ORIGINAL ARTICLE

Impact of Lockdown on Physical Activity, Sleep and Eating Habits in Central India

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Abstract

Context: India, in its strategy to reduce the spread of COVID-19 pandemic, imposed a nation-wide lockdown. Social restriction measures, when imposed legally, could change behavioural patterns among population groups. The changes in key behavioural patterns including exercise, sleep and eating habits are influenced during lockdown & can have implications on health of individual for a long duration.

Aim: To assess the effect of lockdown on physical activity, sleep and eating habits among adults in Nagpur, Maharashtra, India

Settings and Design: A web-based cross-sectional survey

Methods and Material: After obtaining ethics clearance, the was conducted among volunteers ≥18 years of age in Nagpur district. A self-reported retrospective pre-post questionnaire was disseminated through multiple platforms as an online survey form. A modified Global Physical activity questionnaire was used to assess level of physical activity. Sleep pattern was assessed using selected components of Pittsburgh Sleep Quality Index. Diet pattern was assessed by using food frequency questionnaire for specific food groups.

Statistical analysis used:. Most of the quantitative parameters followed a non-normal distribution. The Wilcoxon Signed-rank test, McNemar's test and a binomial test were used to study difference between quantitative parameters, paired proportions and difference in proportions respectively using SPSS v 24.0.

Results: A total of 586 responses were received through the online survey. The prevalence of physical inactivity increased from 47.6 % to 51.3% during the lockdown. The change in physical activity pattern from adequate to inadequate was 63% less likely compared to the converse (OR (95%CI) – 0.37 (0.18 -0.74)).The increase in sleep latency was at least 9 (OR (95%CI) = 9.33 (5.73 - 15.19)) times more likely during lockdown compared to a reduction. There was a significant increase in frequency intake of Green leafy vegetables, fresh fruits and fried foods during lockdown. But there was a significant decline in intake of eggs and non-vegetarian foods during lockdown.

Conclusions: The levels of physical inactivity and duration of sleep latency increased during lockdown in central India. Leafy vegetables and fresh fruits were preferred over non-vegetarian foods. The impact of these behavioural changes needs to be further explored.

Keywords: COVID-19, Eating habits, Lockdown, Physical activity, Sleep.

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Introduction

As of July 9th September 2020, India has reported 4,207,647 confirmed cases and 72,775 deaths from COVID-19 in 31 states and union territories since its first case on 30th January.[1] To stop the spread of this disease, India has the largest COVID-19 national lockdown in the world which started on 25th March 2020 and has been extended to 31st May.[2] Lockdown, a term conventionally used for "mass quarantine", defined as a state of isolation or restricted access instituted by authority as a security measure.[3] It is hence mostly used for counteracting an ongoing outbreak, mandating residents to stay inside their homes, except for carrying out essential activities (health visits, tending to a vulnerable person, purchasing medicines, food and beverages) or providing essential work (e.g. healthcare and social care sectors, police and armed forces, firefighting, water and electricity supply, critical manufacturing). Other non-essential activities are hence stopped or carried out from home. Nevertheless, stay-at-home orders may also be associated with numerous side effects, especially when the lockdown is protracted for months, thereby disrupting social habits and jeopardizing personal health.

One of the most important undesirable effects of prolonged homestay such as physical inactivity, change in dietary habits and sleeping patterns need to be addressed. The lockdown in India has led to the combination of abrupt interruption of physical exercise and prolonged inactivity which may promote many adverse health changes. The disruption of daily schedule or lack of a schedule, worries and fear of catching the coronavirus to self or family members as well as economic concerns and excess screen time due to work from homes and binge-watching for entertainment has led to disturbed sleep patterns. Change in dietary pattern is another dimension of adverse health effect. Quarantine and

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self-isolation imposed on people has got them shifting back to local, homegrown ingredients with minimal risk involved in eating. With little or no options to eat out, the trend of cooking at home and eating home-cooked food is clearly growing. All these indicators point towards one direction - the fact that food trends and eating habits will never be the same even after COVID-19 subsides. The impact of the virus is here to change the dynamics of food for a reasonably long time to come.

