RESEARCH ARTICLE

A cross-sectional study on the cardiovascular risk associated with the Covid-19 Lockdown

Mathangi Murali[1] | Sanathanan. N.Rs[1] | Arbind Kumar Choudhary[2*] | A Abdul Rahman[2] | L Madhan[3] | E. Manivannan[4] | R. Sivaraj[5]

[1]II MBBS, Government Erode Medical College, Perundurai – 638053, Erode District, Tamilnadu, INDIA

[2]PhD Scholar, Vinayaka Mission's Research Foundation - Deemed to be University (VMRFDU), NH-47, Sankari Main Road, Seeragapadi, Salem, Tamil Nadu 636308, INDIA.

[3]Professor and HOD of Pharmacology, Govt. Erode Medical College, Erode -638053, Tamilnadu, India.

[4]Professor of Pharmacology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, , Salem, Tamil Nadu 636308, INDIA.

[5]Professor & HOD, Dept. of Pharmacology, Arupadai Veedu Medical College, Kirumampakkam, Pondicherry, INDIA.

Abstract

Background: In December 2019, an outbreak of Severe Acute Respi-ratory Syndrome Coronavirus-2 (SARS-CoV 2), emerged in Wuhan, China causing a global pandemic. Stringent measures were imple-mented in several parts of the world and a nation-wide lockdown was declared in India to alleviate disease transmission. This confinement severely impacted people's lives and forced them to switch to a seden-tary lifestyle. The present study aimed to analyse the cardiovascular risk associated with lifestyle modifications due to the lockdown. Results :This cross-sectional study used a structured online questionnaire with data collection using convenience sampling method. The data analysis was performed using PASW Statistics Version 18.0.A total of 432 respondents, aged between 20 and 60 years (mean age-33.39 $\pm$10.8 years) were included in the study. The perception of weight gain was observed in 46.06% of the population;19.90% reported an increased carbohydrate intake; a decrease in physical activity was observed in 27.08%; 62.73% reported an increase in screen time; more females complained of having sleep disturbances and stress perception was more in the population group aged between 30-50 years. Discussion: The behavioral and lifestyle risk factors of cardiovascular diseases are obesity, physical inactivity, sedentary behavior, and stress.[7] Among the respondents, 46.06% have gained weight with the lockdown and this is evident from the increase in carbohydrate consumption in 28.64%and decreased physical activity in 34.67% of them. Based on previous studies, it can be speculated that the weight gained may not be easily reversed and may lead to excess adiposity which in turn can increase the cardiovascular risk. Conclusion: Quarantine results in an increased cardiovascular risk due to the associated unhealthy lifestyle and stress. Following quarantine, a global action supporting healthy diet and physical activity should be made mandatory to encourage people to return to a good lifestyle routine. This study would help in execution of public health interventions during the pandemic as well as in future times.

Keywords: COVID-19, Sedentary lifestyle,Quarantine,Lifestyle, Cardiovascular diseases

1 | INTRODUCTION

In late December 2019, a novel corona virus emerged in Wuhan, Hubei Province, China, sparking a pandemic of Acute Respiratory Syndrome in humans known as COVID-19. In the following months, the disease spread worldwide. [1] The World Health Organization (WHO) declared the COVID- 19 outbreak, a global health emergency on 30th January 2020, and as a pandemic on 11th March 2020[2] . In order to contain the spread of the virus, the Government of India announced a nationwide lockdown on 24th March, 2020. As of 10th September 2020, the total cases in India stands around 4,465,863 with the mortality rate of 1.68%, as per records of the Indian Ministry of Health and Family Welfare[3]. Non-pharmacological interventions (NPIs) such as wearing masks, social distancing, regular washing of hands, and self- isolation became mandatory to decrease the disease transmission, given the absence of any treatment for the disease. Although these measures have helped to curb the disease to an extent, they have radically changed people's everyday activities[4] .

