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Impact of COVID-19 outbreak on lifestyle behaviour: A review of studies published in India

Dimple Rawat ^a, Vivek Dixit ^{b, *}, Sarthak Gulati ^c, Shreya Gulati ^d, Arti Gulati ^a^a Clinical Epidemiology Unit, All India Institute of Medical Sciences, New Delhi, India^b Department of Orthopedics, All India Institute of Medical Sciences, New Delhi, India^c Department of Orthopedics, J.J.M Medical College, Davanagere, Karnataka, India^d Dr. Ram Manohar Lohia Hospital, New Delhi, India

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ABSTRACT

Background and aims: The entire globe is undergoing an unprecedented challenge of COVID-19 which has affected the lifestyle behaviour of individuals. The present review is an attempt to summarize the effect of pandemic COVID-19 on lifestyle behaviour among the Indian population.

Methods: A review was carried out to summarize the effect of pandemic COVID-19 on lifestyle behaviour focusing on changes in dietary or eating behaviour, stress, sleep pattern, and level of physical activity among the Indian population. Literature searches were conducted in PubMed and Google Scholar from inception till October 2020 to identify all relevant studies.

Results: A total of 11 studies (n = 5957, age group 18–70 years, comprising both genders) consisting of 1 hospital and 10 community based, were included in the present review. A change in lifestyle behaviour was observed due to COVID-19. Psychosocial or any kind of mental stress among the participants was found to be prevalent. Weight gain and decline in physical activity were also observed. Not only sleep quantity but sleep quality was also found to be affected due to COVID-19.

Conclusion: The present review indicates the need for lifestyle behaviour programmes via using the platform of E-media and also for the dissemination of health education.

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1. Introduction

Coronavirus disease (COVID-19), which originated in the Wuhan province of China, was declared as a global pandemic by the World Health Organization (W.H.O) on March 11, 2020 [1]. Since then it has spread beyond borders and affected the lifestyle behaviour of people.

This pandemic not only adversely affected the physical health of individuals, but also brought forth significant changes in their lifestyle. India has a widely recognized health care delivery system but due to the lack of organized infrastructure, there is a growing sense of crisis, as the majority (66.53%) of its population reside in rural areas which are plagued with wide discrepancies related to the delivery of health care needs [2]. Needless to say, this pandemic has magnified this dearth by diverting its focus on specific medical

conditions, neglecting other issues related to lifestyle behaviour.

Due to this crisis (COVID-19) paralleled with the growing number of cases, there was an immediate spike in the need for several preventive and protective tools namely N-95 masks, personal protective equipment (PPE kits), ventilators, thermo-regulators, oximeters, etc., and as a result of which, the majority of the existing health care facilities/centres were either turned into dedicated COVID-19 centres or existing health resources were shifted to COVID-19 management. Health and wellbeing are the priorities of any nation, therefore India went through perhaps the strictest lockdown in 5 phases following partial-unlock down along with recommendations like restrictions on freedom of movement, social and physical distancing, self-isolation, and quarantine measures, etc., to curb down the disease spread.

Whilst the entire nation is gradually progressing through the process of gradual 'unlocking', along with the prevailing state of confinement side by side, there is a need of the hour to assess the impact of COVID-19 on changes in lifestyle behaviour among individuals. Arguably all these prevailing restrictions might have had bearing on the eating or dietary habits, sleep status, physical

* Corresponding author. Scientist, Department of Orthopedics, AIIMS, New Delhi, India.

E-mail address: vivek_sgpqi@yahoo.com (V. Dixit).

activity, and mental stress, culminating in worsening of both the physical and mental health among the rank and file.

2. Methodology

Search strategy: A comprehensive literature search using the keywords (COVID-19) OR (pandemic) OR (lifestyle) AND (diet) AND (stress) AND (physical activity) AND (Sleep) of articles published on PubMed and Google scholar was conducted from inception till October 2020. A selective filtration strategy was applied for articles published only in the English language and studies that were conducted on the Indian population were included for the review.