There is no published literature demonstrating the effect of COVID-19 lockdown on sleep. But several newspaper surveys have reported altered sleep patterns due to lockdown[4-6] while an investigation into the effects of vacations on the health status in male white-collar workers demonstrated no improvement in sleep patterns.[7] Many studies focus on the need of maintaining physical activity during COVID-19.[8,9] Compliance of the people to such advice is not known. There is a need to collect data on physical activity status during lockdown. Several studies to assess eating habits during lockdown are being done across nations. Guidelines for healthy eating during lockdown due to COVID 19 have been issued by WHO. Several newspapers have evaluated the impact of lockdown on changing habits of eating. One area of impact is in the eating and drinking habits people are adopting while staying at home as people deal with anxiety, restrictions on movement and profound changes to their routines.[10] But there is no published literature in this regard, particularly in India or Nagpur region.

Generally, humans require 21 days to acquire a new habit. People have been put in lockdown for more than 21 days by the Indian government. While you are locked inside your home, it is the best time to reflect on your lifestyle and start eating mindfully. The data on the effect of lock down on physical activity, sleep and dietary habits is crucial to identify the health effects and to formulate the strategies established for preventing these derangements. Therefore, we planned the study to assess the effect of lockdown on physical activity, sleep and eating habits among adults in Nagpur, Maharashtra, India.

Subjects and Methods

A cross-sectional study was conducted among volunteers above 18 years residing in Nagpur district. However, volunteers from other areas were free to participate. The study was conducted after approval from the Institutional Ethics Committee following the Declaration of Helsinki guidelines. The sample size was estimated to be 465. Estimated sample size for a two-sample paired-proportions test was calculated using Stata v13.0, by large-sample McNemar's test (Ho: p+1 = p1+ versus Ha: p+1! = p1+) assuming an α error of 5%, power of 80%, delta = 0.0500 (difference baseline), p1+ = 0.5500, p+1 = 0.6000, corr = 0.7000, power of study 80%, prevalence of physical inactivity to be 55% [11] and assuming a 5% increase in prevalence during the lockdown.

In order to assess change in behavioural lifestyles during and before lockdown, a web-based pre-tested structed questionnaire was prepared using Google forms. The form included an informed consent and the participants were free to withdraw from the study at any point of time. The weblink for the online form was disseminated through social media sites including Facebook, Whatsapp, Telegram and Twitter. The link for the form was also advertised in local newspaper. The investigators of the study also disseminated it to their contacts. The study period was from 5th June to 25th June 2020.

The participants were questioned about their behavior during and before lockdown in a self-reported retrospective pre-post online survey form. The survey form included sociodemographic parameters, physical activity levels, sleep habits, food frequency questionnaire for selected food groups and alcohol intake. The respondents were asked if they were working in essential services during lockdown. We hypothesize that behavioral changes may be less pronounced in those who were working during lockdown as compared to those who were not working. The compliance to lockdown norms were assessed only among those who were not involved in essential services. The compliance was assessed in a Likert scale with the common stem "I stayed at home" and the responses -all the time(most compliant), more than the usual time that I spent before lockdown, more than the usual time that I spent before lockdown, I stayed at home only when it is necessary (least compliant).

The sociodemographic data including age, gender, highest completed education level, occupation, total monthly family income and place of residence was collected from the participants. The total monthly family income was categorized based on the Kuppuswamy socioeconomic scale adjusted for the Consumer Price Index of March 2020. In addition to the above information, the total number of family members in the household during lockdown was also noted.