The lockdown has provided grounds for an altered lifestyle among the people, such as smart working, online education, and restriction of outdoor activities which contributes to a sedentary behaviour. This pandemic has also come up with an increase in stress levels due to job insecurities, social isolation, and financial crisis. Dysfunctional eating and altered sleep patterns has resulted from an increased screen time, anxiety and boredom with the lockdown. The current indolent lifestyle is associated with an increased cardiovascular risk. Emotional eating, reduced physical activity, and increased sitting may contribute to obesity and metabolic syndrome, which are key risk factors of the cardiovascular diseases.[5] An online questionnaire survey was conducted among the public to assess their lifestyle changes with this pandemic and the cardiovascular risk associated with their current lifestyle[6].The aim of this study is to analyze the changes in lifestyle and the increased risk of cardiovascular diseases.

2 | MATERIALS AND METHODS

This study was conducted by the Department of Pharmacology, Government Erode Medical College, Perundurai, Tamil Nadu, India using a web-survey to obtain data on lifestyle changes before and during the COVID-19 pandemic to assess their cardiovascular risk. The target population were adults aged between 20 and 60 years from several regions across India.This cross-sectional study used data collected via an anonymous online questionnaire consisting of more than 20 questions about living habits during the COVID-19 confinement and the previous time. The questionnaire was shared via social media platforms such as Whatapp, Facebook, and Instagram to the personal contacts of the research group members. To increase the sample size, the participants were requested to share the survey link to their contacts as well. The data collection was carried out through an online structured questionnaire using Convenience sampling. It was created using the Zoho survey and was made available to the participants between 7^{th}August, 2020 to 21st August, 2020. Informed consent was included as a part of the questionnaire and the confidentiality of the details was assured to the participants. The questionnaire was divided into eight sections as described in Table 1 and the responses were collected for lifestyle pattern before and during the lockdown.

3 | RESULTS

3.1 | Participants:

An online survey was conducted among people of the age groups 20-60 years in order to assess their lifestyle changes during this lockdown and evaluate

Corresponding Author: *Arbind Kumar Choudhary PhD Scholar, Vinayaka Mission's Research Foundation - Deemed to be University (VMRFDU), Salem, Tamil Nadu 636308, INDIA,*
*Email: arbindkch@gmail.com*

the cardiovascular risk associated with their current lifestyle. A total of 447 participants completed the questionnaire and after validation of the collected data, 432 participants were included in the study. Out of the total respondents, 214(49.54%) were males, 216(50.00%) were females and 2(0.46%) of them belonging to unidentified gender. The participants were from urban, semi-urban and rural localities. These characteristics are explained in Table 1

3.2 | Questionnaire Review:

The results of the questionnaire are as presented in Table 2. A total of 93.52 % (Females-51.23%; Males-48.26%) feel that the pandemic has brought a lifestyle change among them. Also, 10.19% of the respondents reported to have pre-existing ailments.

3.3 | Diet and Physical Activity

The consumption of carbohydrates was found to be increased in 19.90%. There was an evident decrease of 53.70% in the consumption of packed foods due to a setback in the manufacturing sector and fears of the public on Covid-19 transmission. 29.16% have reported to have increased their duration of physical activity from pre-lockdown. However, only 46(10.65%) participants engage in more than 120 minutes per week of physical activity both pre-lockdown and during the lockdown.
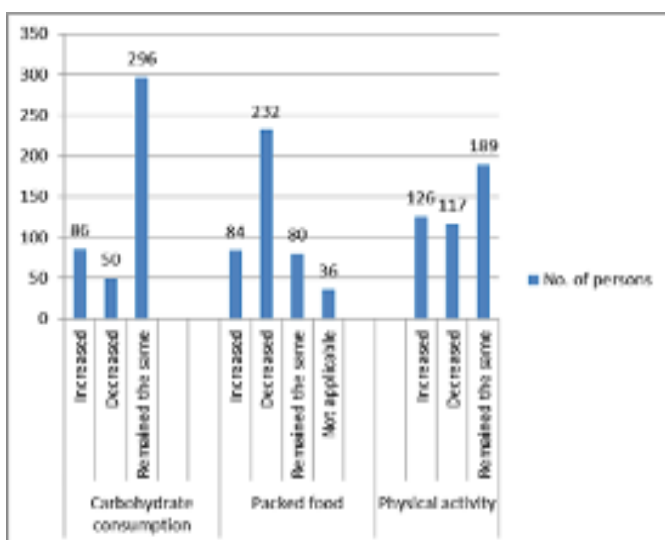
FIGURE 2: Changes in food consumption and physical activity : represents the changes in consumption of carbohydrates, packed foodsand time spent on physical activity among the participants before and duringthe lockdown.
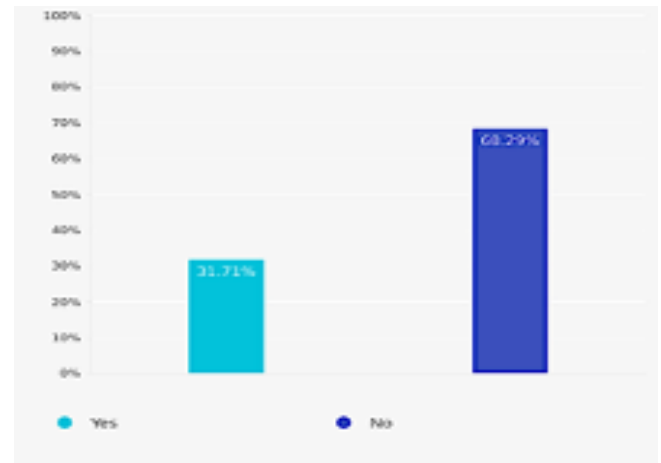

