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Home gardens moderate the relationship between Covid-19-induced stay-at-home orders and mental distress: a case study with urban residents of India

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Abstract

With the increasing spread of the Covid-19 pandemic, restrictions on public life were strengthened across the world. Non-pharmaceutical interventions like stay-at-home orders, cancellations of events, work from home, etc. are the first line of defence to combat the spread of highly transmittable infections like Covid-19. But these interventions create whole new situations that urban residents need to cope with, which often creates mental distress. Home gardens, due to their therapeutic benefits, can help individuals to relax and unwind, thus reduce mental distress. Hence, the present study attempts to investigate whether home gardens moderate the effects on mental distress from confinement at homes due to the enforcement of stay-at-home orders. Samples (N = 408) were collected through an online question survey with urban residents across different parts of India. Moderation analysis reported the significant effect of home gardens in lowering mental distress. Further analysis with time spent in home gardens revealed that with increasing time spent from less than 10 min to more than 2 h, an individual score of stress and anxiety, and overall Depression, Anxiety and Stress Scale (DASS) scores had significantly decreased. These findings illustrate the beneficial properties of nature-based solutions, home gardens in this case, in improving mental health, even during the difficult times of the Covid-19 pandemic. Our results suggest the necessity of scaling up these nature-based solutions in urban planning processes to make the residents healthy and resilient.

1. Introduction

The novel Coronavirus (Covid-19) pandemic has put the world’s population in an unprecedented situation. Initially identified as a cluster of unidentified pneumonia cases in Wuhan, China at the end of December 2019, the World Health Organization (WHO) declared it as a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, and just over one month, Covid-19 was declared as Pandemic on March 11, 2020. To date (September 22nd, 2020) Covid-19 has infected over 32 million people and over 980,000 deaths across 213 countries/territories. Though pandemics are not new, Covid-19 is unique due to the extent, magnitude, and rapidity of its spread. In addition to the direct health impacts, there are enormous ‘collateral damages’ caused by the responses to combat the pandemic like the closure of schools, workplaces, public and private entertainment spaces like parks, cinemas, and theatres, restaurants, shopping malls, etc, restricted socialization and restrictions on travel. One of the most critical ‘collateral damage’ is the impact on the mental health of not only the health and frontline workers but also for the vulnerable population like elderly people and individuals suffering from chronic illness and the general population who must undergo significant changes in their lifestyle to cope with
the ‘new normal’. Mental health impacts of COVID-19 have already gained widespread attention in the academic arena with experts highlighting the urgency and need for proper intervention measures (Holmes et al 2020, Torales et al 2020, Tull et al 2020, Wang et al 2020). In addition, dense urban areas, both megapolises and secondary cities, are found to be infection hotspots (World Bank Group 2020).

Social distancing has been a common and effective public health response to curb the transmission of outbreaks (Kelso et al 2009, Ahmed et al 2018). Social distancing interventions include restricted public gatherings, maintaining at least 6 feet of distance between people, closure of nonessential businesses, teleworking, distance learning, non-essential outings, and stay-at-home orders. These non-pharmaceutical interventions (NPIs) play a significant role in maintaining physical health, but the negative impacts of NPIs have also become a matter of concern. Previous studies on the impacts of quarantine due to SARS, Ebola, or H1N1 influenza reported socio-economic distress due to economic loss as well as psychological impacts including emotional disturbance, irritability, anxiety, stress, insomnia, depression, low mood, and emotional exhaustion (Reynolds et al 2008, Wang et al 2011, Pellechcia et al 2015). Initial studies on the impact of Covid-19 on the public also report widespread psychological distress including anxiety, loneliness, depression, and financial concerns (Tull et al 2020, Wang et al 2020). The threat of losing jobs, financial worries, work from home pressures, physical and social distancing created loneliness among individuals which also contributes to mental distress (Ozamiz-Etxebarria et al 2020, Tull et al 2020).

