

Original Research Article

Impact of COVID-19 pandemic restrictions on the lifestyle of people in India and its public health concern: an online survey using mHealth

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ABSTRACT

Background: The SARS-CoV-2 virus with the emergence of new highly transmissible variants at sporadic intervals has brought unparalleled damage to global health not only by its direct effect on mortality but also through its impact on lifestyle diseases. This study aimed to understand the lifestyle changes that have occurred among people across India during the period of nationwide lockdown.

Methods: The present cross-sectional study was conducted among a large cross-section of people across India (n=1559) with mHealth technology using research electronic data capture (Redcap) platform. The online tool was pre-tested and validated and was disseminated through an easily accessible online social media platform. The online survey form was incorporated with a participant information sheet, an informed consent/assent form with an electronic signature capture method.

Results: Among the 1559 participants, 292 (18.72%) were of age less than 25 years, 724 (46.4%) were of age between 25 to 39 years, 384 (24.63%) were 40-54 years of age and 159 (10.19%) were of 55 years and above. The study results showed a significant change in weight across different age groups (p=0.041) and gender (p<0.001) during the lockdown period. The sleep pattern was affected during the lockdown period across different age groups (p=0.021) and gender (p=0.021). The level of physical activity has increased across different age groups (p=0.008) and gender (p=0.002) as compared to pre-lock down. A significant increase in the utilization of mobile (p=0.028) and television (p<0.001) was seen and is found to be more in males as compared to females.

Conclusions: The findings from this study clearly suggest that comprehensive health recommendations focussing on healthy lifestyle and individual wellbeing need to be implemented along with careful continuous monitoring at the grass-roots level to mitigate the negative impact of continuing pandemic restrictions and possible future lockdowns.

Keywords: COVID-19 lockdown, Electronic data management, Lifestyle changes, Public health, India

INTRODUCTION

The SARS-CoV-2 virus with the emergence of new highly transmissible variants at sporadic intervals has brought unparalleled damage to global health not only by its

direct effect on mortality but also through its impact on lifestyle diseases.^{1,2} The COVID-19 pandemic is associated with non-communicable diseases at multiple levels, from enhancing the susceptibility to lifestyle diseases owing to poor management of the behavioral risk

factors during the period of pandemic restrictions to premature deaths due to acute cardiac injury during infection.^{2,3} Also, during an emergency like a pandemic, stressful situations resulting from the imposed restrictions and the resultant economic insecurities, degradation of living conditions and interruption of medical care could directly compromise the health of elderly or people living with non-communicable diseases.⁴ Altogether, the impact of the COVID-19 pandemic on public health is beyond that of a contagious disease and requires a renewed sense of focus revisiting the strategies to adopt adequate and appropriate measures to prevent the dual burden of diseases.

During the nationwide lockdown in India, the government enforced strict guidelines to control the spread of COVID-19 and allowed the functioning of limited essential services with restricted movement of people.⁵ Along with the preventive strategies for COVID-19 control, guidelines and recommendations were put forward by health professionals and authorities to maintain healthy lifestyle measures like staying active amid social isolations, sufficient sleep and an increase in fruit and vegetable intake.⁶ As the global attention was towards the mitigation and containment of the pandemic, the national-level policies were implemented with an intention of delaying the surge. This in turn overshadowed the burden of non-communicable diseases existing in the country and the preventative strategies that should have been implemented without losing the focus on a healthy lifestyle were overlooked. At this juncture, it was pertinent to understand the lifestyle changes that have occurred among people across India during the period of nationwide lockdown which could attribute to the non-communicable disease burden of the country, to enable policy recommendations in the future.

METHODS

In India, a nationwide complete lockdown extended over a period of more than two months from 25 March 2020, till 31 May 2020.^{7,8} The study was conducted from June to July 2020, during the initial phase of unlocking, to capture the impact of the lockdown on the lifestyle of the people. With the continuing restrictions and local lockdown on containment areas, conducting a face-to-face interview was impractical. The possibility of the electronic data capture (EDC) method utilizing mHealth was explored and the survey form along with the consent form was developed using Redcap platform.⁹ The online tool was pre-tested and validated and was disseminated through an easily accessible online social media platform. The online survey form was incorporated with a participant information sheet, an informed consent/assent form with an electronic signature capture method. Once the respondent consent to participate in the survey, they were directed to the online questionnaire with questions related to daily routine activities and the most common factors affecting their lifestyle. These included dietary habits, sleeping patterns, use of electronic devices and

physical activities. The questions were framed to get the combined answers, before and during the lockdown period, specifically to capture the changes in lifestyle due to the pandemic restrictions. The survey data was transferred and stored in a real-time mode in a server installed centrally at the institute.