Data extraction was done by two independent investigators using the search keywords and according to the inclusion and exclusion criteria of the review. Discussions were made to solve the discrepancies among the investigators until a consensus was made. For all included articles key findings such as data for author, year, sample size, study period, study design, and summary were extracted.

Studies were included if they fulfilled the following inclusion and exclusion criteria.

2.1. Inclusion criteria

- a. Studies conducted on the Indian population.
- b. Studies reporting any of the lifestyle changes, dietary changes, any kind of mental stress, sleeping pattern, and physical activity level during the COVID-19 crisis.

2.2. Exclusion criteria

- a. Studies other than the English language

Ethical approval: The present review was based on secondary data; hence institutional review board approval was not required.

3. Results

A total of 205 articles from the electronic database and 49 articles via manual searches from the reference list of included studies were achieved. Upon removal of duplicates, from the screened articles, we shortlisted 228 articles. Titles and abstracts of those 228 articles were screened resulting in a yield of 89 relevant articles. Full text for all these 89 relevant articles was downloaded and was further assessed for eligibility. Out of 89 articles, 72 were excluded due to various reasons including insufficient data availability, a study conducted among the non-Indian population, studies having different objectives, or not meeting the inclusion-exclusion criteria. Hence, in the present review finally, a total of 11 articles were included (Fig. 1).

3.1. Study characteristics

Fig. 1 represents the steps taken for literature search. A total of 11 cross-sectional studies (10 community based [3,4,6–13] and 01 hospital based [5]), conducted among the Indian population, with a varying sample size from 110 to 1026 subjects, conducted between the duration of March 29, 2020, to August 30, 2020, were included.

Out of all 11 articles (N = 5957, age group 18–70 years, comprising males and females) included in the present review 9 [3–11], 8 [3,5–12] and 6 [3,5,7–9,11] articles were stressed studying about eating or dietary behaviour, sleep and physical activity or exercise status respectively. Whereas, psychosocial or any kind of mental stress was found common among all 11 articles [3–13]

(Table 1).

3.2. Dietary and eating behaviour

A mixed result was observed among all the surveys conducted. However, in general, an overall change in eating and dietary habits than usual was observed in terms of overeating. Snacking and meal frequency was found to be increased [5,6,8,9]. An increased intake of fruits, herbal tonics, vitamins [4], consumption of ginger, garlic along with multivitamins [6] among the participants due to their perceivable immune-boosting effect was observed. Consumption of hydroxychloroquine as prophylaxis by the participants was also observed [10]. Improvements in healthy eating like consumption of vegetables [5,8], fruits [5,8,9], drop-down in unhealthy snacking were also observed [5,8]. Whereas, Dey S et al., [7] reported that more than half of the participants were eating unhealthily (Table 2).

3.3. Physical activity

The level of physical activity and exercise duration [3,5,8,9,11] was found to be reduced and an increase in weight gain [3,7,9] among the participants was observed (Table 3).

3.4. Psychosocial or mental stress

Out of 11 studies included in the present review, the prevalence of any kind of mental stress particularly the level of anxiety was found to be at the highest. In one study conducted by Sankar P et al. [5], it was observed that the majority of the participants with increased mental stress were following an unhealthy dietary pattern (p = 0.002). Roy D. et al. [12], reported 36.4% of participants were distressed due to social media and more than 80% of participants felt the need for their mental wellbeing and counseling. Chakraborty K et al. [10], observed that 71.8% and 24.7% were more afraid and depressed, which had affected (64.9%) their mental level status to some extent respectively. However, only 2.2% took psychiatry help and 2% of those were started on anti-depressant or anti-anxiety drugs [10] (Table 4).

3.5. Sleep

Sleep was found to be affected in most of the studies. Importantly, not only sleeping hours [6,8,9,11] but the quality [3,7,8,10,12] was also observed to be affected (Table 5).

4. Discussion

To our knowledge, this is the first review of its kind from the Indian population summarising the key findings of the cross-sectional surveys and attempted to highlight the changes in lifestyle behaviour due to the COVID-19 pandemic.