As both the long-term and short-term mental health impacts due to Covid-19 become evident, it is necessary to investigate the various NPIs to improve mental health. Physical exercise, maintaining a healthy diet and sleep routine, and avoiding excessive media coverage of Covid-19 are highlighted to be a few such NPIs that can contribute to improving mental health during and after the pandemic (Jiménez-Pavón et al 2020). Previous studies on mental health emphasized the importance of access to green space in relieving stress and anxiety, and uplifting mood and positive thoughts (Gascon et al 2018, Fouso et al 2020). However, depending on the situation of the pandemic in different countries, different levels of lockdown are enforced and access to outer green spaces like parks, playgrounds or community grounds has been moderately or strictly restricted (Fouso et al 2020). Exposure to nature helps in developing psychological health and enhances overall well-being (Barton and Pretty 2010, White et al 2019). The immediate greenness around a home is also reported to improve human health and a home garden provides this greenness and appears to also be beneficial (De Vries et al 2003). There is increasing evidence that horticultural therapy including gardening, provides substantial human health benefits like reductions in depression, anxiety, and body mass index, as well as increases in life satisfaction, quality of life, and sense of community (Soga et al 2017). Availability of home gardens provides an opportunity to relax and unwind with access to sunshine and fresh air which has several reported health benefits including sleeping patterns and mood enhancement (Park et al 2009). Maas et al (2009) also reported a sense of community and social support among residents with closer accessibility of green spaces, more strongly in urban areas. Home gardens, owing to their therapeutic values like stress reduction and cognitive functioning, might prove as one of the effective natural interventions to combat psychological stress, especially when people are confined to their homes and going through a stressful time due to Covid-19. Hence, the present study attempts to investigate whether having a home garden influences the mental health of the public confined to homes due to the enforcement of stay-at-home orders during this Covid-19 period. The results of this study will make a significant contribution towards home gardens as an effective nature-based intervention to revitalize mental health. When found effective, home gardens can be included as an integral part of urban settlement planning for a healthy and sustainable future.

1.1. Home gardens as therapeutic landscapes

With the enforcement of stay-at-home orders, urban life, which otherwise used to be busy and occupied, have come to a sudden halt. Though people connect through online platforms and adjust to the ‘new normal’ conditions, the breakdown of the social system is yet to be understood and adjusted. The situation is more severe for elderly and vulnerable people who are already suffering from different comorbidities (Singh et al 2020). Mental health impacts are anticipated to be serious implications of these stay-at-home orders. Therefore, the first hypothesis to be tested is

H1: Stay-at-home orders due to Covid-19 significantly affects the mental health of the general population.

With the increasing urban population across the world, opportunities to interact with the natural environment in urban areas have become fewer. Public green spaces including parks, communally accessible green spaces, and community gardens are the most common form of urban greenspaces studied (Home and Vieli 2020, Sanchez and Liamputtong 2017). Despite covering a significant proportion of urban green spaces, home gardens received relatively insufficient attention for the benefits they provide to the urban population.

Apart from providing material and nutritional benefits to the households, home gardens produce aesthetic, spiritual, and different health benefits including physical and mental health benefits (Dunnett and Qasim 2000,
The physical exercise carried out while gardening activities like watering, weeding, pruning, etc. are valuable from the point of physical health while mental health benefits like aiding in recovery, stress reduction, and cognitive functioning are well-reported. Domestic gardens also provide opportunities for building social relationships and learning from community members (Maas et al 2009). The ‘healing’ or ‘restorative’ properties of gardens are so well-recognized that they have become an essential design component in health care facilities (Dobson 2017). Ulrich et al (2012) included ‘accessible garden to patients’ as one of the main design features for reducing stress and aggression in psychiatric facilities. Visual or physical exposure to ‘restorative’ environments like gardens in working places reportedly imbibe a positive attitude towards workplaces, increase job satisfaction and work performance, and decrease the perceived level of stress (Lottrup et al 2013).

