±10.74	0.554
Diastolic BP (mmHg)	94.10±7.11	70.25±8.65	0.455
Stress score	30.20±5.83	8.70±2.92	0.003*

[Table/Fig-2]: Comparison of blood pressure, serum lipid profile and stress score.
P*→ p-value <0.05 statistical significant

The [Table/Fig-3] shows correlation between stress scores of HCWs in direct contact with COVID-19 patients admitted in DCH and DCHC hospitals with cardiovascular risk factors such as serum lipid profile, systolic and diastolic BP and Pearson correlation coefficient (r) was calculated. Stress scores were found to be strongly correlate with serum TC (p<0.001), serum TG (p<0.01), HDL (p<0.001), LDL (p<0.0001), VLDL (p<0.0001), LDL/HDL (p<0.0001) and systolic (p<0.001), and diastolic BP (p<0.001), with r values 0.713, 0.274, -0.411, 0.644, 0.808, 0.672, 717 and 0.810 respectively.

Variables	r	r^2	p-value
Systolic BP (mmHg)	0.717**	0.51	< 0.001
Diastolic BP (mmHg)	0.810**	0.65	<0.001
TC (mg/dL)	0.713**	0.50	<0.001
TG (mg/dL)	0.274	0.07	<0.01
HDL (mg/dL)	-0.411**	0.16	<0.001
LDL (mg/dL)	0.644**	0.41	<0.0001
LDL/HDL	0.672**	0.45	<0.0001
VLDL (mg/dL)	0.808**	0.65	<0.0001

[Table/Fig-3]: Correlations of stress scores with cardiovascular risk factors in workers coming in direct contact with patients.
*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

This study aimed to determine whether HCWs working in DCH and DCHC (group A) can experience increased stress and can demonstrate increased levels of serum lipid levels than their colleagues who worked in same hospital set-up but not in direct contact with COVID-19 patients (Group B). In the present study, stress score and serum lipid level were evaluated in HCWs at DCH and DCHC hospital in the context of COVID-19 pandemic. The results revealed elevated level of stress scores in Group A as compared to Group B HCWs. Recent studies also found that COVID-19 duties affect mental health anxiety, depression, and post-traumatic stress symptoms [21,22]. In addition, HCWs represent the population that are particularly vulnerable to mental illness due to long working hours, risk of infection, lack of personal protective equipment, physical fatigue, and separation from family members [23]. To the best of our knowledge, in India few studies has been done to evaluate stress biomarkers such as serum lipid profiles in this population.

It can be rightly said that physical and psychological stress are indeed a risk factor for increasing TG, and LDL and decreasing HDL. Various studies have reported that chronic stress alters HPA axis activity, which contributes to the development of mental disorders such as depression, anxiety and burnout [24-26]. According to the results of previous studies, the cardiovascular risk factors will be affected more by physical and mental stress in some of the working environmental conditions such as shift duties exposure to heat [27-29].

Muldoon MF et al., proposed that psychological stress increases serum lipid levels by increasing hepatic lipoprotein lipase activity due to increase sympathetic response [30]. In addition, the present study showed strong association between perceived stress and serum lipid levels in HCWs doing COVID-19 duties, which was similar to the study done in workers engaged in different types of working environmental condition [31-33]. Sawai A et al., observed that mental stress elevates BP in young men [34]. In summary, this study demonstrates the importance of assessing the psychological and physical stress of HCWs, which is a vulnerable population statistic in the context of the COVID-19 pandemic. Additionally, serum lipid level has been a valuable screening instrument for stress.

Limitation(s)

A possible limitation of this study was related to the small number of HCWs evaluated as only HCWs working in the morning shift i.e. from 8:00 am to 2:00 pm were selected for the study. However, depression values are clinically confirmed by inventory. In addition, stress levels and lipid profiles are indicators that support the results of this study.

CONCLUSION(S)

Stress scores were elevated in HCWs in direct contact with patients and were strongly correlated with serum lipid levels and BP which affects physical and mental health as well as put them on high cardiovascular risk on long-term basis. The implementation of strategies to manage this psychological stress is the responsibility of the health authorities.

