Herself, and her child—who is worse off?
Impact of COVID-19 on dietary practices and welfare of mothers and children in rural Bihar

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Abstract

The paper examines the impact of the lockdown to contain COVID-19 on dietary practices of women and their youngest child in rural Bihar. The outbreak of COVID-19, and the national level lockdown to contain it, was expected to disrupt supply chains, and cause a food shortage; simultaneously, it was anticipated that the loss of livelihood and decline in income would also impact food security. Studies in India portrayed a grim situation and predicted a near famine-like situation. In this study, we examine the change in dietary score (number of food groups consumed) and proportion of respondents complying with Minimum Dietary Diversity norms (consuming at least three food groups) among women aged 15-49 years and their youngest child (aged between 6-36 months). We also examine whether ownership of ration cards and contacts with the village head and local party in power helped the household to tide over the crisis. The study is based on a two-phase primary survey undertaken in January-March 2020 (pre-lockdown period) and October-November 2020 (post-lockdown period). It was undertaken in six districts of Bihar, a state with a history of poor maternal and child health outcomes and dysfunctional delivery of health services. We found that dietary practices of women deteriorated, while that of children remained the same. The deterioration was less among households owning ration cards or having political contacts. Although the decline is less than what was anticipated, it is expected to have long-term consequences, as micronutrient deficiency was observed in our study. The study contributes to the literature on the effect of pandemics on the vulnerability of women and children in an underdeveloped region of a low- and middle-income country. It calls for concerted policy actions to ensure food security and ensure adequate nutrient supply to women and children during pandemics.

Keywords: COVID-19; dietary score; food security; minimum dietary diversity; Public Distribution System; India.

Highlights

- The outbreak of COVID-19 and the associated lockdown were widely expected to impact food security.
- We found that dietary practices of women deteriorated, but that of their youngest child remained the same.
- The ownership of ration cards or political contacts offered some protection.
- Micronutrient deficiency was observed, which may have long-term health consequences.
- Concerted policy actions are necessary to guarantee food security and ensure a balanced nutrient supply to women and children during pandemics.

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1. Introduction

On 24th March 2020, the Government of India had announced a national level lockdown (vide Ministry of Home Affairs (MHA) Order No. 40-3/2020-D dated 24/3/2020) to contain the transmission of COVID-19 in India. The lockdown continued till 31st May, after which sanctions were lifted in a phased manner. The study analyses the impact of this lockdown on dietary practices of women and their youngest child in rural Bihar.

Lockdowns to contain COVID-19 were expected to aggravate the global recessionary trends, resulting in declining income, unemployment, poverty, and inequality. Early estimates indicated that the number of people below the poverty line would increase by 140 million, of whom 42 million would be from South Asian countries (Laborde et al., 2020). It was expected to reduce consumption levels by 3.7 percent in South Asia (Laborde et al., 2020). Studies also predicted a decline in the demand for vegetables, fruits, and animal-sourced foods, which would affect the supply of essential micronutrients. The poorest households, estimated to spend 70 percent of their incomes on food items, would be most affected (Laborde et al., 2020), doubling the number of people in LMICs facing acute food insecurity to 265 million by the end of 2020 (World Food Programme, 2020). The demand side shocks would be aggravated by supply-side effects in the form of disruptions to the supply chain and logistics, particularly of highly perishable foods, through the closed country and state borders, restrictions on movement, shutting down of agricultural product markets, etc. (Swinnen, 2020).

As household and community dynamics change the gender-based disadvantage faced by women is likely to be aggravated (Swinnen & McDermott, 2020). Factors like limited access to a nutrient-rich diet, breakdown of nutrition services, increased gender-based violence, restrictions on mobility, and reduced workforce participation are expected to compromise the diet of women. Children will comprise another vulnerable section of the population, as they are unable to compete with adults for food (Scott et al., 2020). UNICEF reports that in the early months of the COVID-19 pandemic there was a 30 percent reduction in the coverage of essential nutrition services in LMICs (UNICEF, 2020). The situation in South Asia is

concerning (Appendix Table A.1). This will also affect the nutritional status and health of children.

Along with the breakdown in health and nutrition intervention schemes, this is expected to lead to "a 14.3% increase in the prevalence of moderate or severe wasting among children younger than 5" (Headey et al., 2020). Further, the "pandemic is also expected to increase other forms of child malnutrition, including stunting, micronutrient deficiencies, and overweight" (Fore et al., 2020, p. 518). A study published in Lancet Global Health estimates a 9.8 to 44.7 percent increase in under-five child deaths per month and an 8.3 to 38.6 percent increase in maternal deaths per month (Roberton et al., 2020). There are apprehensions, therefore, that COVID-19 will undo the massive investments, made in the past decade, to improve maternal and child health, and render attaining associated Sustainable Development Goals almost impossible within the deadline of 2030.

There have been several studies of the impact of the lockdown in India. A large proportion of the respondent's report job loss, hunger, and liquidity problems. The Centre for Sustainable Environment, Azim Premji University surveyed 5,000 workers over 12 major states (Centre for Sustainable Environment, 2000b). The study reports that 66 percent of the workers had lost their jobs. Income declined by 64 percent, inducing a decline in consumption by 73 percent in rural areas (83 percent in urban areas). In the case of rural Bihar, the study (Centre for Sustainable Environment, 2000a) found job loss among 46 percent of respondents, with a consumption decline among 69 percent of households. About 37 percent of households did not have resources to purchase essentials beyond a week. The Dalberg study (Dalberg, 2020)— covering 18,000 Below Poverty Line (BPL) households in ten states— reported an average income loss of 61 percent of the regular income of an average BPL household. A series of telephonic surveys in the National Capital Region of Delhi (NCAER, 2020a, 2020b, 2020c, 2021) found that half of the households reported a severe income decline, while about a third of rural households reported a shortage, particularly in vegetables, fruits, grain, cereals, and milk. Another study by Population Council in Bihar and Uttar Pradesh (Acharya, 2020) found that the decline in household income affected food intake; consumption levels fell in 45-59 percent of households, and 32-48 percent faced a food shortage in the last 30 days. Analysis of the Consumer Pyramid data collected by the Centre for Monitoring Indian Economy found that out of the 5779 households surveyed in 27 states, 84 percent reported a loss in income, with

the second and third quintile of the income distribution being affected most (Chicago Booth and Rustandy Centre for Social Sector Innovation, 2020).

These studies have provided real-time analysis of the impact of lockdown, thereby drawing the attention of policymakers to a potential crisis in the making. Most of the studies, however, had not been able to employ a scientific sampling design due to the circumstances in which they had been undertaken. This led to two problems.

Firstly, restrictions on movements during the lockdown and subsequent period implied that the survey covered a non-random sample of households. For instance, the Azim Premji University study combines sub-samples collected using different (non-random) sampling strategies (Centre for Sustainable Environment, 2020, pp. 8–10). Similarly, the Dalberg study uses data from BPL households only, without explaining how the respondents are selected (Dalberg, 2020); it is also true for the DVARA study (Agrawal & Ashraf, 2020). The SWAN survey covers stranded migrant workers who called up the SWAN helpline to seek relief (Adhikari et al., 2020). As a result, the resultant sample may be selective, so that results do not apply to the population at large. Secondly, such biases may be aggravated by the leading nature of questions resulting in biased responses. An example of this danger is the question "For how long can your household continue without borrowing or getting any help in cash or kind from anyone?" (Chicago Booth and Rustandy Centre for Social Sector Innovation, 2020). Households — especially during times of economic crisis— may choose responses in a manner that makes them potentially eligible for government welfare schemes. It is possible, therefore, that studies cited in this paper had painted an exaggerated picture of reality. To obtain a more accurate picture of the impact of COVID-19 and the associated lockdown, a study employing a scientific sampling design is required.

This paper examines the impact of the national lockdown on dietary practices of married women aged 15-49 years and their youngest child aged 7-36 months. We also present estimates of the resultant change in welfare using a Willingness to Pay (WTP) approach. The study differs from existing studies and those been currently undertaken in three ways. Firstly, it uses a baseline survey undertaken in Bihar between January-March 2020, followed by an end-line survey in October-November 2020, rather than a recall of pre-lockdown dietary practices. Secondly, the gap between the two surveys implies that respondents would be unable to recall their initial response and, therefore, would not give a misleading picture of their current

situation, minimising the social desirability bias. Thirdly, our study is perhaps the only one to attempt an estimate of the welfare change of respondents due to lockdown.

Our study focuses on Bihar for the following reasons:

(i) Bihar is a resource-constrained state in India, having a high prevalence of undernutrition and anemia among under-five children and mothers for several past decades (see Appendix Table A2). Maternal and child malnutrition has been the largest risk factor driving death and disability in Bihar since the 1990s (Indian Council of Medical Research et al., 2017).

(ii) The coverage of women and children under nutrition supplement programmes is very poor in Bihar—only 30 percent of pregnant and lactating women and 40 percent of children are covered under supplementary nutrition programmes; such coverage rates are far below the national average (Avula et al., 2020). This already vulnerable group is likely to become even more vulnerable due to the shock of COVID-19 and the associated lockdown.