The present cross-sectional study was conducted targeting people above 12 years of age living in India who have access to smartphones. A web link of the survey questionnaire including the participant information sheet and consent form was circulated through social media. No pre-fixed sample size was calculated and it was planned to consider all the responses with less than 10% missing values obtained in a span of ten days (24 June 2020 to 3 July 2020) for data analysis.

The data analysis was performed using STATA version 15.0. The categorical variables were expressed in proportion. Pearson's Chi square test was used to test the differences in lifestyle changes across different age groups and between gender.

Ethical considerations

Both the institutional ethics committees approved the study (Ref. No: NIE/IHEC/202005-01 dated 23 June 2020 and PHB/NIMR/EC/2020/152 dated 25 June 2020) of ICMR-NIE and ICMR-NIMR respectively. The survey was initiated after obtaining proper online informed consent from all the respondents. Participants were informed about their willingness to participate voluntarily and were also given clear information regarding the risks and benefits of their participation.

RESULTS

A total of 1985 participants, across the country, participated in the survey in a span of ten days and out of them, 1559 responses with less than 10% missing values were considered for analysis. Tables 1 and 2 represent the distribution of changes in lifestyle characteristics during the lockdown period compared to the pre-lockdown period, across different age groups and between different gender respectively.

Lifestyle changes among the young individuals (12-24 years)

Among the 1559 study participants, 292 (18.72%) were of age less than 25 years. Among the 292 young individuals, nearly half of the participants reported having a change in main course mealtime, with 150 (51.2%), 142 (48.8%) and 113 (38.7%) of participants reporting a change in breakfast, lunch and dinner time respectively. Also, 26 (8.9%), 6 (2.1%) and 5 (1.7%) of them had skipped their breakfast, lunch and dinner respectively during the lockdown period. An altered sleep pattern was reported among the young participants with 181 (62%) participants reporting a late bedtime by 2 hours or more.

An increase in fruit and vegetable intake was seen among respectively. Also, 117 (40.2%) young study participants have reported an increase in food intake and 120 (41.2%) reported an increase in weight. Among the reported participants, 59 (23.8%) has mentioned an increase in consumption of snacks. Three-fourth of the young 218 (76.2%) spent additional hours on mobile and 121 (48.2%) spent more hours watching television programs during lockdown compared to pre lockdown period.

Lifestyle changes among middle-aged individuals (25 to 54 years)

Among the study participants, 724 (46.4%) were of age between 25 to 39 years, 384 (24.6%) were 40-54 years of

142 (48.6%) and 147 (50.5%) young study participants age comprising the largest proportion of study participants. Among the 1108 middle age group participants, 656 (59.2%) reported a change in food intake, with 379 (34.2%) having an increased food intake. Nearly half of the middle-aged participants (515-587) reported a change in timing of all the three main course meals. A change in sleep pattern and timing of bedtime was reported by more than 50% with 654 (59.4%) reporting a late bedtime. An increase in fruits, vegetables and dairy products was reported by 468 (42.2%), 552 (49.8%) and 327 (29.5%) respectively. However, an increase in junk food consumption was reported by 233 (21%) participants and 361 (32.5%) had reported an increase in weight during the lockdown period.

Table 1: Age-wise distribution of change in lifestyle characteristics.