Physical Activity was assessed using the Global Physical Activity questionnaire (GPAQ) before and during lockdown. This questionnaire collects information on moderate and vigorous intensity physical activity (PA) in three domains of activity *viz.* at work, during travel and recreational activity. It also collects information during inactivity i.e. sedentary behavior. The physical activity questionnaire was perceived to be lengthy during the pre-test. The questions for the three domains were combined into a single question for each level of intensity. The duration of physical activity each week was then converted into MET (Metabolic equivalent) minutes per week stratified by type of activity total weekly MET minutes. Physical inactivity was defined as <600 MET minutes per week.

Sleep habits were assessed using Pittsburgh Sleep Quality Index (PSQI) before and during lockdown. PSQI is a validated tool to measure the quality and patterns of sleep.[12] This questionnaire assesses the quality of sleep in 7 components that produce total PSQI score. Few components were selected from PSQI to reduce the lengthy nature of the questionnaire

and are presented separately. The total PSQI score could not be assessed.

Frequency of various food group consumption was assessed using Frequency Food Questionnaire (FFQ).[13] FFQ gives the frequency of food type consumption over a week before and during lockdown. Food groups that were assessed included green leafy vegetables, fruits, eggs, other non-veg food (like meat and seafood), baked foods and fried foods. Alcohol intake was also assessed using a frequency scale.

Statistical Analysis

Data was exported from the web platform and analyzed using SPSS v 24.0. The categorical variables like presence of Physical Inactivity, Poor quality sleep etc were summarized as proportions. Most of the quantitative parameters followed a non-normal distribution. The quantitative variables like per capita income, total MET minutes etc., were summarized either Median (IQR). The difference in the parameters during and before lockdown were assessed. The difference between quantitative parameters like MET minutes, PSQI score etc., were assessed using Wilcoxon Signed-rank test. The difference in paired proportions for parameters like presence of physical inactivity and poor sleep quality were assessed using McNemar's test. Alternatively, a binomial test of proportion was also used for difference in proportion.

The sample was divided into two sub-groups based on whether the participants were working in essential services during lockdown or not. Sub-group analysis was also performed based on district of residence–Nagpur/Other districts.

Results

A total of 586 responses were received using the web-based structured self-reported questionnaire. The sociodemographic profile of the sample is presented in Table 1.

In the study sample, three-fifths of the respondents (60%; N =351) were in the age group of 18 to 40 years. A slight majority of responses were received from men (55.8%; N = 327) compared to women. More than four-fifths of the respondents were residing in urban areas (86.5%; N= 507) and more than three-fourths were from Nagpur (76.3%; N=447). The educational level of the respondents in this study was higher, with more than four-fifths completing graduation (81.9%; N=474). Similar pattern was observed with occupation and income. The proportion with a high monthly family income (31000 or above) was to the tune of 67.6% (N=396). On an average, each household had four members.

The self-reported compliance to lockdown measures was analysed among 457 (78%) respondents who were not working as a part of essential services during lockdown. More than three-fourths (75.3%) claimed they spent either most of the time or all the time at home during the lockdown period.

Physical Activity

Of the 586 responses, 23 (3.9%) were excluded due to extreme values either in vigorous and moderate physical activity. The results are presented in Table 2. The remaining responses (N=563) also showed higher values, especially related to vigorous physical activity showing limited understanding among respondents. The change in physical activity habits were measured. There was a significant decline in involvement in vigorous physical activity during lockdown period. But there was only a slight increase in moderate activity during lockdown.

The physical activity levels of the respondents were converted into Metabolic equivalent (MET minutes). The difference in self-reported physical activity levels was

Table 1: Sociodemographic profile of the study population (N= 586)