FIGURE 3: Intake of nutritionalsupplements : represents the intake of nutritional supplements among theparticipants. Among those who consumed nutritional supplements, females were ina greater proportion (56.20%).
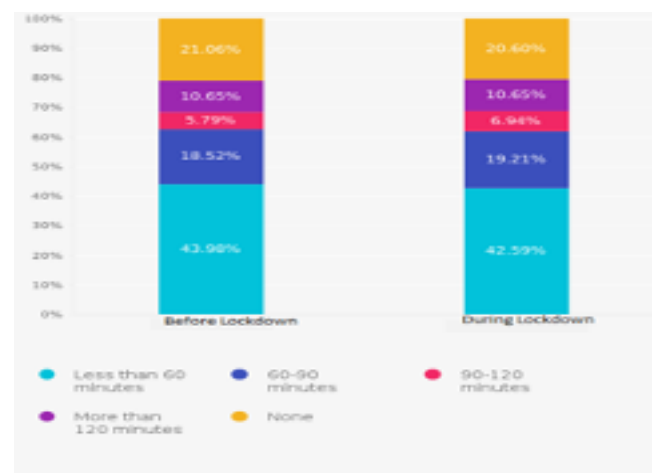
FIGURE 4: represents thetime(minutes/week) spent by the participants on physical activities before and during this lockdown

Alcohol and Smoking

(a)   (b)
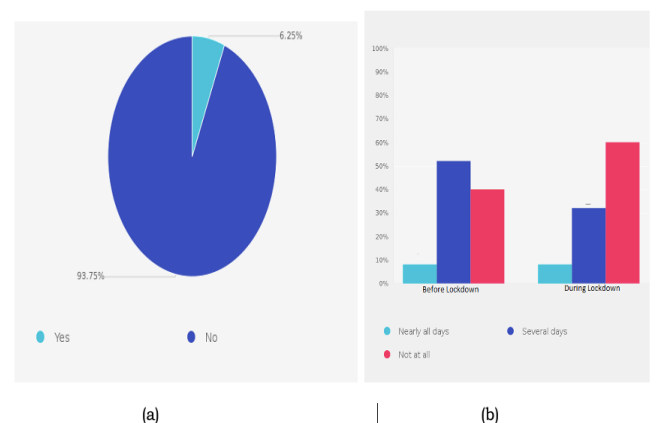
FIGURE 5: (a).Alcohol consumptionrate (b). Comparison of consumption of alcohol before and during the lockdown: represents the percentage of alcohol consumption among the participants. Alcohol consumption was found to be more in males (p<0.05) and the consumption has reduced during the lockdown owing to the fact that theliquor shops has been shut down. Similarly, smoking was also found to be commonamong males (p=0.058).