As Covid-19 induced stay-at-home orders were enforced, frequency of visits to green spaces reduced substantially in countries like Italy and Spain, and however, it was observed that people opted for more diverse kinds of green spaces including tree-lined streets and urban gardens (Ugolini et al 2020). Home gardens, owing to their multiple benefits, easy access, and ‘restorative’ properties, can help in improving the mental health conditions during Covid-19 and beyond (Corley et al 2021). Hence, the study hypothesizes that urban households with home gardens faced comparatively lesser mental distress during the enforcement of stay-at-home orders than households with no home gardens. Though there are no official statistics available regarding the number of households with home gardens in India, single urban households or multi-storied apartments usually have balconies, terraces, front yards and/or backyards which are primarily used for urban gardening. Model 1 (figure 1) demonstrates the hypothetical framework consisting of H1 and H2.

H2: Availability of home garden moderates the relation between the number of days in stay-at-home order and mental distress.

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H2: Availability of home garden moderates the relation between the number of days in stay-at-home order and mental distress.

The composition of home gardens is a representation of cultural factors, socio-economic conditions, climatic conditions, and geographic location of a household apart from their material, nutritional, and/or spiritual needs (Dunnett and Qasim 2000, Abdoellah et al 2020). Diversity in the composition of home gardens has been reported to enhance the resilience of a household and its overall well-being (van der Stege et al 2012). In addition to composition, time spent on gardens is reported to influence emotional outcomes like anxiety, anger, sadness, contentment, etc, and other dementia-related behavior like aggression (Dunnett and Qasim 2000). Therefore, for the household with home gardens, we further hypothesize that composition and time spent working in the home gardens reduces the impact of stay-at-home orders on the mental distress of the individuals. Model 2 (figure 1) shows the hypothetical impacts of the composition of the home garden and time spent working on the home garden, on the number of days under stay-at-home orders, and mental distress.

H3a: More varied composition of home garden reduces the impact of stay-at-home order on mental distress

H3b: Higher is the time spent on working in the home garden, lower is the mental distress due to stay-at-home orders.

H3c: The interactive effect of home garden composition and time spent on working in the same reduces mental distress from stay-at-home orders.
2. Research methodology

2.1. Site selection
In India, the first case of Covid-19 was reported on 29th January 2020 in the state of Kerala. However, the sparkled increase in infections started from the 1st week of March 2020 after which India faced an exponential increase in the number of Covid-19 infections. To combat the spread of infections, the Indian Government issued a stay-at-home order on March 24, 2020, and called for a nationwide lockdown for 21 days. In response to increasing infections, the second phase of lockdown was announced on April 14, 2020, which extended the stay-at-home order till May 3, 2020. With some relaxations in less-infected zones of the country, nationwide lockdown continued till May 31, 2020. Alike other parts of the world, Covid-19 infections are more concentrated in the urban areas in India. Megapolises and big cities like Mumbai, Bangalore, New Delhi, Kolkata, Chennai, Pune, Indore, Jaipur, etc. record an alarming number of Covid-19 infections. The number of containment zones is also high in these urban areas where the stay-at-home orders are still enforced by the different State Governments.

2.2. Survey structure and data collection
The questionnaire survey was administered online through Survey Monkey\textsuperscript{5} for two weeks at the end of May 2020. The survey comprised 19 questions divided into three sections (Supplementary material). To collect as many responses as possible across different cities in India, the survey was administered in English. Though different languages are used across different parts of India, urban residents with internet access and using social media are presumed to be well-acquainted with English, which is also an official language of the country predominantly used for official communication. The survey link was shared on social media platforms like
Facebook groups ‘Home Garden Family’, ‘Balcony Gardening’, ‘Gardening Ideas & More’, ‘Houseplants Society of India’, etc. for wider dissemination and through WhatsApp and emails. The recipients were requested to re-forward the survey link to as many people as possible within their contacts and social networks. On receiving and clicking the link the participants got auto-directed to the information about the study and informed consent. The objectives and target respondents of the survey were made clear in the introductory information. All procedures performed in this study were in accordance with the xxx human research ethics protocol and the preamble of the survey stated the purpose of the study and that participation was confidential, and voluntary was seen by participants before them commencing the questionnaire. The study was performed following the ethical standards of the Declaration of Helsinki (World Medical Association 2013). A total of 447 responses were checked for consistency out of which 39 responses were excluded as they were missing essential information.