Sociodemographic Characteristic	*Categories*	*N (%)*
Age group	18-30 years	226 (38.6)
	31-40 years	125 (21.3)
	41-50 years	103 (17.6)
	51-60 years	98 (16.7)
	> 60 years	34 (5.8)
Gender	Female	257 (43.9)
	Male	327 (55.8)
	Transgender	2 (0.3)
Type of Residential area	Rural	79 (13.5)
	Urban	507 (86.5)
Place of Residence	Nagpur	447 (76.3)
	Others	139 (23.7)
Education	Primary School	1 (0.2)
	High School	10 (1.7)
	Higher Secondary	101 (17.2)
	Graduate	190 (32.4)
	Postgraduate	284 (48.5)
	Professional	281 (48.0)
Occupation	Semi-Professional	24 (4.1)
	Skilled worker	12 (2.0)
	Semi-skilled worker	6 (1.0)
	Unskilled worker	10 (1.7)
	Healthcare worker	99 (16.9)
	Currently unemployed	127 (21.7)
	Homemaker/Housewife	27 (4.6)
Income groups*	<3130	16 (2.7)
	3131-9299	24 (4.1)
	9300-15499	56 (9.6)
	15500-23249	37 (6.3)
	23250-30499	57 (9.7)
	31000-61999	109 (18.6)
	>62000	287 (49.0)
Total Family members	Median (IQR)	4 (3-5)

*Based on Kuppuswamy classification adjusted for the CPI of Nagpur for March 2020

assessed (Table 2). When analyzed among all respondents, there was no statistically significant change in MET minutes, for total Physical activity and different intensity levels of physical activity during lockdown. In the sub-group analysis, there was significant difference in MET minutes for vigorous and total physical activity among those that were not working in essential services during lockdown.

The proportion of respondents with physical inactivity before and during lockdown was assessed (Table 3). The prevalence of physical inactivity increased from 47.6% to 51.3% during the lockdown. The change among respondents was assessed as matched pair analysis. The level of physical activity reduced from adequate to inadequate during lockdown for 27 participants represented as negative change (red colour). And for 10 of the participants, there was improvement from inadequate to adequate physical activity during lockdown indicate as positive change (green colour). The positive change was 63% less likely compared to that of negative change (OR (95%CI) – 0.37 (0.18 -0.74)). Overall, the net change was reduction in prevalence of adequate physical activity.

In the sub-group analysis significant difference was observed only among the respondents who were not working during lockdown.

Sleep Pattern

Sleep quality was assessed for all respondents before and during lockdown (Table 4). Two-fifths of the respondents (40.3%; N=236) rated their sleep quality as good or excellent during lockdown. But on the other hand, two-fifths of the respondents (41.8%; N=245) reported they had problem to keep up enthusiasm during this period.

The duration of sleep in hours increased during the lockdown. Though the duration of sleep (median (IQR)) was similar both before (7 (6 - 8)) and during lockdown (7 (6-8)), there was a significant difference in the mean rank ($p < 0.001$; Wilcoxon -Signed Rank test). In the sub-group analysis, the difference in duration was statistically significant only among those who were not working during lockdown.

Sleep latency increased during the lockdown period.

Table 2: Physical activity levels and Sleep duration compared before and during lockdown with subgroup analysis

Sample	*Type of Physical Activity*	*Before Lockdown N (%) Median (IQR)*	*During Lockdown N (%) Median (IQR)*	*p-value**
Involvement In Physical Activity (N = 563)	Vigorous Physical Activity**	146 (25.9)	120 (21.3)	0.07†
	Moderate Physical Activity[$]	293 (52.0)	305 (54.2)	0.45†
All Respondents	Vigorous (N = 93)	2880 (1920 -4320)	2460 (1440- 4320)	0.05
	Moderate (N =221)	1440 (840 – 2880)	1440 (720 – 2880)	0.69
MET minutes	Total (N=251)	2400 (1200 -5085)	2130 (900-4320)	0.11
Respondents working in essential services during lockdown	Vigorous (N=26)	2880 (2160 – 4560)	3360 (2280 – 4320)	0.64
	Moderate (N= 58)	1500 (960 – 3360)	1800 (945-3360)	0.43
MET minutes	Total (N = 61)	2940 (1395-5731.5)	2880 (1350-6240)	0.43
Sample not working in essential services during lockdown	Vigorous (N=67)	2880 (1440-4320)	2400 (1440 – 4320)	**0.04**
	Moderate (N = 163)	1440 (720 – 2522.33)	1260 (720 – 2520)	0.89
MET minutes	Total (N = 190)	2360 (1200 -5040)	1800 (840 – 3600)	**0.03**
Sleep Duration	Hours of sleep	7 (6 – 8)	7 (6-8)	**<0.001**