(iii) Finally, state-level estimates of supply-side susceptibility using an index (based on indicators like cropped area, irrigated areas, cold storage density, supply procurement of cereals, the density of Agricultural Produce Marketing Committees, and rural *haats*) indicate that Bihar was not well placed to face the pandemic (Saroj et al., 2020).[1]

Given that COVID-19 is projected to remain for the next two years, recurring in repetitive waves (Leung et al., 2020), and that current relief measures have implementation and leakage related issues (Khan, 2020a, 2020b; Press Trust of India, 2020; Singh, 2020), this knowledge should be useful in designing bailout measures to ensure better targeting of relief measures directed to ensure food security, reduce leakages, and make such policies more inclusive. Further, the results of this study should also help to improve service delivery to vulnerable sections in general and in the context of disasters.

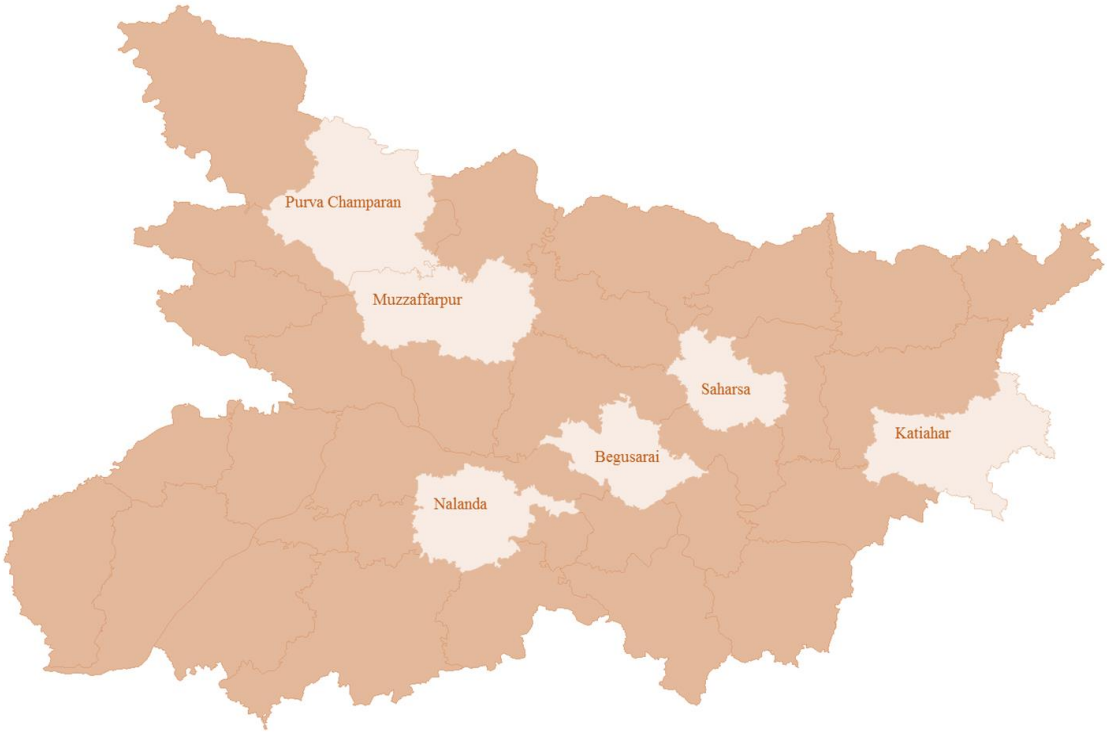
2. Materials and methods

2.1 Sampling design and strategy

The data used in this study was collected through a two-phased primary survey. The baseline, representing the pre-lockdown period, was conducted between January to March 2020. It examined the prevalence of maternal and child health practices in rural Bihar, and assess the

success of the Health and Nutrition Strategy (HNS) being implemented by JEEViKA.[2] Respondents were selected using a multi-stage sampling design. In the first stage, we selected 13 districts out of 38 districts of Bihar, where the JEEViKA Technical Support programme (JTSP) and HNS were in place during the last five years preceding the survey. In the second stage, these 13 districts were classified into three tercile groups based on a composite index of human development indicators, namely, percentages of non-SC/ST population, female literacy, and male non-agricultural labourers – using data from the 2011 census. At the third stage, two districts from each tercile group were selected randomly. The selected districts are Nalanda and Saharsha for the bottom tercile; Begusarai and Muzaffarpur from the middle tercile; and Purba Champaran and Katihar from the upper tercile (see Figure 1). Thus, a total of six districts were selected for the study. After the selection of the study districts, i.e. at the fourth stage, four community development blocks were selected in each district based on the implementation of the JTSP and HNS programme. Two blocks were selected randomly where JTSP and HNS programmes had been implemented during the last five years, while another two blocks were also selected randomly from the rest of the blocks. Thus, altogether 24 (=6×4) blocks were selected from the study districts. At the fifth stage, five villages from each block were selected by employing the probability proportional to size sampling method. A total of 120 villages (=6 districts ×4 blocks ×5 villages) were selected. At the last stage, 20 women comprising ten JEEViKA members and ten non-members were selected from each village. The recruitment criterion was that the respondent was ever married, had at least one living child aged below three years, and usually resided in the village. Thus, the planned sample size of the study was 2400 (=6 districts ×4 blocks ×5 villages ×20 respondents). The sudden onset of lockdown in March, however, forced us to stop the survey after collecting data from 2250 respondents.

Figure 1: Map of Bihar showing survey districts



In the end-line survey, when we collected information about the lockdown period, a list of all respondents of the first phase was prepared. Respondents who had not provided us with their mobile numbers — either because they did not have any, or because they did not want to give us their contact number — were dropped from the list. Respondents with children below three months were also dropped. Background characteristics (like age, education, asset score,[3] socio-religious identity, and husband's occupation) do not vary systematically between respondents who were selected in the second phase and those who were not selected (Appendix Table A3). So, the probability of a selection bias is low.

Given travel restrictions, the selected respondents were contacted over mobile, and a telephonic survey was conducted in October and November 2020.[4] The survey elicited information on the dietary habits of the original respondent and her youngest child, the financial status of the household, access to government relief measures during the lockdown period, and political links of family members. Since the respondents were acquainted with our survey team, lengthy introductions at the onset of the telephonic interview were avoided. This shortened duration of the interview, reducing refusal rates. It also eliminated recall bias as information on the pre-COVID-19 period has already been collected. We covered 1148 respondents, out of 1,652 respondents who satisfied the recruitment criterion (having children aged between 3 to 36

months at the time of the baseline survey). The response rate was 70 percent, which is satisfactory for telephonic surveys. The main reason for refusal was the failure to contact the original respondent as the mobile was not working, or was switched off. Refusal after contact was below five percent.

The ethical clearances for both the studies were obtained from the Institutional Ethical Committee of the institute undertaking the study. The verbal consent of the respondent was obtained prior to the survey in both the phases.

2.2 Sample characteristics

The sample profile is given in Table 1 (for continuous variables), and Table 2 (for categorical variables).

Table 1: Descriptive statistics for respondents

Variable	Mean	Std. Dev.	Min	Max	Confidence Limits	
Age of the respondent (years)	25.55	4.32	17	47	25.30	25.80
Years of schooling	5.74	4.81	0	17	5.46	6.02
Household size	7.01	2.72	3	20	6.85	7.17
No. of ever born children	2.80	1.56	1	10	2.71	2.89
No. of living children	2.67	1.43	1	8	2.59	2.75
Normalised asset score	0.10	0.89	-1.53	2.68	0.05	0.15
Age of the youngest child (months)	16.80	9.12	3	36	16.27	17.33

Respondents are aged between 17 to 47 years, with a mean age of 26 years; about 45 percent are in the 21 to 25-year category. Most respondents have 6 to10 years of schooling; about a third have no education. The average respondent has six years of education. Most of the respondents reside in households with 6-10 members; the mean household size is 7. The mean normalised asset score is 0.10, with about 38 percent of respondents falling in the top asset tercile.[5] The majority of respondents belong to the Hindu-Other Backward Caste group (58 percent); Hindu-Forward Castes also comprise a numerically large proportion of respondents (26 percent). Only 15 percent of the women are engaged in income-earning activities. The

average number of ever borne and living children is three in both cases, with a maximum of 10 and 8, respectively. Male children comprise 52 percent of the child sample; their average age is 17 months, varying from 3 to 36 months at the time of the first survey.