Variables	<25 (years)	25-39 (years)	40-54 (years)	≥55 (years)	P value
	N (%)	N (%)	N (%)	N (%)	
Morning wake up time					
Changes	179 (61.3)	384 (53.0)	203 (52.9)	75 (47.2)	0.021*
No changes	113 (38.7)	340 (47.0)	181 (47.1)	84 (52.8)	
Breakfast					
Changes	150 (51.2)	329 (45.3)	186 (48.2)	68 (43)	0.205
No changes	117 (39.9)	346 (47.7)	173 (44.8)	82 (51.9)	
Skipped	26 (8.9)	51 (7)	27 (7)	8 (5.1)	
Lunch					
Changes	142 (48.8)	355 (49.1)	187 (48.4)	67 (42.4)	0.419
No changes	143 (49.1)	344 (47.6)	182 (47.2)	87 (55.1)	
Skipped	6 (2.1)	24 (3.3)	17 (4.4)	4 (2.5)	
Dinner					
Changes	113 (38.7)	153 (24.9)	143 (37.1)	55 (34.8)	<0.001**
No changes	174 (59.6)	444 (72.2)	239 (62.1)	97 (61.4)	
Skipped	5 (1.7)	18 (2.9)	3 (0.8)	6 (3.8)	
Night bed time					
Changes	181 (62)	429 (59.3)	225 (58.3)	83 (52.5)	0.271
No changes	111 (38)	294 (40.7)	161 (41.7)	75 (47.5)	
Food intake					
Decreased	56 (19.2)	160 (22.1)	67 (17.5)	30 (19.1)	0.052
Increased	117 (40.2)	253 (35)	126 (32.9)	46 (29.3)	
No changes	118 (40.5)	310 (42.9)	190 (49.6)	81 (51.6)	
Vegetable intake					
Decreased	26 (8.9)	68 (9.4)	36 (9.4)	14 (9)	0.999
Increased	147 (50.5)	362 (50.1)	190 (49.5)	77 (49.4)	
No changes	118 (40.5)	293 (40.5)	158 (41.1)	65 (41.7)	
Dairy product intake					
Decreased	38 (14)	107 (15.6)	41 (11.1)	25 (16.3)	0.013*
Increased	88 (32.4)	202 (29.4)	125 (33.9)	28 (18.3)	
No changes	146 (53.7)	377 (55)	203 (55)	100 (65.4)	
Snacks intake					
Decreased	128 (51.6)	293 (66.8)	134 (44.1)	54 (43.2)	0.224
Increased	59 (23.8)	149 (25.3)	84 (27.6)	28 (22.4)	
No changes	61 (24.6)	146 (24.8)	86 (28.3)	43 (34.4)	
Outdoor food order					
Decreased	87 (40.3)	230 (42.3)	101 (38.4)	41 (38.3)	0.362
Increased	8 (3.7)	20 (3.7)	15 (5.7)	4 (3.7)	

Continued.

Variables	<25 (years)	25-39 (years)	40-54 (years)	≥55 (years)	P value
No changes	25 (11.6)	62 (11.4)	35 (13.3)	22 (20.6)	
Temporarily stopped	96 (44.4)	232 (42.6)	112 (42.6)	40 (37.4)	
Sea food/meat take					
Decreased	85 (34.7)	236 (39.7)	117 (39.5)	39 (34.2)	0.358
Increased	30 (12.2)	98 (16.5)	48 (16.2)	14 (12.3)	
No changes	80 (32.7)	162 (27.3)	80 (27)	36 (31.6)	
Stopped time being	28 (11.4)	63 (10.6)	33 (11.1)	19 (16.7)	
Unavailable	22 (9)	35 (5.9)	18 (6.1)	6 (5.3)	
Fruits intake					
Decreased	42 (14.4)	146 (20.3)	66 (17.1)	32 (20.3)	0.198
Increased	142 (48.6)	294 (40.8)	174 (45.2)	63 (39.9)	
No changes	108 (37)	280 (38.9)	145 (37.7)	63 (39.9)	
Weight change					
Gained	120 (41.2)	246 (34)	115 (29.9)	45 (28.5)	0.041*
Lost	46 (15.8)	132 (18.3)	65 (16.9)	31 (19.6)	
No changes	125 (43)	345 (47.7)	205 (53.2)	82 (51.9)	
Mobile usage					
Changes	218 (76.2)	535 (74.1)	272 (71.4)	107 (68.2)	0.23
No changes	68 (23.8)	187 (25.9)	109 (28.6)	50 (5015.7)	
Watching TV					
Changes	130 (51.8)	336 (52.7)	174 (50.9)	66 (46.5)	0.595
No changes	121 (48.2)	301 (82)	168 (49.1)	76 (53.5)	
Physical activity					
Yes	157 (53.8)	378 (52.2)	206 (53.8)	106 (67.1)	0.008*
No	135 (46.2)	346 (47.8)	177 (46.2)	52 (32.9)	
Stepped out of house					
Yes	229 (78.7)	615 (85.1)	328 (85)	126 (81.3)	0.062
No	62 (21.3)	108 (14.9)	58 (15)	29 (18.7)	
Personal visit to doctor					
Yes	59 (20.3)	141 (19.6)	64 (16.7)	30 (19.2)	0.62
No	232 (79.7)	579 (80.4)	319 (83.3)	126 (80.8)	
Teleconsultation with doctor					
Yes	53 (18.5)	130 (18.2)	66 (17.3)	24 (15.3)	0.823
No	233 (81.5)	585 (81.8)	315 (82.7)	133 (84.7)	