*Wilcoxon-Signed Rank test
†Test of proportions
** A total of 95 respondents reported involvement in vigorous PA both before and during lockdown
[$]A total of 221 respondents reported involvement in moderate PA both before and during lockdown

Table 3: Matched pair analysis of adequate physical activity and sleep latency before and during lockdown among the participants

		Physical activity During lockdown		*OR (CI)*	*p-value**
Inadequate		*Adequate*			
Physical activity before lockdown (N = 251 pairs)	Inadequate	9	10	0.37 (0.18 -0.74)	0.008
	Adequate**	27	205		
		Sleep Latency During Lockdown			
≤ 30 min		31 min and above			
Sleep Latency Before Lockdown (N= 586 pairs)	≤ 30 min	390	112	9.33 (5.73 - 15.19)	< 0.001
	31 min and above	12	72		

*McNemar test
** Physical activity ≥ 600 Metabolic equivalent minutes per week

The proportion with sleep latency of more than 60 minutes was higher during lockdown (9.2%) when compared to before lockdown (2.9%). The duration of sleep latency was recategorized for matched pair analysis (Table 3). Sleep latency increased during lockdown for 112 of the respondents represented as a negative change (red). It showed a decrease only for 12 of the respondents. The increase in sleep latency was at least 9 (OR (95%CI) = 9.33 (5.73 - 15.19)) times more likely during lockdown compared to a reduction in the same. The resultant overall change was an increase in sleep latency during lockdown ($p < 0.001$). The sub-group analysis showed no change in strength or direction of results for both the sub-groups.

Nutrition and Alcohol Use

The change in intake of specific food groups during lockdown is represented in Table 5. Though the median frequency is similar for some of the food groups, there was a significant difference in Mean rank (presented as separate column) observed on Wilcoxon-Signed rank test. There was a significant increase in frequency intake of Green leafy vegetables, fresh fruits and fried foods during lockdown. But there was a significant decline in intake of eggs and non-vegetarian foods during lockdown. There was an increase in intake of baked food items but not amounting to statistical significance.

Among the 586 respondents, 451 (77%) did not report alcohol use before and during lockdown. Among those who reported alcohol use (N=135), close to two-fifths (38%; N = 52) abstained from alcohol use during lockdown. A small proportion (6.7%; N=9) initiated alcohol use during lockdown.

The frequency of alcohol intake was compared for those who reported alcohol use before and during lockdown (54.8%; N= 74). The frequency of alcohol intake significantly increased during lockdown. The median frequency of intake (IQR) per week was higher during lockdown (Median (IQR) = 3 (1-5)) when compared to before lockdown (Median (IQR) = 1 (1-3)) ($p < 0.001$; Wilcoxon -Signed rank test).

Table 4: Self-reported Sleep Quality among respondents during lockdown

Sleep quality related Query	*Qualifier*	*N (%)*
Rate your sleep quality during lockdown as compared to before	Very Bad	31 (5.3)
	Bad	90 (15.4)
	No change	229 (39.1)
	Good	175 (29.9)
	Excellent	61 (10.4)
Problem to keep up Enthusiasm during lockdown compared to before	A very big problem	50 (8.5)
	Somewhat of a problem	195 (33.3)
	No change	149 (25.4)
	Only a very slight problem	128 (21.8)
	No problem at all	64 (10.9)

Discussion

A research study was conducted to assess the change in physical activity, sleep and dietary patterns during the nation-wide lockdown in Nagpur. A structured self-reported retrospective pre-post questionnaire was disseminated using google forms.

There was increase in physical inactivity among the participants. The change from physically inactive status to a physically active status was 63% less likely than the other way around. It was even more pronounced in those who were not working in essential services.