Table 2: Distribution of respondents across correlates

Group	Frequency	Percentage
Age of the respondent		
17-20 years	124	10.8
21-25 years	514	44.77
26-30 years	388	33.8
31-50 years	122	10.63
Years of schooling		
No schooling	348	30.31
1-5 years	215	18.73
6-10 years	410	35.71
11-17 years	175	15.24
Socio-religious groups		
H-SC&ST	78	6.79
H-Other Backward Castes (OBC)	670	58.36
H-FC	303	26.39
Muslim	97	8.45
Household size		
3-4 members	151	13.15
6-10 members	991	86.32
11-20 members	6	0.52
Whether respondent works		
No	976	85.02
Yes	172	14.98
Asset tercile class		
Low	348	30.31
Medium	353	30.75
High	447	38.94
Gender of the youngest child		

Female	547	47.65
Male	601	52.35

2.3 Methodology

The outcome variables studied relate to the consumption of specific food groups. The following food groups were considered for both the mother and child:

(i) Cereals and potatoes;
(ii) Pulses and nuts;
(iii) Eggs;
(iv) Fish and meat;
(v) Milk and dairy products;
(vi) Fruits that are yellow or orange inside;
(vii) Dark green and leafy vegetables; and,
(viii) Other fruits and vegetables.

Information was collected on the number of times the respondent and her child had consumed a specific food group during the recall period. The recall period for the child was the day preceding the survey in the first phase; in the second phase, it was an average day during the lockdown. Responses were coded in binary form— it was coded as one if the child consumed the food item twice or more, and zero otherwise. The recall period of the mother was the week preceding the survey (pre-lockdown period) and the average week during the lockdown.[6] Her responses were coded as zero (if response was infrequently, or never), or one (if response was daily, or weekly). Aggregating the number of food groups consumed by the mother and child, respectively, we created Dietary Score (DS) (Swindale & Bilinsky, 2006). In addition, a binary indicator called Minimum Dietary Diversity (MDD) was estimated with a value of one if the individual (mother or child) consumed at least four food groups, and zero otherwise (USAID et al., 2010; FAO and FHI 360, 2016).

After descriptive analysis, based on tabular and graphical analysis, we undertook an econometric analysis of changes in dietary practices for both mothers and their children. Two variables were created, and analysed as follows:

(i) *Change in Dietary Score*: We created $\Delta DS \equiv DS_{Lockdown} - DS_{Pre\text{-}lockdown}$ when DS is Dietary Score (or the number of food groups consumed out of a maximum of eight groups) It was analysed using an Ordinary Least Square (OLS) model.

(ii) *Change in Minimum Dietary Diversity*: Using the information on whether the respondent had complied with MDD norms (i.e. consumed at least four out of eight possible food groups) in pre-lockdown and lockdown periods, we created a variable with four possible values: Never complied with MDD norms (Never), complied with MDD norms only in pre-lockdown period (Deterioration), complied with MDD norms only in lockdown period (Improvement), and complied with MDD norms in both periods (Always). A multinomial probit model was used to estimate this model, with the fourth category (Always) as the reference category. The complete results are reported in the Appendix, with the results for only the sub-case of Deterioration vis-à-vis the reference category (Always) is reported for the mother and child. While this is partly for brevity, it may be justified because the focus of this study is on the vulnerable section whose dietary practices have worsened during the lockdown. Further, these results are more relevant to policymakers.

Given the clustered nature of our data, heteroscedasticity—leading to overestimation and underestimation of z-statistics—is a potential problem. We, therefore, clustered the data at the village level to obtain robust standard errors.[7] The following variables were included in the models as possible determinants:

(i) Dietary practices of mothers: Age, education, and socio-religious identity of the respondent, husband's occupation, whether respondent worked, household size, asset score, whether the husband was migrant, land ownership, possession of ration card, and contacts with *pradhan* or ruling political party.

(ii) Dietary practices of children: In addition to the above variables, the age, and gender of the child were included. Age of mother was, however, dropped.

We also estimated the welfare change of mothers and children using the WTP approach (Fig. 2). As our survey was undertaken over the telephone, a detailed Contingent Valuation type survey could not be undertaken. Nor was it feasible to obtain prices of different commodity items — even if the house-bound women, who were our respondents, had the information. Instead, we obtained information on the time taken to collect rations from the Public Distribution System (PDS) shops before and during the lockdown. These opportunity costs are

taken to be a proxy of the actual price paid by respondents. The dependent variable was whether pulses were consumed or not.[8] The control variables were whether the husband is a migrant (for mother), and age of the child, years of schooling of the mother, and whether the father is a migrant (for children).[9] Under this approach, the maximum WTP (OADC) and actual payment (OEDC)[10] are first estimated. The difference (EAD) is the consumer surplus. It is estimated for the pre-lockdown and lockdown periods, and the difference in the consumer surplus between the two periods is the welfare change.

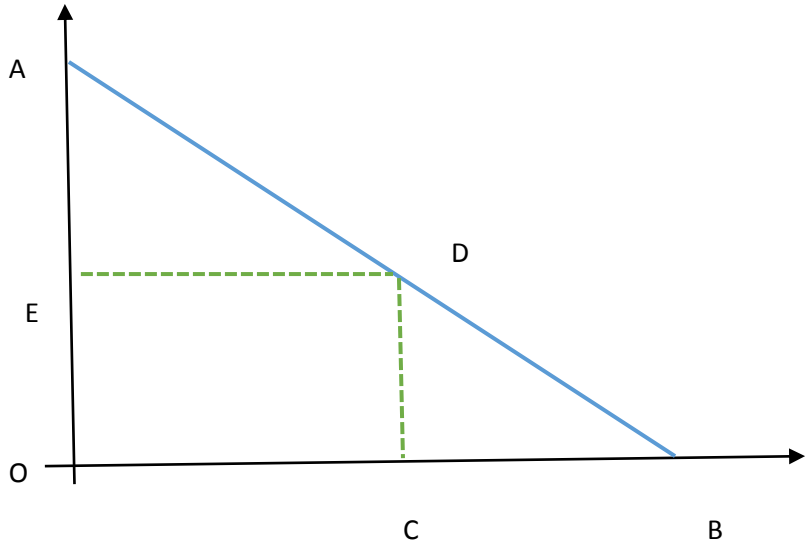


Figure 2 Willingness to pay and welfare

Empirically, the WTP was estimated using a probit model (Lopez-Feldman, 2016). This model regresses whether a person is willing to pay or not (= 0 if the person is not willing to pay, = 1 if the person is willing to pay) upon bid levels and the socio-economic characteristics of the respondents.

$$Y_i = \alpha + \beta BID_i + \delta Xi$$

when

Y = 0 if the person is not willing to pay, = 1 if the person is willing to pay;

BID is the amount requested from the person; and,

X is a vector of control variables.

The mean WTP is given by $\frac{\alpha + \delta \bar{X}_i}{\beta}$. As the households without ration cards might have obtained pulses from the open market, the prices and time costs for obtaining pulses would be substantially different from those households who obtained pulses from the ration shops. Hence

the calculation of the welfare changes was undertaken only for the 804 households with ration cards; such households comprised 70 percent of the total. In the case of the children, 70 percent of the families of the 942 children surveyed had ration cards (73 percent of 511 the children aged 18-36 months).

3. Findings: Impact of the lockdown

3.1 Changes in the dietary practices of mothers

Analysis of the data reveals that, on average, women used to consume about six food groups out of a possible eight before lockdown. During the lockdown, it decreased to five, with the decrease being statistically significant (mean DS before and during lockdown: 5.65 and 5.20, t = 7.12). The decline in mean DS is highest among women belonging to Hindu Forward Caste (HFC) households, and families in the highest asset tercile class, and among women with below primary education (Table 3).

Table 3: Variations in Dietary Score for mothers across correlates

Dietary score	Pre-lockdown	Lockdown	Difference (%)	t-statistic
Asset groups				
Low	5.53	5.08	-8.16	4.00
Medium	5.57	5.18	-6.92	3.25
High	5.81	5.30	-8.82	5.04
Education				
No education	5.49	5.07	-7.64	3.73
1-5 years	5.62	5.02	-10.60	3.94
6-10 years	5.72	5.27	-7.76	4.13
11-17 years	5.86	5.48	-6.44	2.33
Socio-religious identity				
H-SC&ST	5.42	5.47	0.95	-0.23
H-OBC	5.61	5.10	-9.00	6.01
H-FC	5.72	5.19	-9.34	4.35
Muslims	5.91	5.64	-4.54	1.18

A decline in the proportion of women attaining MDD was also observed. While 94 percent of mothers had attained MDD before lockdown, the proportion declined to 83 percent during the lockdown. The difference of 11 percentage points is statistically significant z = 8.01). Women

with below primary education, and those belonging to OBC and HFC households, and households in the lowest asset tercile group are most affected (Table 4).

Table 4: Variations in Minimum Dietary Diversity for mothers across correlates

Minimum Dietary Diversity	Pre-lockdown	Lockdown	Difference (%)	z-statistic
Asset groups				
Low	94.83	83.05	-12.42	5.04
Medium	92.35	81.02	-12.27	4.49
High	94.41	85.68	-9.25	4.40
Education				
No education	92.82	81.32	-12.39	4.58
1-5 years	93.85	80.47	-14.26	4.27
6-10 years	94.14	85.37	-9.32	4.19
11-17 years	95.43	86.86	-8.98	2.85
Socio-religious identity				
H-SC&ST	96.15	91.03	-5.33	1.31
H-OBC	94.03	82.09	-12.70	6.85
H-FC	94.06	83.17	-11.58	4.28
Muslims	90.72	87.63	-3.41	0.69

Analysis of change in consumption of specific food groups (Table 5) reveals that consumption of cereals and potatoes is universal in both periods. The proportion of mothers consuming this food group increases marginally by 0.17 percent, though the increase is not statistically significant even at the 10 percent level. The consumption of pulses is also very high, and increases by about two percent; this increase is statistically significant at one percent level. We also find that consumption of orange and yellow fruits has gone up significantly in the lockdown period by about 50 percent. However, it is low in both periods.