Gender			Males (n=214)	Females (n=216)	Others (n=2)	Total (n=432)
Mean Age (Std. Dev.)			33.91 ±11.40	32.80 ±10.09	40.25 ±21.56	33.39 ±10.8
Age Groups		20-30 years	118 (55.14)	124 (57.41))	1 (50)	243 (56.25)
		31-40 years	37 (17.29)	33 (15.28)	0	70 (16.20)
		41-50 years	28 (13.08)	46 (21.30)	0	74 (17.13)
		51-60 years	31 (14.49)	13 (6.02)	1 (50)	45 (10.42)
Physical Evaluation (Before Lockdown)		Height (cm)	173.27 ±9.41	160.34 ±10.22	190.5 ±20.3	166.89 ±11.92
		Weight (kg)	60 ±16.97	63.67 ±12.28	102.5 ±45.07	62.75 ±14.23
		BMI (kg/m²)	23.48 ±4.50	23.66 ±4.98	22.39 ±6.86	22.71 ±4.77
Physical Evaluation (During Lockdown)		Weight (kg)	57 ± 19.08	64.33 ±11.92	80 ±42.43	62.5 ±13.75
		BMI (kg/m²)	23.84 ±4.37	23.80 ±4.92	21.01 ±3.75	23.81 ±4.66
Place of	Residence	Urban	140 (65.42)	159 (73.61)	1 (50.00)	300 (69.44)
		Semi-urban	42 (19.63)	40 (18.52)	1 (50.00)	83 (19.21)
		Rural	32 (14.95)	17 (7.87)	0 (0.00)	49 (11.34)
Declared Addictions		Smoking	8 (3.74)	1 (0.46)	0 (0.00)	9 (2.08)
		Alcohol	22 (10.28)	5 (2.31)	0 (0.00)	27 (6.25)

Table 1. Participant Baseline Characteristics

All categorical variables are expressed in frequency and percentage[n(%)] and continuous variables are expressed in Mean ± Standarddeviation[M±SD].

Screen Time

In view of the screen time shown in Fig6, there is a humongous increase in people having a screen time of more than 4 hours with the lockdown.
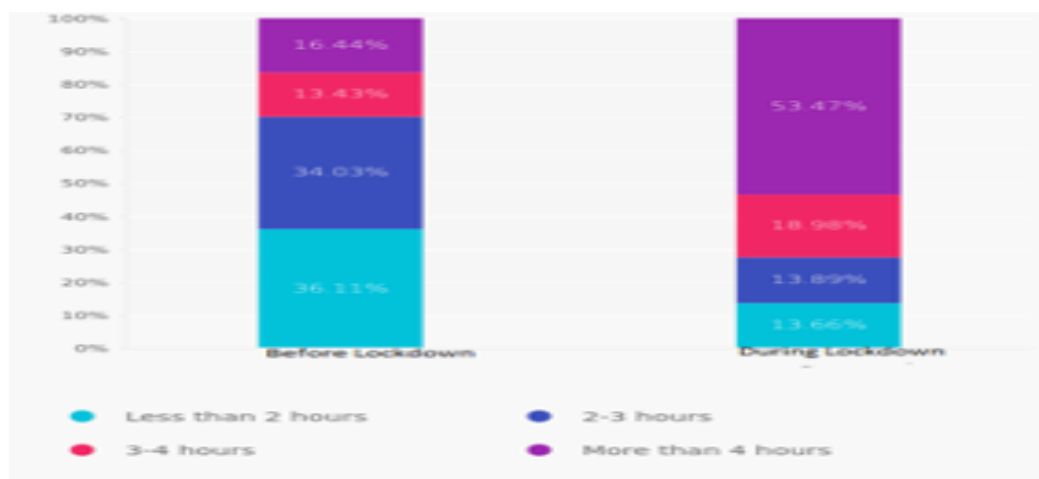

FIGURE 6: Screen time among the participants before and during this lockdown

Category			Before Lockdown	During Lockdown
Carbohydrate Intake	Number of times per day	0	2 (0.46)	2 (0.46)
		1	70 (16.20)	59 (13.66)
		2	168 (38.89)	159 (36.81)
		3	177 (40.97)	186 (43.06)
		4	12 (2.78)	20 (4.63)
		5	3 (0.69)	6 (1.39)
Physical Activity	Number of minutes per week	<60 minutes	190 (43.98)	184 (42.59)
		60-90 minutes	80 (18.52)	83 (19.21)
		90-120 minutes	25 (5.79)	30 (6.94)
		>120 minutes	46 (10.65)	46 (10.65)
		None	91 (21.06)	89 (20.60)
Screen time	Number of hours per day	<2 hours	156 (36.11)	59 (13.66)
		2-3 hours	147 (34.03)	60 (13.89)
		3-4 hours	58 (13.43)	82 (18.98)
		>4 hours	71 (16.44)	231 (53.47)
Sleep hours	Number of hours per day	<6 hours	80 (18.52)	48 (11.11)
		6-7 hours	232 (53.70)	126 (29.17)
		7-8 hours	107 (24.77)	148 (34.26)
		>8 hours	13 (3.01)	110 (5.46)