Among all Asian countries, India has the largest number of confirmed cases of COVID-19 till November 07, 2020. The nation is already fighting its battle with the deadly figures of non-communicable diseases (NCDs), and unfortunately at the same time, this pandemic has hit India's door, which is a matter of concern. As it is uncertain whether the change in lifestyle behaviour aroused due to COVID-19 would continue throughout the pandemic and post-pandemic, it is of paramount importance that we should continuously monitor for changes inflicted upon Indian citizens to fathom its long-lasting impact on lifestyle behaviours for the required steps to mitigate its burden.

This ongoing pandemic brought out the role of a balanced diet for building up a strong immune system as strengthening the immune system is not an overnight process [14]. Misra A., et al.,

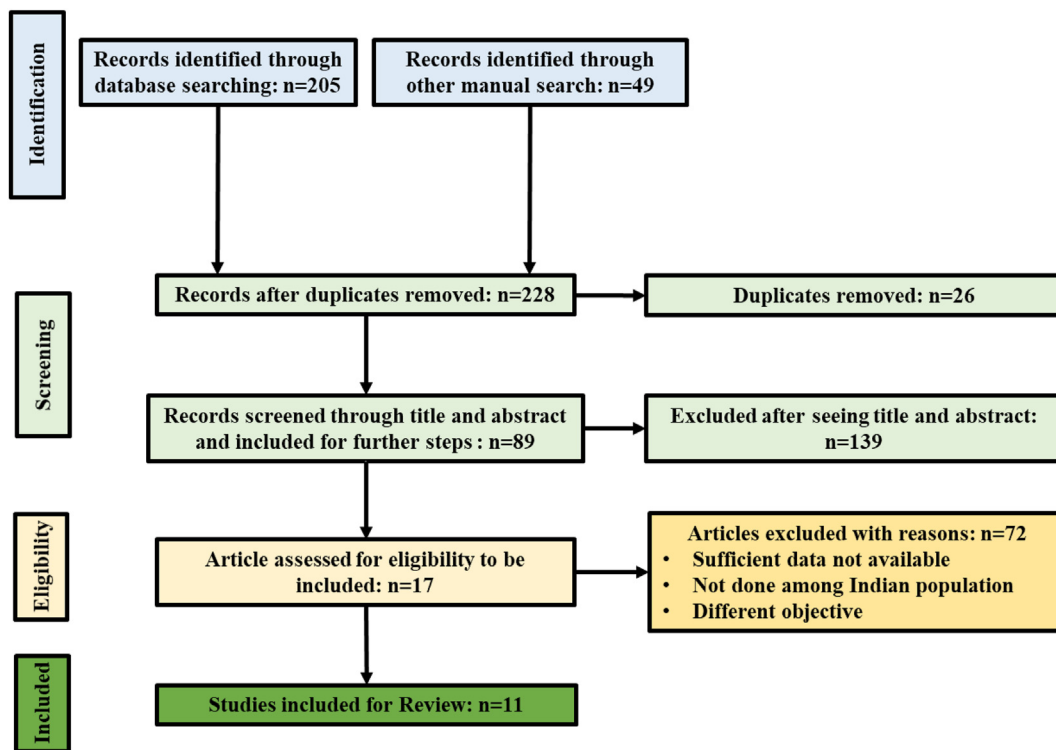


Fig. 1. Study flow diagram for study selection required for the review of the literature.

Table 1

A summary of 10 selected articles included in the review and the studied lifestyle behaviour.