Consumption of all other food groups has lessened substantively; further, the reduction is statistically significant in all cases. Owing to cultural norms, consumption of non-vegetarian items like fish and meat, and eggs are historically low in Bihar.[11] Lockdown reduced this

proportion even more (by 30 percent and 12 percent, respectively). Consumption of dark green and leafy vegetables and other fruits and vegetables (23 and 14 percent, respectively) have also experienced significant declines. The decline for milk and dairy products is statistically significant, but the magnitude of the decline is only five percent.

Table 5: Proportion of mothers consuming specific food groups in pre-lockdown and lockdown periods

Food items	Pre-lockdown	Lockdown	Percentage change	t-test
Cereals and potatoes	98.87	99.04	0.17	0.41
Pulses & nuts	95.73	97.47	1.82	2.30
Fish and meat	58.01	40.84	-29.60	-8.30
Egg	41.90	36.76	-12.27	-2.52
Milk & dairy products	74.91	70.91	-5.34	-2.16
Yellow/orange fruits	22.74	34.15	50.18	6.11
Dark green, leafy vegetables	88.07	67.68	-23.15	-12.13
Any other fruits or vegetables	84.84	72.65	-14.37	-7.22

There also seems to be a substitution of dark green and leafy vegetables, and other fruits and vegetables by orange and yellow fruits. Part of this change could be due to the different seasons in which the surveys were undertaken. During January-March, availability of seasonal dark green and leafy vegetables like *palak sag* (spinach greens), *sarson ki sag* (mustard greens), *sag chana* (chickpeas greens), *muli sag* (radish greens), *khesari sag* (pea greens), *bandha gobi* (cabbages), etc. ensures that their consumption is high; in summer, their consumption declines - with their non-availability. On the other hand, orange and yellow fruits like pumpkin, papaya, and mangoes are available in summer. Consumption of potatoes also increases during the summer months.

Political contacts may also play a role in helping a household to access government schemes and reducing the impact of the shock. The mean value of change in DS is compared between sub-samples defined as follows:

(i) Whether respondent and *pradhan* is of the same caste;

(ii) Whether respondents' family members have any contacts with the *pradhan*; and

(iii) Whether respondents' family members have any political contacts.

Table 6: Political contacts and change in Dietary Scores

Group	Deterioration	Improvement	t-statistics
Dietary Score			
Same caste	-0.40	-0.56	-1.22
Contact with *pradhan*	-0.52	-0.31	-1.67**
Political contact	-0.49	-0.12	-2.00**
Minimum Dietary Score			
Same caste	-9.27	-12.83	1.32
Contact with *pradhan*	-13.71	-3.33	-3.81***
Political contact	82.24	93.50	-2.84***

*Note: ***, ** and * denotes Probability < 0.01, Probability < 0.05 and Probability < 0.10, respectively.*

Although caste does not seem to have any impact (probably because sub-caste is more important than caste), contacts with the *pradhan* or political party in power cushions the mother's consumption (Table 6). This is expected, given that state elections were due in October-November.

3.2 Changes in the dietary practices of children

In the case of children, although the mean DS was very low both before and during the lockdown, it increased from 2,89 to 3.15; the difference of about 11 percent is statistically significant at one percent level (t = 4.75). The mean DS is low for children of both genders. It is marginally higher among girls, compared to the boys. Neither in the pre-lockdown period nor the lockdown period the gender difference in DS statistically significant. DS has increased for both boys and girls over the lockdown period. The increase is about 11 percent for both. DS increases for children for all sub-samples formed based on asset holdings of families, education level of mothers, and socio-religious identity (Table 7).

Table 7: Variations in Dietary Score of children across socio-economic correlates

Correlate	Pre-lockdown	Lockdown	Difference (%)	t-statistic
Gender of the child				

Correlate	Pre-lockdown	Lockdown	Difference (%)	t-statistic
Male	2.85	3.16	11.12	-3.40
Female	2.90	3.23	11.20	-3.31
Asset				
Low	2.90	3.47	19.91	-4.60
Medium	2.95	3.17	7.36	-1.79
High	2.79	2.99	6.99	-1.86
Education of the mother				
No Education	3.06	3.52	14.83	-3.68
1-5 years	2.79	3.02	8.14	-1.63
6-10 years	2.88	3.08	7.10	-1.75
11-17 years	2.58	3.01	16.76	-2.49
Socio-religious group				
H-SC&ST	2.55	3.25	27.11	-2.72
H-OBC	2.88	3.11	8.28	-2.68
H-FC	2.87	3.30	15.18	-3.28
Muslim	3.13	3.36	7.52	-1.09

Compliance with MDD is low among children— about 46 percent do not achieve the recommended level of MDD in either of the two periods. It has, however, increased marginally from 33 percent before lockdown, to 34 percent (z = 0.73) during the lockdown. In the pre-lockdown period, the percentage of children who have adhered to the MDD norm is low—32 among boys, and 34 among girls (Table 8). However, this is not a statistically significant difference. In the lockdown phase, there is an increase in the percentage of boys attaining MDD by three percentage points. In the case of girls, however, there is a marginal decrease. The temporal change is insignificant in both cases.

Table 8: Variations in percentage of children complying with Minimum Dietary Diversity across socio-economic correlates

Correlate	Pre-Lockdown	Lockdown	Difference (%)	z-statistic
Gender of the child				
Male	31.66	34.87	10.13	0.07
Female	33.86	33.63	-0.67	-1.07

Correlate	Pre-Lockdown	Lockdown	Difference (%)	z-statistic
Asset				
Low	31.40	44.03	40.22	-3.18
Medium	37.19	33.33	-10.38	0.96
High	30.22	27.20	-10.00	0.90
Education of the mother				
No Education	38.91	45.39	16.67	-1.59
1-5 years	27.57	28.11	1.96	-0.12
6-10 years	33.13	30.96	-6.54	0.59
11-17 years	25.53	26.95	5.56	-0.27
Socio-religious group				
H-SC&ST	18.46	33.85	83.33	-2.01
H-OBC	33.33	30.77	-7.69	0.91
H-FC	31.30	39.84	27.27	-1.98
Muslim	43.53	41.18	-5.41	0.31

The percentage of children complying with MDD increases throughout our study for most sub-samples. The exceptions are children from families with medium and high asset holdings, children whose mothers have 6-10 years of schooling, and children from H-OBC and Muslim families.

Analysis of consumption of specific food groups reveals that the proportion of children consuming cereals and potatoes, pulses and nuts, and milk and dairy products are high in both periods (Table 9). Out of these three food groups, consumption of milk and dairy products has declined by 5 percent, while that of cereals and potatoes, and pulses and nuts have increased significantly by 4 percent and 32 percent, respectively. Consumption of non-vegetarian items and yellow or orange fruits is very low in both periods. The percentage of children consuming dark green and leafy vegetables, and other fruits and vegetables is also low; their presence in the consumption basket of children also needs to be increased substantially to ensure an adequate supply of micronutrients and vitamins. However, the lockdown does not seem to have affected their intake significantly.

Table 9: Change in consumption of food groups by children

Food groups	Pre-lockdown	Lockdown	Difference (%)	z-statistic
Cereals and potatoes	88.43	92.25	4.32	-2.81
Nuts and pulses	63.59	84.08	32.22	-10.40
Fish and meat	7.86	4.03	-48.73	3.52
Eggs	2.34	3.29	40.60	-1.25
Milk and dairy products	68.68	65.18	-5.10	1.62
Yellow/Orange fruits	3.18	7.11	123.58	-3.87
Dark green leafy vegetables	23.57	22.08	-6.32	0.77
Other fruits and vegetables	29.72	31.74	6.80	-0.95

3.3 Econometric analysis

In the penultimate step of our analysis of dietary practices of mothers and their youngest children, we undertook an econometric analysis. Two models were estimated — for DS and MDD, respectively. While complete results of the MDD models are reported in the Appendix (Appendix Tables A4 and A5), the text focusses on the results for "Deterioration" only.

Table 10 reports results for mothers. The result for DS indicates that DS of older women had declined, while that of women from H-SC&ST families and households with ration cards had increased. Results of the multinomial probit model reveal that the probability of suffering a deterioration (in the sense of failing to comply with MDD norms in lockdown period) increases if the spouse is a migrant worker, works in non-agricultural jobs, does not have a ration card, or does not have political contacts.