*Significant at 5% level ($p < 0.05$), **0.1% level ($p < 0.001$).

Table 2: Distribution of changes in lifestyle characteristics of the participants.

Variables	Male (%)	Female (%)	Total (%)	P value
	N (%)	N (%)	N (%)	
Morning wake up time				
Changes	377 (50.9)	464 (56.7)	841 (53.9)	0.021*
No changes	364 (49.1)	354 (43.3)	718 (46.1)	
Breakfast				
Changes	323 (43.5)	410 (49.9)	733 (46.9)	0.001**
No changes	377 (50.8)	341 (41.5)	718 (45.9)	
Skipped	42 (5.7)	70 (8.5)	112 (7.2)	
Lunch				
Changes	348 (46.8)	403 (49.4)	751 (48.2)	0.500
No changes	372 (50.1)	384 (47.1)	756 (48.5)	
Skipped	23 (3.1)	28 (3.4)	51 (3.3)	
Dinner				
Changes	273 (36.9)	300 (36.6)	573 (36.8)	0.178
No changes	457 (61.8)	497 (60.7)	954 (61.2)	
Skipped	10 (1.4)	22 (2.7)	32 (2.1)	

Continued.

Variables	Male (%)	Female (%)	Total (%)	P value
Night bed time				
Changes	441 (59.5)	477 (58.3)	918 (58.9)	0.630
No changes	300 (40.5)	341 (41.7)	641 (41.1)	
Food intake				
Decreased	147 (19.9)	166 (20.3)	313 (20.1)	0.373
Increased	246 (33.3)	296 (36.3)	542 (34.9)	
No changes	345 (46.7)	354 (43.4)	699 (45)	
Vegetable intake				
Decreased	68 (9.2)	76 (9.3)	144 (9.3)	0.794
Increased	363 (49.1)	413 (50.7)	776 (49.9)	
No changes	308 (41.7)	326 (40)	634 (40.8)	
Dairy products intake				
Decreased	105 (14.8)	106 (13.7)	211 (14.3)	0.843
Increased	211 (29.8)	232 (30.1)	443 (29.9)	
No changes	393 (55.4)	433 (56.2)	826 (55.8)	
Snacks intake				
Decreased	276 (46.1)	333 (50)	609 (48.1)	0.188
Increased	150 (25)	170 (25.5)	320 (25.3)	
No changes	173 (28.9)	163 (24.5)	336 (26.6)	
Outdoor food order				
Decreased	218 (40.2)	241 (41)	459 (40.6)	0.007*
Increased	32 (5.9)	15 (2.6)	47 (4.2)	
No changes	78 (14.4)	66 (11.2)	144 (12.7)	
Temporarily Stopped	214 (39.5)	266 (45.2)	480 (42.5)	
Sea food/meat take				
Decreased	218 (37.6)	259 (38.7)	477 (38.2)	0.879
Increased	90 (15.5)	100 (14.9)	190 (15.2)	
No changes	165 (28.4)	193 (28.8)	358 (28.7)	
Stopped time being	65 (11.2)	78 (11.7)	143 (11.4)	
Unavailable	42 (7.2)	39 (5.8)	81 (6.5)	
Fruits intake				
Decreased	137 (18.6)	149 (18.2)	286 (18.4)	0.973
Increased	317 (43)	356 (43.5)	673 (43.3)	
No changes	283 (38.4)	313 (38.3)	596 (38.3)	
Weight change				
Gained	215 (29.2)	311 (37.9)	526 (33.8)	<0.001***
Lost	134 (18.2)	140 (17.1)	274 (17.6)	
No changes	387 (52.6)	370 (45.1)	757 (48.6)	
Mobile usage				
Changes	558 (75.8)	574 (70.9)	1132 (73.2)	0.028*
No changes	178 (24.2)	236 (29.1)	414 (26.8)	
Watching TV				
Changes	371 (56)	335 (47.2)	706 (51.5)	0.001***
No changes	291 (44)	375 (52.8)	666 (48.5)	
Physical activity				
Yes	433 (58.5)	414 (50.7)	847 (54.4)	0.002**
No	307 (41.5)	403 (49.3)	710 (45.6)	
Stepped out of house				
Yes	692 (93.6)	606 (74.3)	1298 (83.5)	<0.001***
No	47 (6.4)	210 (25.7)	257 (16.5)	
Personal visit to doctor				
Yes	143 (19.4)	151 (18.6)	294 (19)	0.677
No	594 (80.6)	662 (81.4)	1256 (81)	
Teleconsultation with doctor				
Yes	112 (15.3)	161 (19.9)	273 (17.7)	0.019*
No	618 (84.7)	648 (80.1)	1266 (82.3)	