Finally, a total of 408 responses were used for data analysis from different cities in India. The collected responses are found to be well-distributed from different cities across India as shown in figure 2. Nearly half (46.6%) of the total sample respondents \( N = 408 \) are from nine Tier-1 cities i.e., the top metropolitan cities in India.

2.2.1. Measures

Socio-demographic characteristics like age, gender, marital status, educational level, occupation, and average household income level were included in the questionnaire. Survey participants were asked to self-report about their Covid-19 experience, more specifically on the stay-at-home order status like, ‘Since how many days have you been at home due to the stay-at-home order?’.

The first question about home gardens asked whether the respondent has any home garden in their residence \([0 = \text{no}; 1 = \text{yes}]\). If the answer is negative, the respondents were directed to the mental health sections of the question. If affirmative, the participants were asked about the time they usually spend working in their home garden i.e., their active interaction with home gardens \([1 = \text{less than 10 min}; 2 = 10 \text{ to 30 min}; 3 = 30 \text{ min to 1 h.}; 4 = 1 \text{ to 2 h.}; 5 = \text{More than 2 h.}]\). The diversity in home gardens is represented by the composition of different plant categories. The more varied the composition of home gardens is, the higher is its contribution to different ecosystem services production and human well-being (Galluzzi et al 2010). The questionnaire included a question on the composition of the home garden, like ‘what is the composition of your home garden?’.

The answer options included ornamental plants, fruits, vegetables, flowering plants, herbs and spices, and medicinal plants. The participants had the option to choose more than one answer or write any other type of plants not listed in the questionnaire. Currently mental health status was assessed using the Depression, Anxiety, and Stress Scale – 21 items (DASS-21) which measure the emotional states of depression, anxiety, and stress (Lovibond and Lovibond 1995, Zanon et al 2020). The scale assumes that depression, anxiety, and stress represent a general mental distress construct, but also have distinct characteristics. DASS-21 consists of 7 items under each of the three sub-scales and the scores are calculated by summing the scores for the relevant items. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/ involvement, anhedonia, and inertia. The anxiety scale assesses autonomic arousal, musculoskeletal effects, situational anxiety, and subjective experience of anxious affect. The stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive, and impatient (Lovibond and Lovibond 1995). DASS-21 is being frequently used to assess the psychological impacts of Covid-19 on the general and vulnerable population as well as healthcare personnel (Gorrochategi et al 2020, Tull et al 2020, Wang et al 2020).