S. No.	Author and Year	Sample Size	Study design	Study Period	Diet	Physical Activity	Stress	Sleep	Type of study
	Nair DR et al., 2020 [3]	263	Cross-sectional (Online Survey)	April 30, 2020, to May 12, 2020	✓	✓	✓	✓	C
	Paul G et al., 2020 [4]	1026	Cross-sectional, observational study (Online Survey)	The first week of May	✓		✓		C
	Sankar P et al., 2020 [5]	110	Cross-sectional, observational study (Direct Interview)	May 2020 (third week) to June 2020 (third week)	✓	✓	✓	✓	H
	Basu S et al., 2020 [6]	1011	Cross-sectional (Online survey)	–	✓		✓	✓	C
	Dey S et al., 2020 [7]	234	Descriptive, observational, cross-sectional study	Last week of May	✓	✓	✓	✓	C
	Chopra S et al., 2020 [8]	995	Cross-sectional (web-based survey)	August 15, 2020, to August 30, 2020	✓	✓	✓	✓	C
	Ghosh et al., 2020 [9]	150	Cross-sectional (Telephonically interviewed)	May 10, 2020, to May 16, 2020	✓	✓	✓	✓	C
	Chakraborty K et al., 2020 [10]	507	Cross-sectional	March 29, 2020 to March 31, 2020	✓		✓	✓	C
	Kumar M et al., 2020 [11]	749	Cross-sectional, observational study (Online Survey)	April 5, 2020, to April 7, 2020	✓	✓	✓	✓	C
	Roy D et al., 2020 [12]	662	Cross-sectional, observational study (Online Survey)	March 22, 2020 to March 24, 2020			✓	✓	C
	Singh S et al., 2020 [13]	250	Cross-sectional	March 29, 2020, to April 14, 2020			✓		C

H-Hospital based, C- Community based.

correctly pointed out the “call for action” to disseminate the knowledge regarding healthy dietary and eating practices [15]. Another article published by Jayawardena R and Misra A [16] highlighted the role of a balanced diet for COVID-19 prevention. The finding highlighted the importance of maintaining an appropriate lifestyle-during the ongoing pandemic COVID-19 by virtue of regular physical activity/exercise with consumption of a balanced diet.

In the present review, the role of Indian ancient herbal products by Ministry of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) like consumption of chyavanpras, herbal tea/decoction (kadha), basil (tulsi), cinnamon (dalchini), black

pepper (kali mirch), dry ginger (shunthi), raisins (munakka), natural sugar (jaggery), fresh lemon, golden milk made from turmeric and milk has been highlighted during this ongoing pandemic. An increase in consumption of fruits was also noticed [4,5,8,9]. Basu S et al. [6], reported consumption of ginger and garlic by 35% of the participants as an immunity booster. The ministry has also recommended the maximum consumption of lukewarm water and steam inhalation from time to time during the day, as a prophylactic measure.

COVID-19, by overburdening our health care system, might cause a major setback on our way towards completing predesigned targets like an-achievement of Sustainable Development Goals 2

Table 2

Key points summarising changes in dietary and eating behaviour.

S. No.	Author and Year	Diet
	Nair DR et al., 2020 [3] Paul G et al., 2020 [4]	Among all 17.9% increased their food consumption, and 8.3% ate lesser than earlier <ul style="list-style-type: none"> Increased consumption of fruit was observed among 52% of general public participants and 61% of health care workers, to boost immunity Increased intake of vitamins, herbal tonics, and people turning to be vegan was also observed to boost immunity.
	Sankar P et al., 2020 [5]	<ul style="list-style-type: none"> Unhealthy dietary pattern was observed among younger patients compared to older patients ($p = 0.001$) Increased consumption of vegetables, fruits by 80.9%, 42.7%, and a decrease in unhealthy snacking by 63% were observed respectively. Increased consumption of snacks, fried or processed foods among 24.5% were reported. 11.8% had a change in meal timings
	Basu S et al., 2020 [6]	<ul style="list-style-type: none"> A drop in intake of fast food and meat products by 60% and 34% was observed respectively. Meal frequency increased by 24% Consumption of ginger and garlic (35%) followed by multivitamins (15%) was observed.
	Dey S et al., 2020 [7] Chopra S et al., 2020 [8]	Among all 54.3% were eating unhealthily. <ul style="list-style-type: none"> Routine consumption of meals at regular intervals increased by 7.2% during COVID-19 ($P < 0.001$). Significant improvement in healthy eating like fruits and vegetable intake, consumption of pulses, egg, meat and a balanced diet ($P < 0.05$) was observed. Consumption of fast food (17.5%), fried food (18.3%), junk food (14.4%) was reduced. Intake of unhealthy food items (fast food, fried food, junk food, sugar sweetened beverages) significantly declined ($P < 0.001$).
	Ghosh et al., 2020 [9]	<ul style="list-style-type: none"> 44% were eating less than before CHO consumption increased by 21% Fat consumption increased by 13% Frequency of snacking increased by 23% Consumption of fruits increased by 27% Disruption of meal timings (55%) Increased consumption of sugar among 7%
	Chakraborty K et al., 2020 [10] Kumar M et al., 2020 [11]	<ul style="list-style-type: none"> Hydroxychloroquine consumption was observed among 19%. Consumption of drugs without doctor's advice was observed among 10.8%. A change in eating habits among 75% was observed due to changed lifestyle.