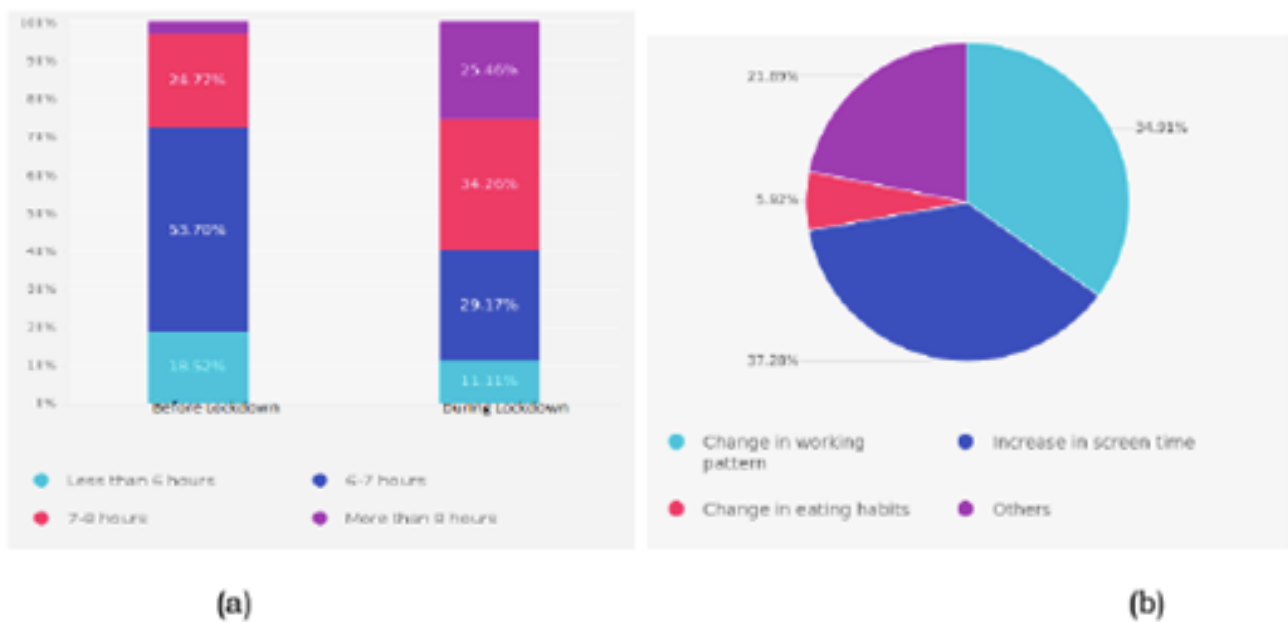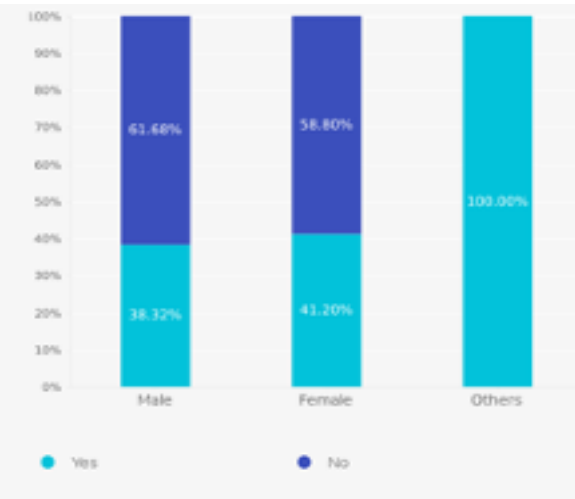Table2. Results of the questionnaire survey

Sleep hours

(a)

(b)

Fig 7.(a) Percentage of sleep hours among the participants before and during this lockdown (b)Various reasons for disturbances in sleep among the participants during the lockdown

FIGURE 8: Comparison of sleepdisturbances among the participants with respect to gender

40.05% of the surveyed participants have sleep disturbances, with females being in a greater proportion (51.44%). Most of them feel that an increase in screen time(37.28%) has contributed to their sleep disturbances.