REFERENCES

[1] WHO, Novel coronavirus-China, 2020. (qhttps://www.who.int/csr/don/12-january-2020-novel-coronavirus-china/en) (Jan 12, 2020) (Accessed Dec 19, 2020) [WWWDocument]. Novel coronavirus-China.
[2] Imo UO. Burnout and psychiatric morbidity among doctors in the UK: A systematic literature review of prevalence and associated factors. B J Psych Bulletin. 2017;41(4):197-204.
[3] Maunder RG, Leszcz M, Savage D, Adam MA, Peladeau N, Romano D, et al. Applying the lessons of SARS to pandemic influenza. Can J Public Health. 2008;99(6):486-88.
[4] Lee AM, Wong JG, McAlonan GM, Cheung V, Cheung C, Sham PC, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. Can J Psychiatry. 2007:52(4);233-40.
[5] Bai Y, Lin CC, Lin CY, Chen JY, Chue CM, Chou P. Survey of stress reactions among health care workers involved with the SARS outbreak. Psychiatr Serv. 2004;55(9):1055-57.
[6] Maunder R, Hunter J, Vincent L, Bennett J, Peladeau N, Leszcz M, et al. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. CMAJ. 2003;168(10):1245-51.
[7] Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Network Open. 2020;3(3):e203976.
[8] Shih FJ, Gau ML, Kao CC, Yang CY, Lin YS, Liao YC, et al. Dying and caring on the edge: Taiwan's surviving nurses' reflections on taking care of patients with severe acute respiratory syndrome. Applied Nursing Research. 2007;20(4):171-80.
[9] Wong TW, Yau JK, Chan CL, Kwong RS, Ho SM, Lau CC, et al. The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. Eur J Emerg Med. 2005;12(1):13-18.
[10] Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic-A review. Asian J Psychiatr. 2020;51:102119.
[11] Zhang W, Wang K, Yin L, Zhao WF, Xue Q, Peng M, et al. Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. Psychotherapy and Psychosomatics. 2020;89(4):242-50.
[12] World Health Organization, World Health Statistics. 2013:10-30. Available at: http://www.who.int. (Accessed June 1, 2014).
[13] Catalina-Romero C, Calvo E, Sánchez-Chaparro MA, Valdivielso P, Sainz JC, Cabrera M; ICARIA (Ibermutuamur Cardiovascular Risk Assessment) Study Group. The relationship between job stress and dyslipidemia. Scand J Public Health. 2013;41(2):142-49.
[14] Djindjic N, Jovanovic J, Djindjic B, Jovanovic M, Jovanovic JJ. Associations between the occupational stress index and hypertension, type 2 diabetes mellitus, and lipid disorders in middle-aged men and women. Ann Occup Hyg. 2012;56(9):1051-62.
[15] Strauss-Blasche G, Ekmekcioglu C, Marktl W. Serum lipids responses to a respite from occupational and domestic demands in subjects with varying levels of stress. J Psychosom Res. 2003;55(6):521-24.
[16] Shirom A, Toker S, Melamed S, Berliner S, Shapira I. Burnout and vigor as predictors of the incidence of hyperlipidemia among healthy employees. Appl Psychol Health Well Being. 2013;5(1):79-98.
[17] Bachen EA, Muldoon MF, Matthews KA, Manuck SB. Effects of hemoconcentration and sympathetic activation on serum lipid responses to brief mental stress. Psychosom Med. 2002;64(4):587-94.
[18] Dimsdale JE, Herd JA. Variability of plasma lipids in response to emotional arousal. Psychosom Med. 1982;44(5):413-30.
[19] Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the beck depression and anxiety inventories. Behav Res Ther. 1995;33(3):335-43.
[20] Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultra centrifuge. Clin Chem. 1972;18(6):499-502.
[21] Walton M, Murray E, Christian MD. Mental health care for medical staff and affiliated healthcare workers during the COVID-19 pandemic. European Heart Journal: Acute Cardiovascular Care. 2020;9(3):241-47.
[22] Salari N, Hosseinian-Far A, Jalali R, Vaisi-Raygani A, Rasoulpoor S, Mohammadi M, et al. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. Global Health. 2020;16(1):57.
[23] Kang L, Li Y, Hu S, Chen M, Yang C, Yang BX, et al. The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. The Lancet Psychiatry. 2020;7(3):e14.
[24] Chrousos GP. Stress and disorders of the stress system. Nat Rev Endocrinol. 2009;5(7):374-81.
[25] Miller GE, Chen E, Zhou ES. If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. Psychological Bulletin. 2007;133(1):25.
[26] Tsigos C, Chrousos GP. Hypothalamic-pituitary–adrenal axis, neuroendocrine factors and stress. J Psychosom. 2002;53(4):865-71.
[27] Ghiasvand M, Heshmat R, Golpira R, Haghpanah V, Soleimani A, Shoushtarizadeh P, et al. Shift working and risk of lipid disorders: A cross-sectional study. Lipids in Health Dis. 2006;5(1):01-05.
[28] Lin CM, Li CY. Prevalence of cardiovascular risk factors in Taiwanese healthcare workers. Ind Health. 2009;47(4):411-18.
[29] Hundekari J, Bondade AK. Study of effect of heat stress on serum lipid levels. Indian Medical Gazette. 2005;432-34.
[30] Muldoon MF, Herbert TB, Patterson SM, Kameneva M, Raible R, Manuck SB. Effects of acute psychological stress on serum lipid levels, hemoconcentration, and blood viscosity. Arch Intern Med. 1995;155(6):615-20.
[31] Patterson SM, Gottdiener JS, Hecht GA, Vargot SU, Krantz DS. Effects of acute mental stress on serum lipids: Mediating effects of plasma volume. Psychosom Med. 1993;55(6):525-32.
[32] Fakhari A, Ebrahimzadeh M, Shiva S, Fekrat S, Mohammadpoorasl A. Effect of mental stress on serum triglyceride level. Res J Biol Sci. 2007;2(4):476-78.
[33] Niaura R, Stoney CM, Herbert PN. Lipids in psychological research: The last decade. Biol Psychol. 1992;34(1):01-43.
[34] Sawai A, Ohshige K, Kura N, Tochikubo O. Influence of mental stress on the plasma homocysteine level and blood pressure change in young men. Clin Exp Hypertens. 2008;30(3-4):233-41.

PARTICULARS OF CONTRIBUTORS:

1. Professor and Head, Department of Physiology, Government Medical College, Ratlam, Madhya Pradesh, India.
2. Assistant Professor, Department of Physiology, Government Medical College, Ratlam, Madhya Pradesh, India.
3. Associate Professor, Department of Physiology, Government Medical College, Ratlam, Madhya Pradesh, India.
4. Demonstrator, Department of Community Medicine, Government Medical College, Ratlam, Madhya Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Sanjay Wasnik,
Flat No. 201, F Block, GMC Campus, Banjali, Ratlam, Madhya Pradesh, India.
E-mail: jchpune@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Mar 14, 2022
- Manual Googling: Apr 29, 2022
- iThenticate Software: Jun 28, 2022 (24%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 05, 2022**
Date of Peer Review: **Apr 14, 2022**
Date of Acceptance: **May 02, 2022**
Date of Publishing: **Jul 01, 2022**