Table 10: Results for Change in Dietary Score and MDD of mothers

Variables	Change in DS				MDD: Deterioration			
	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t
Age of the respondent (years)	-0.04	0.02	-2.41	0.02	0.03	0.02	1.64	0.10
Education of the respondent (Ref: No education)								
1-5 years of education	-0.28	0.19	-1.46	0.15	0.07	0.16	0.43	0.67
6-10 years of education	-0.20	0.18	-1.12	0.27	-0.07	0.16	-0.47	0.64
11-17 years of education	-0.04	0.21	-0.19	0.85	-0.13	0.25	-0.50	0.62
Socio-religious group (Ref: HFC)								
H-SC&ST	0.78	0.21	3.65	0.00				
H-OBC	0.04	0.17	0.22	0.83				
Muslim	0.21	0.24	0.85	0.40				
Asset score	-0.09	0.09	-1.07	0.29	-0.11	0.09	-1.31	0.19
Landholding (Ref: No land)								
1-9 katha	-0.02	0.19	-0.10	0.92	0.20	0.20	0.97	0.33
10-19 katha	-0.22	0.25	-0.90	0.37	0.27	0.28	0.97	0.33
20 katha & above	0.06	0.19	0.30	0.76	0.08	0.23	0.33	0.74
Household size	-0.02	0.02	-0.99	0.33	0.00	0.02	-0.08	0.93
respondent works	-0.04	0.18	-0.21	0.83	0.04	0.18	0.23	0.82

Husband is a migrant	-0.06	0.14	-0.47	0.64	0.22	0.12	1.76	0.08
Occupation of the husband (Ref: Agriculture)								
Others	0.17	0.17	0.99	0.32	0.34	0.18	1.90	0.06
Wage & Salaried	0.05	0.21	0.24	0.81	0.15	0.18	0.87	0.38
Possesses ration card	0.42	0.14	2.94	0.00	-0.40	0.14	-2.93	0.00
Contact with party in power	0.29	0.21	1.34	0.18	-0.74	0.24	-3.06	0.00
Intercept	0.39	0.58	0.67	0.50	-2.22	0.59	-3.78	0.00
N	1143							
F (Wald Chi2)	2.23			0.01				
R2 (Count R2)	0.06							
AIC/n								

***Note**: Result for MDD reported for "Deterioration", with "Attained MDD in both periods" as the base outcome. The inclusion of socio-religious identity created convergence problems and had to be excluded.*

Table 11 presents the results of both regression models—the OLS regression model of change in DS, and multinomial probit for Deterioration in MDD vis-à-vis Attained MDD in both periods—for children. Results of the OLS model indicate that older children experience a greater decline in Dietary Score. A possible cause is that children aged below 12 months are being weaned away from exclusive breastfeeding.[12] There is no difference between male and female children. Children from disadvantaged social groups, like Muslims and HSC&STs, are more likely to experience a decline in DS, compared to children from HFC families. Children from families with higher asset scores experience a greater decline in DS; however, children from families with above 20 *kathas* of land have experienced an increase in DS. The coefficient of contact with political parties is also positive and significant. In line with studies on clientilism (Anderson et al., 2015; Bardhan & Mitra, 2014; Bardhan et al., 2009; Bardhan & Mookherjee, 2000, 2016; Dasgupta, 2017; Gallego, 2018; Véron et al., 2003), it indicates that such contacts had offered some degree of protection against food insecurity.

Table 11: Results for Change in Dietary Score and MDD of children

Variables	Change in DS				MDD: Deteriorated			
	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
Age of the child (Ref: 6-12 months)								
13-18 months	-0.66	0.17	-3.76	0.00	0.02	0.30	0.06	0.95
19-24 months	-1.00	0.20	-5.06	0.00	0.12	0.31	0.39	0.70
25-36 months	-1.08	0.19	-5.74	0.00	0.01	0.27	0.04	0.97
Girl child	-0.04	0.13	-0.30	0.76	-0.26	0.17	-1.58	0.11
Education of the mother (Ref: No education)								
1-5 years of education	-0.28	0.18	-1.54	0.13	0.90	0.25	3.65	0.00
6-10 years of education	-0.34	0.17	-1.97	0.05	0.55	0.21	2.58	0.01
11-17 years of education	0.02	0.21	0.08	0.94	0.63	0.31	2.03	0.04
Socio-religious group (Ref: HFC)								
H-SC&ST	-0.54	0.25	-2.13	0.04	0.59	0.38	1.55	0.12
H-OBC	-0.40	0.25	-1.60	0.11	0.47	0.41	1.14	0.26
Muslim	-0.57	0.32	-1.79	0.08	0.47	0.43	1.08	0.28
Asset score	-0.28	0.09	-3.21	0.00	0.33	0.12	2.85	0.00
Landholding (Ref: No land)								
1-9 *katha*	0.25	0.18	1.40	0.16	0.38	0.28	1.39	0.17
10-19 *katha*	-0.10	0.22	-0.44	0.66	0.17	0.30	0.57	0.57
20 *katha* & above	0.50	0.23	2.22	0.03	-0.35	0.28	-1.27	0.20

Household size	0.01	0.02	0.61	0.54	-0.07	0.03	-2.08	0.04
Mother works	-0.23	0.22	-1.03	0.31	0.21	0.20	1.08	0.28
Father is a migrant	0.07	0.15	0.48	0.63	-0.03	0.17	-0.21	0.84
Occupation of the father (Ref: Agriculture)								
Others	-0.08	0.18	-0.46	0.64	-0.41	0.23	-1.82	0.07
Wage & Salaried	0.35	0.22	1.59	0.11	-0.44	0.27	-1.61	0.11
Possesses ration card	0.13	0.15	0.86	0.39	-0.45	0.21	-2.20	0.03
Contact with party in power	0.65	0.33	1.96	0.05	0.06	0.23	0.24	0.81
Intercept	9.57	0.48	20.13	0.00	0.70	0.60	1.16	0.25
N	937				937			
F	4.79			0.00	1020.05			
R2	0.09				0.48			
AIC/n					2.47			

Results of the multinomial probit model for changes in compliance with MDD norms for children indicate that illiterate mothers are more likely to comply with MDD norms in both periods; it may reflect the stronger influence of Accredited Social Health Activists and other front-line workers upon less educated women (Dutta et al., 2021; Ghosh & Keshri, 2020). The probability of failing to comply with MDD norms is higher in households with higher asset scores. The inverse relationship between compliance with MDD norms, and education and wealth is not consistent with expectations; it is, however, a recent feature of maternal and child health in Bihar (Dutta et al., 2021; Ghosh & Keshri, 2020). In larger families, children are less likely to experience deterioration concerning MDD norms in the lockdown phase. Possession of ration cards ensures that MDD norms will be complied with in both periods.

3.4 Welfare changes

The final step of our analysis comprises measuring welfare changes. From Table 12, we can see that the lockdown has not reduced the welfare of both the mothers and their children. Welfare levels of mothers have increased from 1800 to 2135 (an increase of about 20 percent), measured in minutes. In the case of the youngest child, welfare is observed to increase substantially from 207 minutes to 1411 minutes. The increase is less if we consider children in the age group 18-36 months—it is 906 minutes. We have converted the change in welfare to money terms using the MNREGA wage rate of Rs.171 per day (for eight hours). In money terms, the welfare increase is not very impressive—Rs.126.30 (mothers), Rs.429.10 (all children), and Rs.322.68 (children aged 18-36 months).

Table 12: Change in welfare measured using pulse consumption for mothers and the youngest child

Group	Mother	Child (7-36 months)	Child (18-36 months)
Pre-WTP	1821.33	166.41	645.77
Pre-CS	1779.91	206.79	687.52
Post-WTP	2187.22	1358.79	1539.47
Post-CS	2134.54	1411.14	1593.28
Difference	19.92	582.41	905.76
t-statistic	-140	445.56	905.76

Probability	0.00	0.00	0.00
Money value	126.30	429.10	322.68
Sample size	804	665	374

Prima facie, the estimated welfare gain appears inconsistent with the deterioration in dietary practices observed for the mothers and children in the 18-36 months age group. The results reflect that pulses, from being a stable consumption item in the pre-lockdown period, became an item essential to maintain dietary standards during the lockdown due to the loss of livelihood, lack of an alternative source of income, and breakdown of the supply mechanism. The increased value of this item to households resulted in an outward shift in the demand curve from A to A_1. Thus, even though the time cost of collecting rations increased from 59 minutes in the pre-lockdown period to 75 minutes during the lockdown (represented by OD and OD_1, respectively), the consumer surplus increased from ADB to $A_1D_1B_1$. The supply of free rations through the PDS, therefore, not only provided food security but also improved the welfare of the respondents, albeit marginally.