Stress and related parameters

Among the respondents, 55.56% reported to have recent experience of stess with a higher percentage of males(51.66%). 50.21% feel stressed nearly all days or several days and 49.79% feel so occasionally.
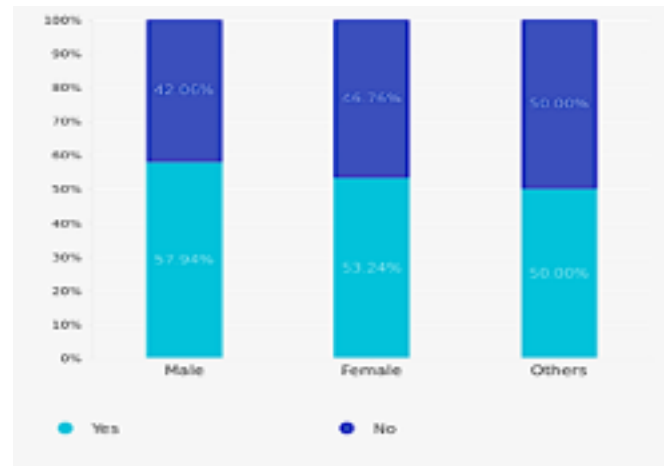
FIGURE 9: Comparison of stress amongthe participants with respect to gender

BMI Class	Carbohydrate Consumption			Packed foods Intake				Physical Activity		
	Increased	Decreased	Remained the same	Increased	Decreased	Remained the same	Not applicable	Increased	Decreased	Remained the same
Under weight	17(28.33)	6(10.00)	37(61.66)	11(18.33)	35(58.33)	9(15.00)	5(8.33)	21(35.00)	18(30.00)	21(35.00)
Normal	37(17.45)	22(10.37)	153(72.16)	43(20.28)	116(54.71)	39(18.39)	14(6.60)	61(28.77)	59(27.83)	92(43.39)
Over weight	22(18.33)	15(12.50)	83(69.16)	25(20.83)	60(50.00)	24(20.00)	11(9.16)	36(30.00)	26(21.66)	58(48.33)
Obese Class I	7(21.87)	5(15.62)	20(62.50)	4(12.50)	18(56.25)	5(15.62)	5(15.62)	6(18.75)	12(37.50)	14(43.75)
Obese Class II	2(28.57)	2(28.57)	3(42.85)	1(14.28)	3(42.85)	2(28.57)	1(14.28)	2(28.57)	1(14.28)	4(57.14)
Obese Class III	1(100.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(100.00)	0(0.00)	0(0.00)	1(100.00)	0(0.00)

Table 3. Change in consumption of carbohydrates, packedfoods and physical activity. Values are expressed as frequencies and percentages [n(%)].

BMI Class	Increased Carbohydrate consumption	Increased Packed foods Intake	Decrease in Physical Activity	Increase in Screen time
Underweight	17	11	18	38
Normal	37	43	59	137
Overweight	22	25	26	74
Obese Class I	7	4	12	19
Obese Class II	2	1	1	2
Obese Class III	1	0	1	1
p value	p <0.01	p <0.01	p <0.01	p <0.01

Table.4 Number of persons and p value calculation for different classes of BMI

Body Mass Index

The BMI of the participants was calculated using the equation 1 and classification was done using the World Health Organization Criteria shown in Table 2.

$$BMI = \frac{Weight\ (Kg)}{Height\ (m)2} \quad --- (1)$$

BMI Class	BMI Range
Under weight	<18.5
Normal	18.5- 24.9
Over weight	25.0 – 29.9
Obese Class I	30 – 34.9
Obese Class II	35 – 39.9
Obese Class III	>40