The changes in sleep pattern during lockdown were complex. There was an increase in sleep duration and perceived sleep quality during lockdown. But on the other hand, the sleep latency increased and there was a reduced enthusiasm during the day. The increase in sleep latency was observed irrespective of their involvement in employed work during lockdown.

The intake of Green leafy vegetables, fresh fruits and fried foods increased but there was a decline in intake of eggs and non-vegetarian during lockdown in terms of frequency. Among alcohol users, there was an increase in frequency of intake during lockdown.

Physical Activity

The physical activity in terms of MET minutes did not significantly change for participants in the study. Among the participants who were not involved in essential services during lockdown, there was a significant decline in total MET minutes specifically in vigorous intensity. There

Table 5: Comparison of weekly intake frequency of selected food groups before and during lockdown (N= 586)

	Before Lockdown Frequency of intake per week Median (IQR)	*During Lockdown Frequency of intake per week Median (IQR)*	*Overall Decline or Increase***	*P-value**
Green Leafy Veg	3 (2 – 5)	3 (2-5)	Increase	0.005
Fresh fruits	4 (2 – 6)	4 (3-7)	Increase	<0.001
Eggs	1 (0 – 3)	1 (0 -3)	Decline	0.001
Non-Veg	1 (0 – 2)	0 (0-1)	Decline	<0.001
Baked foods	2 (1 – 3)	2 (0-4)	Increase	0.131
Fried foods	2 (1 – 3)	2 (1 -4)	Increase	0.001

*Wilcoxon-Signed Rank test
**Based on Mean Ranks

were limited studies available for comparison. A study in France and Switzerland by Cheval *et al.*[14] among general population reported an average decline in physical activity by 15 min/day during lockdown. The study collected data using International Physical activity questionnaire at two time points – one at the beginning of lockdown and the other two weeks apart. A study conducted in Haryana[15] among physiotherapy students/professionals also reported a large decline in MET minutes. The study used IPAQ– SF questionnaire and was done in a relatively smaller sample (N=143). The self-reported median weekly MET minutes were much lower in the present study compared to other studies (7809.7 min/week). This difference could be attributed either to a change in assessment tool or to a significant overreporting among the physiotherapists.

In the present study the physical inactivity, defined as less than 600 MET minutes/week increased from 47.6% to 51.3% during lockdown. A multi-centric study by Ruiz-Roso et al16among adolescents in five countries showed a similar increase in prevalence of physical inactivity from 73% to 79.5% during lockdown. Ruiz-Roso *et al.*[16] used IPAQ and defined physical inactivity as less than 300 minutes/week of physical activity in multiple domains. The difference in baseline levels of physical inactivity in these studies could be due to difference in the study tool and definition.

The present study demonstrated that the Vigorous-intensity physical activity declined significantly during the lockdown while there was a slight increase in moderate-intensity physical activity. The study by Chavel et al14 also reported similar changes in France and Switzerland.

This short-term reduction in physical activity may result in deleterious health effects. Studies show that reduction from the recommended physical activity to a low level, even for short periods of 3 to 14 days could lead to increased intraabdominal and ectopic fat deposition and even hyperinsulinaemia.[17] Physical activity reduces stress and improves mental health.[18] Its positive impact on immune system might be of greater significance in the context of the current pandemic.[19]

Sleep Quality

A substantial proportion of respondents (41.8%) reported they had problem to keep up enthusiasm during lockdown. But on the other hand, two-fifths of them rated their sleep quality as good or excellent during this period. Studies in other countries reported increase in sleep disturbances during this period.[20,21] A study in Italy reported prevalence of sleep disturbances as high as 42%. [21] The apparent perceived better quality or no change in sleep quality during lockdown could be attributed to the increase in sleep duration among the participants.The sleep duration increased during lockdown, more so among those who were not working in emergency services. Another web-based survey in India reported similar increase in sleep duration.[22]

Sleep latency increased during the lockdown period. The odds of increase in sleep latency was 9 times more during the lockdown.Marelli *et al.*[20] assessed sleep quality before and during lockdown among students and administrative workers in Italy using PSQI. In the present study, increase in sleep latency was observed in both the subgroups, irrespective of whether they were working in emergency services. Marelli et al also reported that poor-quality sleep (PSQI score≥ 5) increased both among students and workers. However, it was more pronounced in the students' group.

