Mass Deworming: Does it Impact Nutritional Outcomes in Children?

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The August, 1973 issue of *Indian Pediatrics* published a research paper on the feasibility of periodic deworming in supplementary nutrition programs [1]. As soil transmitted helminthiasis (STH) remains a major public health problem across the globe, especially in low- and middle-income countries, even today, this study is worth a revisit.

THE PAST

The Paper

The study was conducted over a 4-month period and aimed to assess the effect of periodic deworming on parasite infestation rates among children and pregnant/nursing mothers in four villa-ges of the Bassein block in the Thana district of Maharashtra. The context explained by authors for conducting this study was that the Supplemental Nutrition Programme (SNP) being carried out in these villages through the initiatives of Government of Maharashtra, was probably not showing full efficiency and cost-effectiveness due to high rates of roundworm infestations among children in these areas. A total of 842 individuals (520 pre-school children from 6 months to 6 years of age, 285 school children from 6 years to 13 years of age, and 37 pregnant/nursing mothers) were adminis-tered the anti-parasite medication piperazine at intervals of 3 months, distributed along with supplementary food on a given day. Stool samples were taken from around 25% of the beneficiaries (213 individuals), prior to administration of piperazine, which showed an overall infestation rate of around 30% (64 individuals), the rates being similar in pre-school (31%) and school children (28%). Post piperazine, successive monthly stool sampling till the next dose, showed that 78% had turned negative, 13.5% showed improvement, while 8.5% showed same or worsened status.

The authors thus concluded that mass periodic deworming was a feasible and worthwhile effort, with no extra cost, no additional need for trained staff if incorporated in the existing SNP. However, the authors admitted that the translation of this deworming exercise in to beneficial change in nutritional status of the individuals was not studied.

Historical Background

The concept of mass deworming or preventive chemotherapy, for soil-transmitted helminths (STH) and schis-tosomiasis in areas with a high prevalence has been supported by many studies in the past, especially from low-income countries, like Ethiopia, Kenya, Guetemala, Bangladesh, Vietnam, Cameroon, Indonesia, etc. [2]. Worm infections were hypothesized to interfere with nutrient uptake, leading to anemia, malnutrition and even impaired cognitive development. One of the largest studies from India, by Awasthi, et al. [3] was conducted in 1995. This open-labelled, cluster-randomized trial, including nearly 4000 children between one and five years of age, receiving albendazole every 6 months over 2 years, showed a significantly greater weight gain in the albendazole-treated arm than the placebo arm; though, height gain was similar in both groups.

In 2001, World Health Assembly urged all endemic member states to attain a minimum target of regular administration of preventive chemotherapy to at least 75% of all school-age children at risk of morbidity by 2010 [4]. By 2014, nearly 400 million pre-school and school-aged children, comprising 47% of children-at-risk had been treated [5]. The World Health Organization (WHO) recommended periodic administration of the anthelmintic medicines in areas where prevalence of any STH infection was more than or equal to 20%, again with a target of covering at least 75% of the children living in STH endemic countries, by 2020 [5].

THE PRESENT

Following the recommendation for mass deworming by WHO, nearly one-third of children in low- and middle-

income countries are being treated for worms via school- or community-based programs, most commonly used deworming drugs being albendazole, mebendazole, and praziquantel [6]. Clearly, such school-based mass treatment is more cost-effective than screening-based treatment, as screening costs are expected to be 4-10 times than the cost of treatment [1].

In India, WHO estimated around 241 million (68%) children between the ages of 1 and 14 years, to be at risk of parasitic infestation. The Government of India, in 2015, took the initiative to observe a National Deworming Day (NDD) on 10 February, with a Mop-up-Day on 15 February, in order to deworm all pre-school and school children from 1 to 19 years of age, using the drug albendazole, through the platform of all Government and Government-aided schools and Anganwadi Centers across the country [7]. Besides the Ministry of Health and Family Welfare (MOHFW) being the nodal agency, other key stakeholders included the Departments of School Education and Literacy under Ministry of Human Resource Development and Women and Child Development (ICDS) in the program. The program turned out to be the world's largest deworming campaign covering about 270 million children across the country in 2015. Since then, the program continues to be operational.