Table 2. WHO Criteria for BMI Classification

Based on the data collection, the participants were categorised based on their BMI into Normal (212), Underweight (60), Overweight (120)and Obese class 1 (32), Obese class II(7) and Obese class III (1) . The pandemic has brought a difference in BMI values of the people, which is represented in Figure 2.
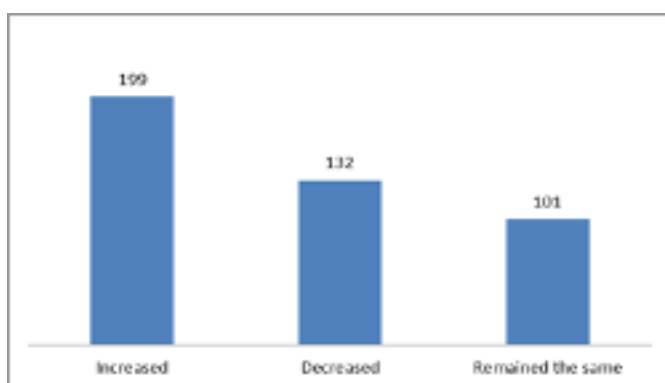
Figure 2. Analysis of Change in individual BMI before andduring the lockdown

The increase in BMI is evidentfrom the data shown in Table 3 which represents changes in consumption of carbohydrates, packed foods and physical activity before and during the lockdown in different classes of BMI(Before lockdown

4 DISCUSSION

The COVID 19 outbreak has strongly impacted the lives of the general population both physically as well as psychologically because of the fear of contracting the disease and strict isolation measures. The objective of the study is to assess the cardiovascular risk associated with lifestyle modifications. The behavioral and lifestyle risk factors of cardiovascular diseases are obesity, physical inactivity, sedentary behavior, and stress. [6].Among the respondents, 46.06% have gained weight with the lockdown and this is evident from the increase in carbohydrate consumption in 28.64% and decreased physical activity in 34.67% of them. Based on previous studies, it can be speculated that the weight gained may not be easily reversed and may lead to excess adiposity which in turn can increase the cardiovascular risk6.Increased screen time perceived in 62.73% of the participants results in prolonged sitting time contributing to cardiovascular risk. One of the associated biological mechanisms shown using animal models is the acute drop in skeletal muscle lipoprotein lipase with ~4 hours of physical inactivity resulting in reduced plasma triglyceride uptake and altered HDL metabolism7,8Although 59.72% have a sufficient sleep duration of >7 hours , 40.05% have reported of sleep disturbances. Sleep deficiency also increases the risk burden due to increased activity of the sympathetic nervous system, tachycardia, vasoconstriction, salt retention, and decreased glucose tolerance9.

Among the respondents, 240 of them reported to feel stressed with the lockdown and 27.31% and 25.00% have complained of stress eating and loss of appetite respectively. The physiological impact of stress involves the activation of the HPA (Hypothalamo-pituitary-adrenocortical) axis due to the stimulation of the sympathetic nervous system. This further increases the release of catecholamines(CAs) from the adrenal medulla which has a negative impact on the heart vessels by its pressor, inotropic, and chronotropic effects10,11. The key pathophysiological component of stress-induced cardiovascular change is the activation of the inflammatory cascade, endothelial dysfunction

and oxidative imbalance associated with the CAs12. This study has a few limitations based upon its study design. Firstly, the cross-sectional design of the study fails to explain a cause and effect relationship13.Secondly, lifestyle behaviors and their likely changes were self-reported, and thus are susceptible to recall bias14.Finally, more than half of the respondents (56.25%) belonged to the age category of 20 to 30 years, about 70% of the participants are from urban region, and the convenience sampling was adopted, the results of the study cannot be extrapolated to the general population15.

5 CONCLUSION

The COVID-19 pandemic associated nationwide-lockdown has come up with a likely increase in the cardiovascular burden in the society. In spite of reduction of the everyday regime of physical work,most of the people continue to have an increased or the same carbohydrate intake and physical activity. Increased screen time, weight gain, stress and over-eating also adds to the burden. However, reduced packed foods intake, sufficient sleep duration, in-take of nutritional supplements, reduced alcohol con-sumption perceived in many with the pandemic is a good sign. Since the pandemic has not completely settled, people would have to be cautious and learn to match their metabolic requirements with food intake and physical activity in order to maintain their qual-ity of life. This study would provide scope for im-portant public health interventions.A possible nega-tive impact of the lockdown on healthcare delivery should also be investigated. The study also excluded people above the age of 65 as only a minority of these are in active employment.Despite these limi-tations, the authors suggest that governments should prevent such health losses and increased severity of health inequities by active intervention in job creation policies and programs. These could target disadvantaged communities to bring their unemploy-ment rates nearer to those of non-Maoris. Active education of the population on the risk of CVD and measures to mitigate this risk should also be on the agenda.

