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There should always be a free lunch: the impact of COVID-19 lockdown suspension of the mid-day meal on nutriture of primary school children in Karnataka, India

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ABSTRACT

Background The COVID-19 pandemic lockdown in 2020 resulted in school closures with eventual suspension of the mid-day meal programme, biannual deworming and iron–folic acid supplements. One year into the lockdown, we evaluated the impact of the withdrawal of these programmes on the nutritional status of rural primary-school children, aged 6–12 years, in Karnataka, India.
Methods Anthropometry, haemoglobin, serum ferritin and C reactive protein were measured in 290 children at two time points, 1 year apart, starting from just before the lockdown (February 2020 to February 2021).
Results The prevalence of anaemia doubled from 21% to 40% ($p<0.0001$) with more pronounced changes in older girls (10%–53%); however, the prevalence of iron deficiency did not change (48.8%–51.9%), despite cessation of deworming and iron/folic acid supplements.
Conclusion The increase in anaemia was due to limiting intakes of other erythropoietic nutrients, possibly due to a lower dietary diversity. The mid-day lunch meal at school (MDM) is an important part of daily food intake in rural school children, and it is important to maintain dietary diversity through the delivery of MDM for such vulnerable groups.

INTRODUCTION

The effect of the COVID-19 pandemic, and its associated lockdowns, on the nutritional status of vulnerable populations has been a constant worry for governments. Globally, lockdowns have caused job losses and economic downturns and were reported to have led to a sharp increase in household food insecurity, fueled by loss of livelihoods.[1] However, there is little quantitative evidence on the nature and magnitude of the effect of these lockdowns on the nutritional status of vulnerable populations. In India, all children attending government run schools are beneficiaries to a free daily mid-day lunch meal at school (MDM) which form a significant part of their daily food intake.[2] The evaluation of the impact of the lockdown-induced school closures and withdrawal of the MDM on the nutritional status of primary school children would be a valuable indicator for mitigating policy actions.

We were able to quantify effects of MDM suspension on the nutritional status of primary school children at 1 year post the nationwide (24 March 2020) lockdown, with the attendant closure of schools, which completely stopped the MDM programme along with other school-based programmes like biannual deworming and the weekly iron/folic acid (IFA) supplementation programme.[3] Even though the lockdown was intermittent with successive waves of the pandemic in rural India, schools remained continuously closed, such that children did not have access to the MDM programme (between March 2020 and May 2022).

METHODS

In February 2020, we were about to initiate the evaluation of the impact of an iron-fortified rice intervention in 290 rural primary school children aged 6–12 years on iron deficiency (ID) anaemia, in a socioeconomically poor district (Koppal) in the Indian state of Karnataka. The studies were approved by the Institutional Ethical Committee (IEC No:26/2019) and registered under Clinical trials registry of India (CTRI/2019/04/018567), prior to the start of the study informed consent was obtained from the parents of the children and oral ascent was obtained from the children. Children aged 6–12 years, from rice eating household, with no chronic illness or allergies and not taking any drugs or vitamin mineral supplements were included. Just before the lockdown, we had conducted a careful, quality-controlled baseline evaluation of anthropometry (height measured to the nearest 0.1 cm by portable stadiometer, Medifit, India; and weight measured to the nearest 0.1 Kg by digital weighing scale, Dr Morepan DS-03, India). Standard measures were used for instrument calibration. A venous blood sample was also drawn, and haemoglobin (Hb) was immediately measured at the site laboratory (cyanmethemoglobin method, Beckam Coulter Counter, USA). Serum was immediately separated, and frozen aliquots were transported to Bengaluru on dry ice and stored at −80°C until analysis for serum ferritin (electrochemiluminescence, Roche) and C reactive protein (immunoturbidometry, Roche) concentrations. Bio-Rad trilevel haematology and immunoassay controls were used as quality control materials for each assay and coefficient of variation for all assays was <5%.

One year later, in February 2021, when restrictions eased, we planned to restart the intervention and re-evaluated all the baseline measures in the same children. All measures and blood sampling at both the time points were carried out at the school premises in the village. In consequence, we could evaluate the impact of the year-long suspension of the MDM programme on the children's anthropometry and iron status along with suspension of the weekly IFA supplementation and biannual deworming programme.

RESULTS AND DISCUSSION

During the 1-year lockdown period, there was a greater increase in the prevalence of anaemia, which almost doubled from 21% to 40% (p<0.0001, table 1), although the prevalence of ID did not change (48.8%–51.9%), while the change in Hb was similar in younger (<10 years) boys and girls and (>10 years) older boys, at about −0.36 g/dL to −0.42 g/dL, the change was much higher in older girls (−1.02 g/dL), resulting in more than 30 percentage points increase in anaemia prevalence in older girls (p<0.001).