Table 3

Key points summarising the level of physical activity.

S. No.	Author and Year	Physical Activity
	Nair DR et al., 2020 [3] Sankar P et al., 2020 [5] Dey S et al., 2020 [7] Chopra S et al., 2020 [8] Ghosh et al., 2020 [9] Kumar M et al., 2020 [11]	<ul style="list-style-type: none"> 58.6% did little or no exercise 31.2% experienced weight gain Reduced physical activity levels were noticed among 12.5%, 31.3%, and 56.3% with age above 65 years, 50–65 years, and those with less than 50 years respectively ($p = 0.017$). Rapid weight gain was observed in 16.7% Participation in moderate intensity aerobic exercises declined (38.5% vs 50.5%) significantly ($P < 0.05$). <ul style="list-style-type: none"> Exercise duration reduced by 42% Weight gain occurred by 19% The habit of physical exercise was found to be affected (22%) due to a change in daily routine.

Table 4

Key points summarising any kind of psychosocial or mental stress.

S. No.	Author and Year	Stress
	Nair DR et al., 2020 [3] Paul G et al., 2020 [4] Sankar P et al., 2020 [5] Basu S et al., 2020 [6] Dey S et al., 2020 [7] Chopra S et al., 2020 [8] Ghosh et al., 2020 [9] Chakraborty K et al., 2020 [10] Kumar M et al., 2020 [11] Roy D et al., 2020 [12] Singh S et al., 2020 [13]	<ul style="list-style-type: none"> 39.5% reported moderate to severe stress Anxiety was experienced by 36.1% while 7.2% felt sad Hopelessness and suicidality were felt by 1.6% of the population High anxiety levels with fear of contracting infection were observed as the most common cause of stress among the respondents. <ul style="list-style-type: none"> Increased mental stress was seen in 15.5% Unhealthy dietary habits were observed among those with mental stress and poor sleep ($p = 0.002$). 34% of participants reported intermediate anxiety levels. Higher anxiety levels were observed in females (89%) than males (77%) Participants were anxious due to career (46.6%), family and own health (50), about nothing doing useful (37.2%). Overall stress amongst participants increased by 3.5% ($p < 0.001$). Mental stress of any kind was reported in 87% <ul style="list-style-type: none"> Worriedness and depression were observed among 71.8% and 24.7% of the respondents respectively. COVID-19 affected the mental status of 64.9% of all the respondents to some extent. Only 2.2% of the respondents took psychiatry help and 2% started anti-anxiety or antidepressant drugs. 52% of the participants felt socially isolated due to the restrictions of the pandemic. <ul style="list-style-type: none"> 36.4% were distressed due to social media More than 80% felt need of help for their mental well being 46.4% of the participants were stressed

Table 5
Key points summarising sleep status.