6 REFERENCES

1. Zielinska MA, Magdalena G, Ewa M. Dietary and Lifestyle Changes During COVID-19 and the Subsequent Lockdowns among Polish Adults : PLifeCOVID-19 Study. 2020;(June).

2. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta Biomed. 2020;91(1):157-160. doi:10.23750/abm.v91i1.9397

3. MoHFW _ Home. https://www.mohfw.gov.in/, Referred on 12th September 2020

4. Balanzá–Martínez V, Atienza–Carbonell B, Kapczinski F, De Boni RB. Lifestyle behaviours during the COVID-19 – time to connect. Acta Psychiatr Scand. 2020;141(5):399-400. doi:10.1111/acps.13177

5. Anna Vittoria Mattioli, Milena Nasi, Camilla Cocchi, Alberto Farinetti. COVID-19 outbreak : impact of the quarantine-induced stress on cardiovascular disease risk burden.

6. Hu Z, Lin X, Kaminga AC, Xu H. Impact of the COVID-19 Epidemic on Lifestyle Behaviors and Their Association With Subjective Well-Being Among the General Population in Mainland China : Cross-Sectional Study Corresponding Author : 22:1-10.doi:10.2196/21176

7. Ann Smith Barnes. Emerging Modifiable Risk Factors for Cardiovascular Disease in Women.Tex Heart Inst J. 2013; 40(3): 293–295.

8. Cutting B, Report E, Importance S. Effects of COVID-19 Lockdown on Lifestyle Behaviors in Children with Obesity Living in Verona , Italy : A Longitudinal Study. 2020;28(8):1382-1385. doi:10.1002/oby.22861

9. Khaw K, Sharp SJ, Luben R, Wijndaele K, Brage S. Television viewing time independently predicts all-cause and cardiovascular mortality : the EPIC Norfolk Study. 2011;(June 2010):150-159. doi:10.1093/ije/dyq105

10. Syndrome M, Diabetes T, Hamilton MT, Hamilton DG, Zderic TW. Role of Low Energy Expenditure and Sitting in Obesity, Metabolic Syndrome, Type 2 Diabetes, and Cardiovascular Disease. 2007;56(November):2655-2667. doi:10.2337/db07-0882.CVD

11. Hirshkowitz M, Whiton K, Albert SM, et al. National sleep foundation's sleep time duration recommendations: Methodology and results summary. Sleep Heal. 2015;1(1):40-43. doi:10.1016/j.sleh.2014.12.010

12. Najib T. Ayas,David P. White,JoAnn E. Manson, MD, Meir J. Stampfer, Frank E. Speizer, Atul Malhotra, Frank B. Hu. Investigation O. A Prospective Study of Sleep Duration and Coronary Heart Disease in Women. 2003;163. Arch Intern Med. 2003;163(2):205-209. doi:10.1001/archinte.163.2.205

13. Golbidi S, Frisbee JC, Laher XI, Virginia W. Cardiovascular Responses to Environmental Stress Chronic stress impacts the cardiovascular system : animal models and clinical outcomes. Published online 2020:1476-1498. doi:10.1152/ajpheart.00859.2014

14. Mattioli A V, Sciomer S, Cocchi C, Maffei S, Gallina S. Nutrition , Metabolism & Cardiovascular Diseases Quarantine during COVID-19 outbreak : Changes in diet and physical activity increase the risk of cardiovascular disease. NutrMetab Cardiovasc Dis. 2020;30(9):1409-1417. doi:10.1016/j.numecd.2020.05.020

15. Solem RC. Limitation of a cross-sectional study. Am J OrthodDentofacOrthop. 2015;148(2):205. doi:10.1016/j.ajodo.2015.05.006