*Significant at 5% level (p<0.05), **0.5% level (p<0.005), ***0.1% level (p<0.001).

An increase in the utilization of gadgets and watching television was found in 807 (72.8%) and 510 (46%) of participants respectively. Along with this, a lack of physical activity was reported by 523 (47.2%) of middle age study participants. Also, more than 80% (898 to 900) of the participants reported that during the entire period of lockdown they have neither consulted a doctor directly nor through teleconsultation.

Lifestyle changes among individuals with more than or equal to 55 years of age

Among the study participants, 159 (10.19%) were of 55 years and above. Among the elderly, 76 (47.8%) of the participants reported having a change in food intake during the lockdown period with 46 (28.9%) reporting an increased intake. Though an increase in fruits and vegetable intake was reported by 63 (39.9%) and 77 (49.4%) of individuals respectively, apprehensively the consumption of snacks has also increased among 28 (22.4%) of them. More than 40% of the elderly participants have reported a change in the timing of the main course meal with nearly 4% (4-8 participants) reporting skipping of main course meals during the lockdown. However, a higher proportion of the elder age group did more physical activities, 106 (67.1%) compared to other age groups. Also, the change in watching television and mobile usage was comparatively less among this age group to other groups. Nevertheless, more than 80% of the participants neither visited any medical professionals 126 (80.8%) nor consulted by telecommunication methods 133 (84.7%) throughout the lockdown period. Among the elderly participants, 126 (81.3%) reported stepping out during the lockdown for household purchase, despite their vulnerability to COVID-19.

Lifestyle changes between genders

Among the 1559 participants, 741 (47.5%) were males, 818 (52.5%) were females. An overall increase in food intake was seen in both groups, however, it was more among females as reported by 296 (36.3%) of female participants. Among the participants, 311 (37.9%) females and 215 (29.2%) males reported an increase in weight and this was found to be statistically significant across the groups ($p < 0.001$).

Results indicated a significant difference ($p < 0.001$) in the breakfast time between both groups. A higher proportion of females with 410 (49.9%) participants reported late-breakfast habits than males with 323 (43.5%) of its participants and a total of 112 (7.2%) of the participants developed a habit of skipping their breakfast during the lockdown period. Also, a delay in lunch and dinner time was reported among both the genders which were slightly higher in number among females. Among the study population, 847 (54.4%) of the participants did physical activities like walking, jogging and running. The proportion disinterested in any physical activities during

the lockdown was comparatively higher among females, as reported by 403 (49.3%) than 307 (41.5%) males and was found to be statistically significant ($p < 0.005$).

In relation to electronic device utilization and screen time, a significant difference in watching television and mobile usage ($p < 0.05$) was obtained between the groups. The additional hour spent on television and mobile was higher (371 (56.0%) and 558 (75.8%), respectively) among males.