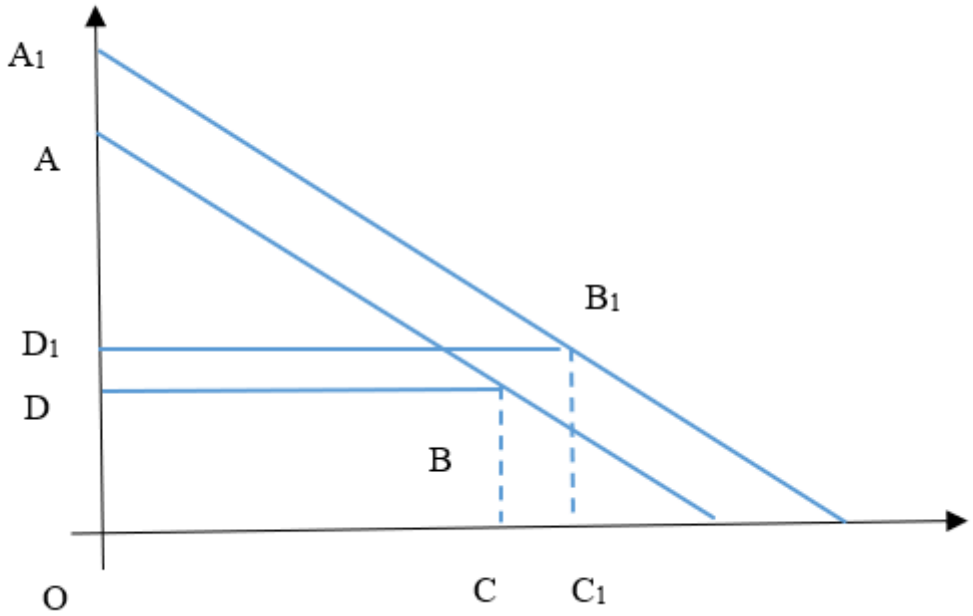


Figure 3: Interpreting the increase in welfare

However, we should keep in mind that welfare change was measured using pulse consumption only, and for only families owning ration cards. This is a limitation of our study.

4. Discussion

Measures to contain the transmission of COVID-19 were expected to have a major impact on food and nutrition security, operating through the following channels (HLPE, 2020b):

(i) Disruptions to food supply chains;
(ii) Loss of income and livelihoods, and consequent widening of inequality;
(iii) Break down of social protection programmes;
(iv) Altered food environment; and,
(v) Rising food prices.

Early Indian studies of the impact of the lockdown revealed a bleak financial outlook, with households running short of money to meet essential requirements.[13] They also reported that, although government support had started to reach the households, it was inadequate to meet the requirements of these families.

Our study found that, although dietary diversity did worsen, particularly among women, a catastrophe of the magnitude anticipated did not occur, at least among the rural population in Bihar. A possible reason was the ability of the state governments to use the PDS successfully to provide a buffer against falling consumption levels.[14] Although coverage of health and nutrition schemes is poor in Bihar (Avula et al., 2020), the PDS in Bihar rose to the occasion and was able to ensure a steady supply of staples to households. The fact that State-level elections were due in the second half of 2020 may have also played a role in motivating the Bihar government to ensure adequate coverage under the different social protection measures. It is also a possible reason why we find a welfare *increase* among families owning ration cards. Such measures, however, were introduced *after* the crisis, and took time to take off; hence, their cushioning effect operated after a lag. It is not surprising, therefore, that early studies found households facing an imminent disaster (Acharya, 2020; Centre for Sustainable Environment, 2000a, 2000b; Gaon Connection and Lokniti-CSDS, 2020; NCAER, 2020a, 2020c).

We find that consumption of pulses increased by about two percent among families with ration cards (Table 13); moreover, the difference was statistically significant at a five percent level ($z = 2.32$). It indicates that the PDS system did play a part in moderating the negative effect of the lockdown on the consumption of pulses.

Table 13: Change in percentage of households consuming cereals & potatoes, and pulses & nuts for households with and without ration cards

Food group	Ration card	Pre-lockdown	Lockdown	Difference (%)	z-statistic
Cereals and potatoes	No	99.13	99.42	0.29	0.44
	Yes	98.76	98.88	0.12	0.23
Pulses and nuts	No	95.35	96.80	1.52	0.98
	Yes	95.90	97.76	1.94	2.13**

Secondly, agricultural activities showed remarkable resilience in most countries, including India (Chand, 2020), so that the shock on rural households was less than what was expected (Gupta & Kishore, 2020). The government declared agri-food production and marketing as essential commodities— exempting restrictions on the movement of farmworkers, farm machinery, and farm produce—and kept agricultural markets open (Chand, 2020). Although the implementation of these decisions at the ground level was not smooth,[15] fears that the supply chain disruptions would have a major consumption shock (Gillespie & Whiteside, 2020; Raghunathan, 2020) did not materialise as the rural households were located at the source of production. For instance, even in the case of families without ration cards, consumption of cereals and pulses remained the same during the lockdown vis-a-vis the pre-lockdown period (Table 13).[16]

Similarly, about 40 percent of households reported owning milch animals (cows and buffaloes). Ownership of milch animals can also protect owners and their family members from shocks such as lockdowns. The change in consumption of milk and dairy items was categorised into four groups — never consumed, always consumed, consumed only in pre-lockdown period (but not in lockdown period), and consumed only in lockdown period (but not in pre-lockdown period). Taking 'always consumed' as the base outcome, a (clustered) multinomial probit was estimated with the change in consumption of this food group being regressed upon ownership of milch animals (=1 if the household owns a milch animal, zero otherwise), asset scores, education, and socio-religious identity. The coefficient of the milch dummy is -0.35 (z= -3.73, prob. = 0.00) in the model for "deteriorated consumption" against "always consumed". The negative sign of the coefficient indicates that the probability of a household reducing consumption of milk and dairy items vis-à-vis households consuming this food group in both pre-and lockdown periods will decline if the household owns a milch animal.

In the case of children, the lockdown seems to have had less of a shock. Particularly children aged 7-12 months report a significant improvement for mean DS and compliance with MDD norms. This result may be partly explained by the substitution of breast milk by complementary food as there is a gap of several months between our survey and re-survey periods. We should also note that children require little food implying that they are not major competitors for food except in periods of famines. For example, during the first phase of the survey, we observed that children were often given a *chapatti* (unleavened flatbread), which they munched away contently for one-two hours. However, dietary practices of children aged 19-36 months, particularly 23-36 months, were found to have deteriorated. This has the potential to increase the incidence of wasting for a short period. Secondly, both the mean DS and proportion of children complying with MDD norms at all age groups is very low and needs to be improved substantially. Finally, the consumption of specific food groups like eggs, fish and meat, milk and dairy products, and dark green leafy vegetables have either declined or is negligible.

Although the short-run impact of the lockdown on nutrient intake is less alarming than what was expected, the change in dietary practices of mothers and the poor dietary quality of children have serious long-term health implications. The dietary practices followed by mothers and children during lockdown are likely to lead to a deficiency in micronutrients like iron, iodine, zinc, Vitamin A, Vitamin D, etc. Such deficiencies impair body growth and intellectual development, cause prenatal complications, and increase the risk of mortality and morbidity. They also increase the chances of cardiovascular disease, diabetes, obesity, stroke, cancer, atherosclerosis, osteoporosis, macular degeneration, while weakening the immunity system. This has long-term health consequences for morbidity and mortality, affects human capital formation by lowering learning outcomes and retention, and further affects long-term growth and development. In the case of children surviving at below subsistence levels even on normal days, even a minor shock (in the form of reduced intake of essential micronutrients) can tip a child into a ‘clinically’ deprived state (Pandey, 2020).

5. Conclusion

The lockdown was found to have worsened the dietary practices of women of reproductive age. The consumption basket has changed with the substitution of cereals and potatoes, and nuts and pulses for non-vegetarian items, dark green leafy vegetables, and other fruits and vegetables. The impact on children was marginal; however, the DS and compliance levels with MDD norms were very low in both periods. The proportion of children consuming specific

food groups is also low. These issues will hinder India's progress towards meeting the nutritional challenges of the *Poshan Abhiyan* and attaining the Sustainable Development Goal of eliminating malnutrition by 2030.

During pandemics, a major objective of policymaking should be to ensure food security (HLPE, 2020a). At the same time, given the higher chances of morbidity and mortality among people with poor nutritional status, food security is also a means to control the transmission of pandemics (Anema et al., 2009; United Nations, 2020). Ensuring food security in a pandemic affected population requires:

(i) Promoting awareness about healthy dietary practices through programmes like JEEViKA's HNS.

(ii) Given that a large proportion of households may suffer a loss of livelihood and decline in income, supplementary social protection measures to facilitate access of vulnerable sections to food and income should also be introduced. Such measures should combine a strong Take Home Rations (THR) system to provide the staple items, with Direct Benefit Transfer in the form of cash to allow households to widen their consumption basket and improve their dietary intake.

(iii) Ensuring that coverage of existing nutritional support programmes targeting women and children are strengthened during pandemics.

The implementation of the measures to ensure the above requires close coordination between national, regional, and local governments, with the local governments being the key actor in implementing the relief measures (Pan American Health Organization, 2020). At the same time, as seen in the study, it is possible that "discretionary provision of private or local public goods or privileges by … political parties to particular groups of citizens, in exchange for their votes (may occur)" (Bardhan & Mookherjee, 2000, p. 2). Welfare programmes must be insulated from such capture, particularly during pandemics.