2.3. Data analysis

IBM SPSS Statistics (V. 27.0) was used to conduct the data analyses in the present study. Independent-samples t-test was utilized to determine whether there was any statistically significant difference in DASS-21 and its subscales between two groups of respondents—with home gardens and with no home gardens. To investigate the hypothetical framework, we carried out moderation analyses using PROCESS macro (V. 3.5) by Hayes (2017) with 5000 bootstraps resamples and 95% bias-corrected confidence intervals (CIs). The socio-economic characteristics like age, gender, education level, occupation, family status, and monthly household income that may potentially confound the relation between dependent and independent variables were considered as control variables in the statistical modeling (Pourhoseingholi et al 2012). This allows to separate the moderation effect of home gardens, their composition, and time spent on the home gardens on mental distress.
Of 408 survey responses, the number of responses by male and female participants is nearly the same, 46.3% are male respondents and 53.7% are female respondents. The majority of the respondents are in the age group of 25–34 years (35.5%) and 35–44 years (30.0%). Based on the survey findings, 239 respondents mentioned that they have home gardens while 149 respondents have no home gardens. Most of the respondents with home gardens are more than 35 years old (70.3%), married with children (68.7%), and live with family (91.1%). Also, they have completed an undergraduate level of education and beyond (95%) and the household income of nearly 77% of the respondents is more than 30,000 INR (400 USD). Most of the respondents with no home gardens are found to be younger and in the age group of 18–44 years (92%). In contrary to households with home gardens, nearly 70% of the respondents with no home gardens are either unmarried or married with no children monthly household income of 95% of the respondents with no home gardens is reported to be more than 30,000 INR (400 USD). Because the focus of studied population was on urban inhabitants, the percent wise difference on educational level is not much high between households with home gardens and with no home gardens.

Table 1 shows the difference in means of the scores of individual subscales i.e., stress, anxiety, and depression, and the overall score of DASS-21 between two groups of study—home and no home garden. There is a significant difference in the mean scores of stress (t188.92 = −12.53, p < 0.05), anxiety (t188.92 = −9.96, p < 0.05) and depression (t188.92 = −29.54, p < 0.05) as well as in the mean score of DASS-21 (t188.92 = −44.53, p < 0.05) between respondents with home gardens and with no home gardens. Negative mean differences denote that the mean scores of all the subscales and DASS-21 are higher for the group of respondents with no home gardens. For individual sub-scales, 65% of the respondents are found to score normally for depression, and nearly 35% score from mild to severe depression. Most of the respondents with no home gardens are either unmarried or married with no children monthly household income of nearly 70% of the respondents with no home gardens are either unmarried or married with no children monthly household income of nearly 35% score from mild to severe depression. Most of the respondents (86.5%) are observed to experience mild to extremely severe levels of anxiety in the last one week before the day of the survey, more than half of which are having severe to extremely severe levels of anxiety. Irrespective of the home garden status, the average number of days in the home due to the stay-at-home orders is reported to be approximately 75 days at the time of the survey and 85% of the respondents are working from home during the survey period.

### 3.2. Hypothesis model testing

We examined the relations between the number of days confined in homes due to the Covid-19 induced stay-at-home orders and mental distress through multiple moderated regressions. In both Model 1 and Model 2 (figure 1), the number of days at home due to the enforcement of stay-at-home orders was considered as an independent variable and the three subscales of DASS-21 i.e., stress, anxiety, and depression as well as the overall DASS-21 score were used as predictor variables.

### 3.2.1. Moderating effect of home gardens

Model 1 tested the relation between the independent variable and predictor variables (H1) as well as the impact of the availability of home gardens (a dichotomous moderator variable) on the above relation (H2). The results for the first two hypotheses are reported in table 2. As hypothesized in H1, the number of days confined in homes due to the Covid-19 led stay-at-home orders was found to have a positive significant relation with stress ($\beta = 0.27, p < 0.001$), anxiety ($\beta = 0.18, p < 0.001$), depression ($\beta = 0.09, p < 0.001$) and overall DASS-21.
### Table 2. Testing results of the main effects and moderating effects of home garden.

| Constructs | Stress | | | Anxiety | | | | Depression | | | | DASS-21 | | |
|------------|--------|-------|-------|--------|-------|-------|-------|----------|-------|-------|-------|--------|-------|-------|
|            | $\beta$ | $t$-value | Sig | $\beta$ | $t$-value | Sig | $\beta$ | $t$-value | Sig | $\beta$ | $t$-value | Sig | $\beta$ | $t$-value | Sig |
| NDAYS      | 0.27   | 10.23 | 0.00** | 0.18   | 8.20  | 0.00** | 0.09   | 5.53  | 0.00** | 0.53   | 10.79 | 0.00** |
| HG         | −6.58  | −12.65 | 0.00** | −8.95  | −20.54 | 0.00** | −11.01 | −35.49 | 0.00** | −26.53 | −26.98 | 0.00** |
| NDAYS x HG | −0.19  | −3.19  | 0.00** | −0.06  | −1.21  | 0.23  | −0.19  | −5.35  | 0.00** | −0.43  | −3.91  | 0.00** |
| R²         | 0.43** |       |       | 0.57** |       |       | 0.78** |       |       | 0.70** |       |       |