DISCUSSION

This population-based study conducted using mHealth had not only tried to cover a large cross-section of the people across India but also a varied number of factors associated with lifestyle diseases unlike previous studies published in this area.¹⁰⁻¹² The results of this study highlighted a substantial change in the lifestyle of people across India during the period of nationwide lockdown which was a matter of concern to public health. During the lockdown, the restrictions and the resultant social isolation had drastically affected the sleep pattern and timing of main course food intake among the study population. Late breakfast, increased food intake and skipping of meals at times among study participants reveal emotional instability. Dysfunctional eating habits were related to stress and negative emotions which in turn could be due to the lower quality of life and individual well-being during the pandemic restrictions.^{13,14} The binge eating and emotional eating could directly affect the weight of an individual and more than half of the study participants have reported a change in their weight during the nationwide lockdown period with more participants reported having a weight gain in such a short period thereby increasing the susceptibility to obesity and metabolic disorders.^{14,15} This was a worrisome trend considering the ongoing pandemic with new more transmissible variants and the fact that overweight and obesity were risk factors for severe COVID-19 infection and hospitalization.^{16,17}

On the other hand, nearly half of the study population had tried to change their lifestyle into a healthier one by increasing fruits and vegetable intake and reducing the consumption of junk foods. In addition to this, half of the population had attempted to stay physically active during the time of social isolation and this was more among the aged participants (≥ 55 years). Factors such as lack of socializing, preference of home-cooked food in fear of infection due to contact, the influence of media to stay active, the belief that staying active and healthy could prevent the contraction of infection could have contributed to this positive change.^{10,18,19} However, the frequency of the activity was not known and also the sustainability of such a behavioral change needed to be explored as non-adherence to the recommended and positive lifestyle remained a frequent obstacle in the control of the non-communicable disease.²⁰

The social isolation due to the pandemic has enhanced the dependency on digital technology to remain socially connected and become active. In an era of digital infodemic, spending more time with electronic gadgets could not only increase the level of anxiety but also the sedentary habits.^{21,22} Among our study population, nearly 75% of the participants had reported an increase in gadget usage during the lockdown period. This was another alarming finding as this might have contributed to the altered sleep pattern seen among one in every two participants of the study. The disruption in the sleep-wake cycle and lowered sleep quality consequently could impact well-being and mental health.²¹

The findings of this study also showcased that a higher proportion of the older adults who were considered vulnerable to severe COVID-19 infection had stepped out of the home during the period of lockdown for purchases, against the guidelines to stay-at-home and reverse quarantining of elderly.²³ This sort of action from a group of people who find it difficult to confine to their limited space and thereby willingly put themselves at the edge of danger for contracting infection highlights the necessity of actions promoting their activity and psychological well-being at home during pandemic restrictions.^{24,25} Also, a significant proportion of elderly participants have neither sought any medical help directly nor through telemedicine services and this was quite alarming considering the burden of non-communicable disease of the country. The postponement of the medical appointment and thereby the lack of monitoring will result in non-adherence to medication and loss of follow up further worsening the chronic conditions. All these factors, from the adoption of unhealthy lifestyle behavior to the disruption of NCD care during pandemic restrictions could lead to increase in morbidity and avoidable mortality with time.²⁶

As the pandemic continued to extend and with the emergence of new variants like omicron the number of cases had been increasing in several parts of the nation with impending lockdown, this study which had been done on a sufficiently large number of people across the country on a critical period provided an opportunity to amend the guidelines and to make appropriate decisions from a public health perspective focussing on the importance of healthier lifestyle during pandemic restrictions.

Limitations

The web survey was designed to be accessed on smart devices and hence only those with the knowledge to operate smart devices and those who possessed it could undertake the study. The survey format was presented only in English, considering that most would be familiar with the simple language questionnaires. Hence, the questionnaire was limited to those who could read and understand the language.

CONCLUSION

The lockdown has caused striking lifestyle changes for the people in India. Even though the restrictions are much needed to prevent the spread of infection, the findings from this study clearly suggest that comprehensive health recommendations focussing on individual wellbeing need to be implemented along with careful continuous monitoring at the grass-root level to mitigate the negative impact of possible future lockdowns. Future studies are mandated to explore the long-term consequences of the behavioral changes adopted during the lockdown on the burden of non-communicable disease in the nation.

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