S. No.	Author and Year	Sleep
	Nair DR et al., 2020 [3]	18.2% were dissatisfied or very dissatisfied with sleep
	Sankar P et al., 2020 [5]	Quality of sleep was worse in 23.6%,
	Basu S et al., 2020 [6]	<ul style="list-style-type: none"> • 44% of the respondents reported that their sleeping time during the pre-lockdown phase was majorly focused between 11 p.m. and 1 a.m., and this proportion attenuated to 37% post lockdown. • 32% of the respondents were sleeping between 9 p.m. and 11 p.m. before lockdown which decreased to 20% post lockdown. • 21% of the respondents were sleeping between 1 a.m. and 3 a.m. before lockdown which increased to 25% post lockdown. • Surprisingly, an increase from 3% to 17% was noted for those who were sleeping after 3 a.m..
	Dey S et al., 2020 [7]	Deranged sleep pattern, insomnia (38.5%), or sleepiness (31.2%), was found to be the commonest problem
	Chopra S et al., 2020 [8]	<ul style="list-style-type: none"> • Daily sleeping hours ($P < 0.001$) significantly increased. • Sleep duration of >8 h was observed among 17.6% however sleep quality declined among 4.1% of the total respondents.
	Ghosh et al., 2020 [9]	<ul style="list-style-type: none"> • A decrease in sleep in 27% • Increase in sleep in 16%
	Chakraborty K et al., 2020 [10]	<ul style="list-style-type: none"> • Disturbed sleep-awake cycle was noticed among 33.1%. • 4.5% were taking sleeping pills.
	Kumar M et al., 2020 [11]	<ul style="list-style-type: none"> • Sleep awake time changed (after 8 a.m.) from 12% to 42% of total respondents since lockdown. • Only 6% of respondents got up at 5 a.m. since lockdown compared to 19% before lockdown routine.
	Roy D et al., 2020 [12]	12.5% people reported sleeping difficulties due to pandemic.

(SDG2) of eradicating hunger and malnutrition by 2030 and to reduce malnutrition by 2022 in India by the National Nutrition Mission (NNM).

Prevalence of any kind of stress was reported to be higher (3–11,13) almost in all the surveys included in the review. The role of the cortisol hormone is well known both for stress and glycemic control. When an individual is under stress and stimulates insulin release to maintain blood glucose levels in the “fight-or-flight” response and thus, an increase in appetite occurs. Stress, induces the wrong (unhealthy) choices of food which may be one of the factors contributing to the onset of NCDs’.

Weight gain was observed in studies due to change in lifestyle because of the ongoing pandemic [3,7,9]. India is already witnessing the burden of obesity and many other NCDs particularly diabetes, heart disease (CVD), and cancer, therefore the importance of being physically active and healthy should not be overlooked during this period provided it is carried out in isolation. In India Yoga & pranayama are another ancient way of healing, which includes specific techniques such as asana (postures), breathing exercises, chants, and meditation to attain the highest level of consciousness and overall wellbeing. It not only encourages the integration of body and mind but also reduces stress.

Over the last two decades of sleep, deprivation has become one of the public health concerns. A cross-sectional study suggested that high body mass index (BMI) and stress are predictors for sleep deprivation which further leads to a vicious cycle of poor health [17].

In all the surveys included in the present review, a negative change in the sleeping pattern was observed, which is a matter of concern. Sleep is the most important pillar for a healthy life and the lack of sleep may impair body functions badly, hence as recommended by the National sleep foundation, 7–9 h of sleep by adults (18–64 years) should be considered [18]. Not only quantity but the quality of sleep is equally important for healthy wellbeing.

A survey conducted by ‘Fitbit’ (playstore application) revealed that Indians are the second most-sleep deprived after Japanese [19] and it is a well-known fact that deprivation of sleep is not only a risk factor for a compromised immune response but also makes an individual more prone to infections [20]. Moreover, it is not limited up to this but may also affect satiety via altering appetite-regulating hormones and may also lead to the development of NCDs.

The World Health Organization defines health as “complete well-being in terms of physical, mental, and social, and not merely the absence of disease” therefore, conduction of continuous

lifestyle behaviour programs via electronic media like television, radio, etc., for improving dietary and eating behaviour, mental health status, fighting with depression and anxiety, maintaining sleep pattern and quality, should be done.

5. Conclusion

COVID-19 has led the world to its knees. Meanwhile, the entire world is struggling to discontinue the chain reaction of COVID-19, and also to optimize its growing burden, it is imperative to keep balance in our lifestyle and behaviour. There is a dire need for monitoring and counseling for the public, during the crisis. There is an intense need for an authenticated single health program platform for the dissemination of correct and appropriate knowledge and to create awareness among the general public.

Limitations

There were some limitations of this review, including the non availability of studies with larger sample size and due to self reporting there may be a possibility of reporting bias. Moreover, the findings of this study can not be generalized as majority of the population do not have access to internet facility.

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None.

Ethical approval

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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