With respect to anaemia, this combination of findings might indicate a poor utilisation of iron stores for Hb synthesis, due to a decline in the intake of the many other erythropoietic micronutrients such as vitamin B_{12}, vitamin B_2 and folate that come from an adequate and diverse diet. The larger adverse change in older girls might be because during early adolescence to puberty, there is a sharp increase in erythropoietic nutrient requirements to support the needs related to menarche and the pubertal growth spurt;[4] and household diets may not be adequate for this purpose and the prevailing economic hardships worsened due to COVID-19 may have further limited their daily nutrient intake. Physical activity is also a demand factor for Hb synthesis,[5] and it is possible that the children were less active in a locked down home, although we did not measure physical activity. At the same time, the prevalence of ID did not worsen, even though the IFA programme was also suspended. This suggests that the existing household food intake was adequate with regards to iron content, or there was a possible upregulation in iron absorption. All these findings point to an inadequate utilisation of iron stores for the formation of Hb, highlighting the 'other' erythropoietic nutrients. A recent national survey of iron status and anaemia reported that ID prevalence was higher, but anaemia was lower, in urban compared with rural children, pointing to a better iron utilisation for erythropoiesis in the former.[6] The findings here emphasise the greater importance of ensuring the supply of diverse food like the MDM single-nutrient supplementary approaches.

The children grew normally and this maintenance of child growth (table 1, height and weight, as well as body mass index, BMI) over the year may be reflective of the supply of dry rations (depending on age, this was supposed to be 3–4.5 Kg cereal, 0.5–0.75 Kg pulses and 0.2 Kg oil/month/child) that was given to the homes of

Table 1 Comparison of anthropometry, iron status and prevalence of anaemia in children with 1 year of suspension of the MDM, IFA supplementation and bi-annual deworming

Parameters	February 2020 (N=290)	February 2021 (N=290)	P value
Age (y)*	8.4±1.4	9.7±1.4	<0.0001
Weight (Kg)*	20.8±3.6	24.4±5.2	<0.0001
Height (cm)*	121.9±8.3	129.4±8.5	<0.0001
BMI for age Z-score*	−1.52±0.86	−1.48±1.06	0.18
Haemoglobin (g/dL)*	12.1±1.1	11.6±1.1	<0.0001
Serum ferritin (ng/mL)‡§	15.1 (10.4, 20.3)	14.8 (9.80, 23.4)	0.037
Anaemia (%)†	62 (21.3%)	115 (39.5%)	<0.0001

*Paired t-test.
†Mc-Nemar's χ^2 test.
‡Wilcoxon Sign-Rank test.
§Mean±SD; median (quartile 1, quartile 3).
BMI, body mass index; ID, iron deficiency, measured based on serum ferritin cut-off <15 ng/mL; IFA, iron folic acid; MDM, mid-day meal.

the children and distributed through the school authorities. However, the provision of these dry rations was only made for 6 months, from June to December 2020, and might have also resulted in less diverse, cereal-dependent and low fruit/vegetable diets at home, resulting in a relative preservation of body weight (and perhaps fat), but more profound impact on Hb levels. The lack of activity in locked down children might also be a factor. As a limitation, the absence of a control group weakens the attribution of the causal effect of suspended MDM and other programmes on the outcome.

We reflect here, even with the limitation of this study design, that the good-quality and diverse-free lunch at primary school is much needed. Studies have already shown the immediate benefits in normal times, for example, a better school attendance.[7] Lunch is the important, even main, meal of the day for poor, rural school children, as a study in an adjoining district showed only half the children received more than one additional meal at home.[8] There was also perhaps a worsening of conditions at home due to the accompanying economic slowdown, which we did not assess, which could have also resulted in a reduced quality of the household diet.[9] The second and third waves of the pandemic are now on us, and the need to safeguard the continuous provision of one diverse meal to the school-going children should remain a priority.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by IEC Ref No: 26/2019 Institutional Ethics Committee, St Johns Medical College and Hospital, Sarjapur Road, Bangalore 560034. Participants gave informed consent to participate in the study before taking part.

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REFERENCES

1 Nguyen PH, Kachwaha S, Pant A, *et al*. Impact of COVID-19 on household food insecurity and interlinkages with child feeding practices and coping strategies in Uttar Pradesh, India: a longitudinal community-based study. *BMJ Open* 2021;11:e048738.
2 Swami D, Gurtoo A. Criticality of midday meals for school children post COVID-19. *IIScCSP* 2020.
3 Interventions of the Anemia Mukt Bharat Programme. Anemia Mukt Bharat Dashboard, 2021. Available: https://anemiamuktbharat.info/home/interventions/ [Accessed 22 Jun 2021].
4 Soliman A, Sanctis D V, Elalaily R. Nutrition and pubertal development. *Indian J Endocrinol Metab* 2014.
5 Hu M, Lin W. Effects of exercise training on red blood cell production: implications for anemia. *Acta Haematol* 2012;127:156–64.
6 Kulkarni B, Peter R, Ghosh S, *et al*. Prevalence of iron deficiency and its sociodemographic patterning in Indian children and adolescents: findings from the comprehensive national nutrition survey 2016-18. *J Nutr* 2021;151:2422–34.
7 Singh S, Gupta N. Impact of mid day meal on enrollment, attendance and retention of primary school children. *Int J Sci Res* 2015;4:1203–5.
8 Karnataka Evaluation Authority. *Hyderabad Karnataka centre for advanced learning Kalburgi. Department of primary and secondary education: evaluation of impact of mid-day meals schemes in Karnataka state (2016-17). Department of planning, programme monitoring and statistics. government of Karnataka*, 2021.
9 Harris J, Depenbusch L, Pal AA, *et al*. Food system disruption: initial livelihood and dietary effects of COVID-19 on vegetable producers in India. *Food Secur* 2020;12:841–51.