Poor sleep quality could be due to fear and anxiety imposed by the pandemic or to a change in lifestyle during lockdown. Poor sleep quality could in turn adversely affect mental health.[23] When coupled with the mental health impact[21] of the pandemic, the consequences could be severe.

Nutrition

In the present study an increase in frequency was observed for green leafy vegetables, fresh fruits and fried foods. It is in contrast to studies in other countries where a majority consume animal meat. Similarity can be observed in terms of increased intake in fried foods. Studies conducted in European countries in general reported an increase in intake of unhealthy foods including snack items like biscuits and sweets during COVID-19 lockdown.[24-27] A cohort study in France reported an increased intake of packed/canned food items and a decrease in freshfruits/ vegetables.[26] A study among users of a health application in the US reported high intake of red meat and starchy vegetable consumption.[27] The increase in intake of packed foods/snacks during lockdown probably reflects the purchasing pattern of the society amidst lockdown. The restrictions imposed could have resulted in panic buying, ultimately resulting in consumption of packed food items.

The intake of eggs and non-vegetarian foods decreased during lockdown in the current study. In India, non-vegetarian items are perceived as 'hot foods' and are believed to increase the chances of infection.

Owing to the ban on alcohol during lockdown, there were several reports of alcohol withdrawal.[28] But in our study population, alcohol intake increased among the users, despite the ban. Similar observations were reported in other countries.[24,29] The rise in alcohol use could be due to panic induced by the pandemic. Leisure time is known to increase alcohol intake. Lockdown may have led to a perception of prolonged leisure resulting in increased alcohol use.

To the best of our knowledge, there are very few studies that tried to evaluate multiple behavioral patterns during lockdown. The use of a web-based self-reported questionnaire could have eliminated interviewer bias. The length of the questionnaire was shortened to reduce respondent fatigue and non-response. Data collection was initiated within two weeks after the end of lockdown to reduce recall bias.

Since the study used web-based platform, there could have been a sampling bias in the study. Most of the respondents had graduate level education and belonged to higher income groups. The study results could be generalized

to a similar population group.

The study tools were modified to reduce the number of items in the questionnaire. This could have affected the validity of responses among the participants. The use of a retrospective pre-post questionnaire and matched analysis could have partly overcome the problem.

The nation-wide lockdown had both positive and negative impacts on the present study population, belonging to higher social strata in Central India. In terms of positive impact, there was an increase in intake of fresh fruits/green leafy vegetables and no significant change in physical activity, in terms of MET-minutes. The negative impact of lockdown included increase in sleep latency, increase in prevalence of physical inactivity, decline in vigorous-intensity activity, and an increase in intake of fried foods. There was dietary preference towards vegetarian foods and a reduction in intake of egg and non-vegetarian food items. In summary, lockdown adversely impacted physical activity and sleep habits while its effect on dietary pattern was equivocal. In hindsight, evidence-based health advice on behavioural modifications through official channels could have been prioritized during this period.

Social restrictions like lockdown can have significant behavioural changes. Whether these changes tend to be short-term or permanent needs to be explored. The long-term effects of these behavioural changes even in short-term needs further study. Will such drastic efforts taken to control one health outcome have multiple collateral effects on health of the population? – is a question for future evaluation.

Conclusion

Social restrictions imposed by the lockdown increased the levels of physical inactivity and duration of sleep latency in Central India. Leafy vegetables and fresh fruits were preferred over non-vegetarian foods. Fried and baked foods were increasingly consumed. The short-term and long-term impact of these changes need to be further explored.

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