Our study has some limitations. Firstly, we have analysed dietary practices, rather than consumption levels. Analysing the impact of lockdown on consumption levels is an important challenge before researchers. Secondly, the end-line survey had been conducted over the telephone. Although the rise in mobile density implies that coverage is not a major issue with telephonic surveys, it is still less reliable than face-to-face interviews (Szolnoki & Hoffmann, 2013), particularly if questions are complex (Tipping et al., 2010).[17] Thirdly, given the constraints under which the survey was undertaken, we had to rely on self-reported responses.

It may lead to overestimation of the impact of COVID-19 due to social desirability bias. Nevertheless, our study tried to find out the change in dietary practices during a pandemic situation based on a scientifically selected sample of the population from the resource-constrained state of Bihar. The study has contributed to the literature on the effect of pandemics on the vulnerability of women and children in an underdeveloped region of a low- and middle-income country; it also provides evidence on the crucial role of THR in ensuring food security and maintaining welfare such crisis.

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APPENDIX

Appendix Table A1: Nutrition-related programmes affected by COVID-19 in South Asia

Nutritional programme	Increase / No change	Decrease
Nutritional support for pregnant and lactating women	40	44
Safe and nutritious diet for children aged 6-23 months	55	49
Vitamin A supplement (children aged 0-59 months)	34	46
Nutrition programme in schools	14	45*
Food subsidies	38	4

Note: *Reported drop in nutrition program in schools by 75-100%: 36 percent.*
Source*: UNICEF (2020) Tackling the situation of children during COVID-19. Accessed from https://data.unicef.org/resources/rapid-situation-tracking-covid-19-socioeconomic-impacts-data-viz/ on 15 February 2021.*

Appendix Table A2: Selected maternal and child health indicators for Bihar and India

Indicators	Bihar						India			
	NFHS-3		NFHS-4		NFHS-5		NFHS-3		NFHS-4	
	Rural	Total	Rural	Total	Rural	Total	Rural	Total	Rural	Total
Infant Mortality Rate			50.0	48.0	47.3	46.8			46.0	41.0
Under-five Mortality Rate			60.0	58.0	57.4	56.4			56.0	50.0
Children under age 3 years breastfeed with an hour of birth	3.8	4.0	34.1	34.9	30.5	31.1	21.5	23.4	41.1	41.6
Children under age 6 months exclusively breastfed	27.3	27.9	54.1	53.4	59.4	58.9	48.3	46.3	55.9	54.9
Children age 6-8 months receiving solid or semi-solid food and breastmilk	58.3	57.3	29.5	30.8	39.0	39.0	53.8	55.8	39.9	42.7
Breastfeeding children age 6-23 months receiving an adequate diet			7.1	7.3	11.2	10.8			8.2	8.7
Non-Breastfeeding Children 6-23 months receiving an adequate diet			9.0	9.2	11.1	11.5			12.7	14.3
Total children age 6-23 months receiving an adequate diet			7.4	7.5	11.2	10.9			8.8	9.6
Children under 5 years who are stunted	51.3	50.1	49.3	48.3	43.9	42.9	47.2	44.9	41.2	38.4
Children under 5 years who are wasted	32.9	32.6	20.8	20.8	23.1	22.9	24.1	22.9	21.5	21.0
Children under 5 years who are severely wasted			6.9	7.0	9.0	8.8			7.4	7.5
Children under 5 years who are underweight	56.3	54.9	44.6	43.9	41.8	41.0	43.7	40.4	38.3	35.8
Women whose Body Mass Index is below normal (BMI <18.5 kg/sq.m)	45.9	43.0	31.8	30.4	26.9	25.6	38.8	33.0	26.7	22.9
Women who are overweight or obese (BMI >= 25.0 kg/sq.m)	3.5	5.3	11.7	11.7	14.2	15.9	8.6	14.8	15.0	20.6
Children age 6-59 months who are anaemic	89.0	87.4	64.0	63.5	69.7	69.4	80.9	78.9	59.5	58.6

Non-pregnant woman age 15-49 years who are anaemic			60.7	60.4	63.1	63.6			54.4	53.2
Pregnant woman age 15-49 years who are anaemic	59.4	60.2	58.0	58.3	63.9	63.1	59.0	57.9	52.2	50.4
All women age 15-49 years who are anaemic			60.5	60.3	63.1	63.5			54.3	53.1

Sources:

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Appendix Table A3: Profile of first phase respondents satisfying recruitment criterion: Selected & not selected in the second phase

Socio-economic characteristic	Not selected	Selected	Total
Education of the respondent			
No education	37.04	30.31	32.46
1-5 years	17.78	18.73	18.42
6-10 years	35.19	35.71	35.55
11-17 years	10	15.24	13.57
Chi2	**1.57 (0.67)**		
Mean	4.94	5.74	
t-statistic	**3.22 (0.00)**		
Age of the respondent			
17-20 years	10.37	10.8	10.66
21-25 years	45	44.77	44.85
26-30 years	35.74	33.8	34.42
31-35 years	8.89	10.63	10.07
Chi2	**12.77 (0.01)**		
Mean	**25.51**	**25.55**	
t-statistic	**0.18 (0.86)**		
Occupation of the husband			
Primary	20.56	16.9	18.07
Other rural occupations	60	64.63	63.15
Salaried class	19.44	18.47	18.78
Chi2	**4.15 (0.13)**		
Low	28.89	30.31	29.86
Medium	40.74	30.75	33.95
High	30.37	38.94	36.2
Chi2	**18.50 (0.00)**		
Mean	**0.03**	**0.10**	
t-statistic	**1.44 (0.15)**		
Socio-religious groups			
H-SC&ST	7.78	6.79	7.11
H-OBC	52.78	58.36	56.58
H-FC	33.33	26.39	28.61
Muslim	6.11	8.45	7.7
Chi2	**11.31 (0.01)**		

Note: *Figures in parentheses are probability values.*

Appendix Table A4: Results of multinomial probit model for MDD of women

Variables	Never attained MDD				Deterioration				Improved			
	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t
Age of the respondent	-0.01	0.03	-0.40	0.69	0.03	0.02	1.64	0.10	0.05	0.02	2.07	0.04
Education of the respondent (Ref: No education)												
1-5 years of education	-0.04	0.37	-0.10	0.92	0.07	0.16	0.43	0.67	-0.03	0.26	-0.13	0.90
6-10 years of education	-0.49	0.35	-1.41	0.16	-0.07	0.16	-0.47	0.64	0.20	0.25	0.78	0.44
11-17 years of education	-0.38	0.39	-0.99	0.32	-0.13	0.25	-0.50	0.62	-0.16	0.32	-0.51	0.61
Asset score	0.31	0.14	2.19	0.03	-0.11	0.09	-1.31	0.19	0.04	0.12	0.32	0.75
Landholding (Ref: No land)												
1-9 katha	0.22	0.30	0.75	0.46	0.20	0.20	0.97	0.33	-0.25	0.23	-1.06	0.29
10-19 katha	-0.22	0.46	-0.47	0.64	0.27	0.28	0.97	0.33	-0.19	0.33	-0.58	0.56
20 katha & above	-0.73	0.54	-1.35	0.18	0.08	0.23	0.33	0.74	-0.56	0.35	-1.63	0.10
Household size	-0.02	0.04	-0.58	0.57	0.00	0.02	-0.08	0.93	-0.02	0.04	-0.54	0.59
respondent works	-0.20	0.33	-0.61	0.54	0.04	0.18	0.23	0.82	0.37	0.20	1.79	0.07
Husband is a migrant	-0.26	0.28	-0.93	0.35	0.22	0.12	1.76	0.08	-0.05	0.20	-0.27	0.79
Occupation of the husband (Ref: Agriculture)												
Others	0.03	0.31	0.11	0.92	0.34	0.18	1.90	0.06	0.50	0.26	1.91	0.06
Wage & Salaried	-0.73	0.51	-1.43	0.15	0.15	0.18	0.87	0.38	0.29	0.33	0.87	0.39
Possesses ration card	0.08	0.31	0.25	0.80	-0.40	0.14	-2.93	0.00	-0.07	0.21	-0.33	0.74
Contact with party in power	-0.38	0.44	-0.86	0.39	-0.74	0.24	-3.06	0.00	0.01	0.26	0.05	0.96
Intercept	-1.67	0.95	-1.76	0.08	-2.22	0.59	-3.78	0.00	-3.85	0.72	-5.35	0.00
N	1143											
Wald Chi^2	1168.68											
Count R^2	0.79											
AIC/n	1.38											

Note: The base outcome is "Always attained MDD".