Note: NDAYS – No. of days at home under stay-at-home orders, HG – Availability of home garden; ** Significant at p < 0.001
(β = 0.53, p < 0.001). Model 1 accounted for 70% of the variance in DASS-21 after the moderator of the availability of the home garden was included. The negative moderating effects imply that when an individual has a home garden, the positive relationship between the number of days at home due to stay-at-home orders and mental distress (except anxiety) would significantly decrease (table 2).

Number of days under stay-at-home orders predicted stress more strongly among respondents with no home gardens (β = 0.38, SE = 0.05, p < 0.001) relative to respondents with home gardens (β = 0.19, SE = 0.03, p < 0.001). Stay-at-home orders also significantly predicted depression in respondents with no home gardens (β = 0.20, SE = 0.03, p < 0.001), but no significant prediction in case of individuals with home gardens. As evident from figure 3, DASS-21 was significantly and strongly predicted by the number of days individuals are stuck in their homes due to the enforcement of stay-at-home orders among respondents with no home gardens (β = 0.80, SE = 0.09, p < 0.001) compared to individuals with home gardens (β = 0.37, SE = 0.05, p < 0.001). The change in R² is statistically significant (ΔR² = 0.035, p < 0.001) and implies that the availability of home gardens does moderate the relation between DASS-21 and the number of days under stay-at-home orders.

Figure 3. Simple slopes analysis depicting the conditional effect of availability of home gardens between the number of days confined at home due to COVID-19 induced stay-at-home orders and DASS-21.

Figure 4. Conditional moderation effect of the composition of home gardens (M1) and time spent on working in the home garden (M2) on the relationship between the number of days confined at home and DASS-21.
3.2.2. Moderating effects of the composition of home garden and time spent on home garden

PROCESS Model 2 was used to analyze the impact of two independent moderators - composition of the home garden (M1; H3a) and time spent on working in the home garden (M2; H3b) on the relation between stay-at-home orders and mental distress measured by overall DASS-21 and its three subscales, stress, anxiety, and depression. The analysis was carried out only with the respondents (N = 259) who reported having home gardens. The results of tests for H3a and H3b assessment are shown in Table 3. Both the moderators and the independent variable (number of days under stay-at-home orders) significantly (p < 0.001) accounted for 36% variance in stress, 40% variance in anxiety, 15% variance in depression, and 47% of the variance in DASS-21. However, the conditional effect of the composition of the home garden (NDAYS X CompHG) is found to have no significant impact on DASS-21 and its sub-scales. Regarding time spent on working in home gardens, most of the respondents are found to spend 30 min to one hour (47.8%) working in their gardens and 74% of the respondents agreed that the time spent on home gardens has increased during the stay-at-home period than the pre-Covid-19 period. Moderation tests demonstrated that time spent working in the home garden (NDAYS X TimeHG) had a statistically significant conditional effect on stress, anxiety, and DASS-21.

Figure 4 shows that stay-at-home orders predicted DASS-21 among respondents with more varied composition of home garden (+1 SD) and lower levels (−1 SD) of time spent (β = 0.31, SE = 0.09, p < 0.001), but did not predict DASS-21 at high (+1 SD) levels of time spent on working in home gardens (β = 0.07, SE = 0.08, p = 0.39). Thus, H3b is found to be supported but H3a does not hold true in the case of the present study.