Appendix Table A5: Results of multinomial probit model for MDD of children

Variables	Never attained MDD				Deteriorated				Improved			
	Coef.	Std. Err.	z	P>z	Coef.	Std. Err.	z	P>z	Coef.	Std. Err.	z	P>z
Age of the child (Ref: 6-12 months)												
13-18 months	-0.72	0.26	-2.80	0.01	0.02	0.30	0.06	0.95	-0.78	0.28	-2.78	0.01
19-24 months	-0.82	0.27	-3.04	0.00	0.12	0.31	0.39	0.70	-0.82	0.26	-3.22	0.00
25-36 months	-0.79	0.23	-3.38	0.00	0.01	0.27	0.04	0.97	-1.18	0.25	-4.74	0.00
Girl child	-0.15	0.14	-1.07	0.29	-0.26	0.17	-1.58	0.11	-0.17	0.14	-1.18	0.24
Education of the mother (Ref: No education)												
1-5 years of education	1.02	0.21	4.82	0.00	0.90	0.25	3.65	0.00	0.66	0.21	3.16	0.00
6-10 years of education	0.47	0.19	2.52	0.01	0.55	0.21	2.58	0.01	0.17	0.21	0.81	0.42
11-17 years of education	0.79	0.28	2.76	0.01	0.63	0.31	2.03	0.04	0.54	0.28	1.94	0.05
Socio-religious group (Ref: HFC)												
H-SC&ST	-0.33	0.46	-0.71	0.48	0.59	0.38	1.55	0.12	-0.40	0.38	-1.07	0.29
H-OBC	-0.48	0.48	-1.01	0.31	0.47	0.41	1.14	0.26	-0.23	0.40	-0.58	0.56
Muslim	-0.79	0.51	-1.54	0.12	0.47	0.43	1.08	0.28	-0.52	0.41	-1.25	0.21
Asset score	0.36	0.11	3.44	0.00	0.33	0.12	2.85	0.00	0.03	0.11	0.30	0.77
Landholding (Ref: No land)												
1-9 katha	0.74	0.24	3.10	0.00	0.38	0.28	1.39	0.17	0.67	0.24	2.79	0.01
10-19 katha	-0.31	0.26	-1.20	0.23	0.17	0.30	0.57	0.57	0.07	0.26	0.28	0.78
20 katha & above	-0.78	0.27	-2.94	0.00	-0.35	0.28	-1.27	0.20	0.07	0.26	0.29	0.77
Household size	-0.05	0.03	-1.65	0.10	-0.07	0.03	-2.08	0.04	-0.04	0.03	-1.30	0.19
Mother works	-0.07	0.21	-0.34	0.74	0.21	0.20	1.08	0.28	0.04	0.20	0.21	0.84
Father is a migrant	-0.10	0.15	-0.67	0.50	-0.03	0.17	-0.21	0.84	-0.17	0.15	-1.14	0.25
Occupation of the father (Ref: Agriculture)												
Others	-0.41	0.24	-1.70	0.09	-0.41	0.23	-1.82	0.07	-0.42	0.27	-1.56	0.12
Wage & Salaried	-0.41	0.28	-1.46	0.14	-0.44	0.27	-1.61	0.11	-0.25	0.30	-0.83	0.41
Possesses ration card	-0.54	0.18	-3.02	0.00	-0.45	0.21	-2.20	0.03	-0.42	0.19	-2.21	0.03
Contact with party in power	-0.11	0.23	-0.48	0.63	0.06	0.23	0.24	0.81	0.56	0.24	2.29	0.02

Variables	Never attained MDD				Deteriorated				Improved			
	Coef.	**Std. Err.**	**z**	**P>z**	**Coef.**	**Std. Err.**	**z**	**P>z**	**Coef.**	**Std. Err.**	**z**	**P>z**
Intercept	3.02	0.65	4.64	0.00	0.70	0.60	1.16	0.25	2.31	0.67	3.46	0.00
N	937											
Wald chi^2	1020.05											
Count R^2	0.48											
AIC/n	2.47											

Note: The base outcome is "Always attained MDD".

Appendix Table A6: Variations in Dietary Score and Minimum Dietary Diversity across age groups

Age in the first phase	Dietary score			Minimum Dietary Diversity		
	Pre-lockdown	Lockdown	Change (%)	Pre-lockdown	Lockdown	Change (%)
7-12 months	2.21	3.22	45.93	15.67	36.41	132.35
13-18 months	2.91	3.25	11.50	34.63	35.02	1.13
19-24 months	3.14	3.20	2.01	38.42	35.79	-6.85
25-36 months	3.18	3.12	-1.81	40.29	30.94	-23.21

ENDNOTES

[1] The value of the index in Bihar is 55, as compared to the national average of 59.

[2] JEEViKA is a World Bank aided Bihar Rural Livelihoods Project whose objective was the social and economic empowerment of the rural poor through self-help groups in Bihar. It was introduced in 2007. A Health and Nutrition Strategy component was subsequently introduced in 2016, with the objective of improving the dietary practices of women of reproductive age and their children through monthly meetings to build an awareness about such practices.

[3] Information was collected on landholdings, live-stock holdings, house type, and consumer durables for every household. Using principal component analysis, we constructed normalized factor scores, with a mean of zero and a standard deviation of one. Households were grouped into three tercile groups based on these scores.

[4] The introduction of mobile phones has increased teledensity in India—it is 57.59 connections per 100 persons in rural areas (Telecom Regulatory Authority of India, 2020). Hence, a telephonic survey is a viable survey method, even during COVID-19 (National Council of Applied Economic Research, 2020).

[5] The asset tercile groups had been formed based on data on 2250 respondents from the first phase survey.

[6] The recall period for the mother was weekly because the daily diet of adults is known to vary with exogenous causes like the presence of guests, family occasions, etc.

[7] The data set is hierarchical; in such cases, a multi-level model structure may be considered appropriate. Analysis of mean of village-level variables, like health facilities, landholding, etc. reveals negligible variations at district and block levels. Coefficients of district-level dummies in the regression model (not reported) are all insignificant at a 10 percent level. So, we have only corrected for village level variations in error terms through clustering.

[8] We had originally planned to estimate welfare change for cereals also; however, as cereal consumption was universal, we estimated welfare change using only pulse consumption.

[9] In the first stage, the probit model for mothers was estimated on BID, socio-religious identity, asset score, household size, whether respondent works, occupation of husband, and whether he is a migrant; in case of children, education of mother, age, and gender of the child, and the number of living children was added. The variables whose coefficients were insignificant were dropped. WTP was estimated for the reduced models. Stata codes were taken from Lopez-Feldman (2016).

[10] As cereals and pulses were distributed free during the lockdown, we took the actual time to collect rations as the actual price paid by the household.

[11] NFHS data reveals that, during 1998-99, only 21.5 percent of women belonging to the 15-49 years age group consumed fish, egg, or meat once a week, while the all-India average was 31.9 percentage. During 2015-16, these percentages were 30.8 and 42.8 for Bihar and India, respectively.

[12] To test this hypothesis, we have examined the changes in DS and MDD over different age groups (Appendix Table A6). The increase in the number of food groups consumed is highest among children in the age group 7-12

months, who are being weaned from breast milk; the increase in the proportion of children complying with MDD is also highest for this age group. In contrast, children aged 25-36 months experience a decline in both DS and MDD, while those aged 19-24 months are observed to experience a marginal increase in DS and a decline in compliance with MDD norms. So, the improvement in consumption, reflected in increases in both DS and MDD is partly due to children growing older, and having to be weaned away from breast milk.

[13] It was reported that 68 percent of respondents faced considerable difficulty in meeting their food requirements (Gaon Connection and Lokniti-CSDS, 2020), and every fifth household had already run out of money and supplies (Dalberg, 2020). Rural households were also affected severely. Apprehensions were voiced that a large proportion of households, particularly the urban poor, would not be able to survive any longer without assistance; in Bihar, this figure is over 90 percent (Chicago Booth and Rustandy Centre for Social Sector Innovation, 2020).

[14] The large stocks of cereals and pulses acquired by the Food Corporation of India were an important factor in this context. As per its report dated 11.06.2020, FCI had 270.89 LMT rice and 540.80 LMT wheat (https://pib.gov.in/PressReleasePage.aspx?PRID=1631110).

[15] It was reported that:

> "vendors of fresh produce as well as transporters have faced considerable difficulties in securing movement passes and permissions for their operations. Several (vendors) are unaware of the rules. Overzealous law enforcers have focussed on enforcing the lockdown, rather than maintaining food supply chains. There have also been worrying reports of social and religious discrimination in many cities – barring vendors belonging to certain minority communities from selling in some neighbourhoods, or barring entry of people from some ethnic background in certain supermarkets" (Narayananan & Saha, 2020).

[16] The majority of respondents without ration cards belong to the top asset tercile group (44 percent). Most households in this group have landholdings above 6 *kathas* (40 percent), with a mean land holding above 14 *kathas*. They are, thus, not dependent on the PDS for cereal and pulse consumption, but able to grow them on their own land; their better financial position also enables them to procure cereals and pulses from the open market.

[17] This is because telephonic surveys may create measurement errors due to social desirability bias (Holbrook et al., 2003), especially if respondents want to finish off the interview quickly; other mechanisms leading to response bias in telephonic surveys include pressuring respondents to respond through verbal introductory statements to the survey and not offering a Don't Know option (Graeff, 2002).