To understand the detailed moderating effect, moderation analysis was again carried out with time spent working in the home garden (PROCESS Model 1) as the only moderator. Number of days confined at home due to the stay-at-home orders predicted stress more strongly among respondents with lower (−1 SD) time spent working in home garden (β = 0.21, SE = 0.03, p < 0.001) but did not predict stress at higher (+1 SD) levels of time spent working in home gardens (β = 0.07, SE = 0.04, p = 0.11). Figure 5(a) shows that with increasing

![Image](542x770)
Time from less than 10 min to more than 2 h, stress levels have decreased. Deconstruction of the interaction showed that the moderation effect was significant for active interaction with home gardens below 1.09 (figure 5(b)). The number of days at home marginally predicted ($\beta = 0.16, SE = 0.03, p < 0.001$) anxiety at lower ($-1SD$) levels of time spent working in home gardens. At higher ($+1SD$) levels of time spent working in home gardens, there was no association between the number of days at home and anxiety (figure 6(a)).

Deconstruction of the interaction showed that moderation by time spent working in the home garden was significant for scores below 0.88 (figure 6(b)).

Unlike stress and anxiety, time spent working in home gardens did not have a significant moderating effect on depression. Those who are confined at home for a longer number of days due to the enforcement of stay-at-home orders were more likely to report higher DASS-21 scores ($\beta = 0.24, SE = 0.05, p < 0.001$), but the time spent working in home gardens was found to have a significant yet negative moderating effect ($\beta = -0.11, SE = 0.04, p < 0.05$) on the relationship between the number of days at home and DASS-21. This signifies that when an individual spends more time working in the home garden and has active interactions with home gardens, the positive relationship between the number of days at home due to stay-at-home orders and mental distress (except depression) would decrease (figure 7(a)). Deconstruction of the interaction showed that moderation by time spent working in the home garden was significant for DASS-21 scores below 1.06 (figure 7(b)).

To test hypothesis H3c, moderated moderation analysis was conducted with PROCESS Model 3 with two moderators i.e. time spent working in home gardens and composition of home gardens. But no significant effect by the interaction of time spent working in the home garden and composition of the home garden on the
association between the number of days at home due to stay-at-home orders and mental distress was observed. Hence, H3c did not hold true in the present study.

4. Discussion

This study examined whether home gardens moderate mental distress associated with stay-at-home orders, one of the most common public health interventions to control the spread of Covid-19. The survey was carried out with the urban residents of India who, during the survey, were confined to their homes due to the enforcement of stay-at-home orders. We found evidence that irrespective of the availability of home gardens, a higher number of respondents are experiencing severe to extremely severe levels of anxiety and mild to moderate levels of stress, while only a few respondents reported to be suffering from mild to moderate levels of depression.

Stay-at-home orders brought a sudden pause to the usual life of people, thus disturbing their lifestyle and regular schedules. Besides, the increasing scare of Covid-19 imposed an environment of anxiety and stress. In our study, the number of days of confinement to homes due to the stay-at-home orders was found to have a significant positive relation with anxiety, stress, depression, and overall DASS-21. Considering a range of socio-demographic and health characteristics as control variables, it can be implied that the general population was experiencing mental distress due to the stay-at-home orders issued by government authorities.

With a lack of access to open green spaces, home gardens provide an opportunity to directly interact and connect with nature. In the case of the urban residents in this study, as socializing was not possible in the pandemic situation, gardens might have provided a way to interact among neighbours and experience social support yet maintaining social distance. All these factors are the probable reasons behind the differences in mental distress from Covid-19 among households with home gardens in their premises and no home gardens, as observed in this study. Our findings are consistent with the research findings of de Bell et al. (2020) who reported that access to private gardens impart higher evaluative and eudaimonic well-being among younger English adults under normal conditions.

To further understand the impact of home gardens, their composition and time spent working on home gardens were investigated (H3a and H3b, respectively). In the present study, moderating effect of home garden composition on the relationship between mental distress and the number of days confined at home due to stay-at-home orders was found to be insignificant. The surveyed population were mainly urban residents who have a decent income and have access to various online delivery services that supply daily food requirements to the households during the stay-at-home orders. The present findings agree with the propositions of Orsini et al. (2013) that urban gardens play a role in food security for the least affluent which might be the probable reason behind less reliance over the composition of home gardens for food or other provisioning services in the current study. However, we found an inverse, yet significant moderating effect of time spent on working in home gardens on the association between stay-at-home orders and stress, anxiety, and overall DASS-21. As the time spent working in home gardens increased from less than 10 min to more than two hours, mental distress from stress and anxiety decreased. Corley et al. (2021) in their study with Scottish older adults revealed that spending more time in a private garden was found to incur better physical health, emotional and mental well-being, and sleeping quality than any type of specific activity in the garden. Spending more time in the garden exposes individuals to nature and provides an opportunity to connect and interact with it which enhances physical and mental health, and overall quality of life (Barton and Pretty 2010, Bratman et al 2019).

The covid-19 pandemic has taught us to be self-reliant and resilient to similar future threats that may change our whole lifestyle. It has allowed rethinking about the personal norms and prosocial actions that may aware and motivate people to adopt mitigative actions to other crises like climate change and pollution (Bouman et al. 2020). Using Covid-19 situations as an experience, there should be a drive to search for the successful strategies and interventions that might help in adapting to a new lifestyle. This study demonstrated that home gardens might prove to be one such effective nature-based solution that could improve the well-being of people, even when they cannot leave their household premises for the sake of safety. Integration of these kinds of nature-based solutions in urban design and planning can significantly improve the health conditions of urban residents in general, i.e., beyond Covid-19, thus making the urban areas more resilient, self-reliant, and sustainable. The research findings could be of importance to policy planners, practitioners, such as urban planners, architects, engineers, and landscape architects, to highlight and upscale the importance of access to green outdoor environments in the design of future urban households.

Though the research findings make some significant contributions, some limitations may propose future research directions. First, socio-economic variables and social-media use were considered as control variables, while they might also have a significant effect on mental health during Covid-19 stay-at-home orders. But this provides future research directions that may focus on how interactions of availability of home garden with different socio-economic characteristics influence mental health during Covid-19. Second, while the team made
all efforts possible to avoid any sort of selection bias because the survey was conducted online, those who do not have access to or are uncomfortable with using these means to communicate may be excluded from the study. Thirdly, we did not enquire respondents about their personal experience of Covid-19 i.e., whether the respondents and/or their family members have been infected by the virus or have been quarantined and how access to immediate green spaces like home gardens might have impacted their mental health. Lastly, the current study did not include the mental health effects of public greenspaces during the stay-at-home orders. This could be a potential research area to investigate in the future.

5. Conclusion

This study attempted to explain the moderating effect of the availability of home gardens on the self-reported mental distress status resulted from the number of days confined at home to control the spread of Covid-19 infections. The study, conducted with urban residents from different cities in India, showed that home gardens negatively moderated the positive relationship between the number of days at home and mental distress. This signified the role of home gardens in lowering the Covid-19 induced mental distress. Though the composition of home gardens did not have any significant impact on the association, active interactions through working in home gardens significantly moderated the relationship between mental distress (except depression) and the number of days confined at home due to the enforcement of stay-at-home orders. With increasing concern over mental health impacts of Covid-19 pandemic and post Covid-19 situations, and until no successful pharmaceutical interventions are available, nature-based interventions like home gardens can significantly help in overcoming the mental distress. Covid-19 infections are not the last highly transmittable infectious disease that emerged and spread, but it allowed improving and preparing for similar uncertainties in the future. Multiple benefits of home gardens including their potential in improving mental distress need to be realized and scaled up in urban planning endeavours.

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Data availability statement

The data that support the findings of this study are available upon reasonable request from the authors.

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