A report of the MOHFW in October, 2020 [8], published the evidence-based impact of the NDD, from data of follow-up surveys in 14 states of India, led by National Centre for Disease Control (NCDC). While their baseline mapping of STH in 2016, across the country showed a prevalence varying from 12.5 % in Madhya Pradesh to 85% in Tamil Nadu, the follow-up survey showed reduction compared to the baseline prevalence, with the states of Chhattisgarh, Himachal Pradesh, Megha-laya, Sikkim, Telangana, Tripura, Rajasthan, Madhya Pradesh and Bihar showing substantial reduction in worm prevalence.

Indian Pediatrics has also been publishing evidence regarding this aspect over the years, the results of the studies being inconsistent [9,10]. In a study of children (4th to 7th standard) in three rural schools in Gujarat [10], it was found that iron-folic acid supplementation combined with deworming showed higher increase in the hemoglobin levels, compared to deworming alone. However, there was no significant change in the prevalence of malnutrition or physical work capacity of the children.

In the global perspective; however, there is controversial evidence regarding the impact of mass deworming on the growth, nutrition and overall health outcomes in children. A recent Cochrane review [2] identified 51 trials (10 being cluster-RCTs), one of the trials including over one million children, with the remaining 50 including a total of 84,336 participants. All except two of the18 trials, reporting the effect of periodic deworming (every three to six months) on weight, showed little or no effect on average weight, irrespective of the prevalence of parasite burden. The two trials showing significant average weight gain included one study done three decades ago in the high burden area of Kenya, and another study from India in a low prevalence area (Lucknow), whereas the subsequent studies in the same area did not show an effect. Similar inconclusive results were seen in the other nutritional parameters. Thus, the review concluded that public health programs conducting mass deworming do not appear to improve weight, height, hemoglobin, cognition, school performance, or mortality. They caution against selecting only the evidence from older studies as a rationale for contemporary mass treatment programs. Another systematic review including all types of studies, published in 2017, echoes the same conclusions that mass deworming for soil-transmitted helminths had little effect with uncertain impact on long-term economic productivity [11].

On the other hand, the report of the demographic and health surveys including only pre-school children (1-4 years), across 45 countries in Africa, the Americas, Asia, and Europe from 2005 to 2016, showed that among the 3,25,115 children, there was a robust and consistent association between deworming and reduced stunting, with additional evidence for reduced anemia in sub-Saharan Africa; though, no consistent association was observed between deworming and improved weight [12].

A most recent meta-analysis published in March, 2022 [13], updating the previous Cochrane review [2], found that in areas with >20% prevalence of STH, multiple-dose deworming significantly increased the weight, mid-upper arm circumference and height of children, with mass deworming being more cost-effective than widely implemented school-feeding programs. The authors did; however, state that mass deworming is not useful in worm-free populations, or those with very low infection prevalence [13].

So, the policies regarding mass deworming campaigns need to be revisited, and perhaps tailored to be implemented in regions as per their prevalence of parasite burden, expected benefits and costs, with a system of closely monitored follow-up surveys assessing the nutritional and health outcomes of children, as well as the long-term educational and economic impact on the country.

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REFERENCES

1. Pyle DF. The feasibility of periodic deworming in supplementary nutrition programs. Indian Pediatr. 1973;10: 507-10.

2. Taylor-Robinson DC, Maayan N, Donegan S, et al. Public health deworming programmes for soil-transmitted helminths in children living in endemic areas. Cochrane Database Syst Rev. 2019;9:CD000371.
3. Awasthi S, Peto R, Pande VK, et al. Effects of deworming on malnourished preschool children in India: an open-labelled, cluster-randomized trial. PLoS Negl Trop Dis. 2008; 2:e223.
4. World Health Organization. Soil-transmitted helminthiasis number of children treated 2007-2008: Update on the 2010 global target [Internet]. World Health Organization, 2016. Accessed May 31, 2023. Available from: *https://www.who.int/publications-detail-redirect/who-wer8516-141-147*
5. Soil-transmitted helminthiases: Number of children treated in 2014 [Internet]. World Health Organization, Weekly epidemiological record; 18 Dec, 2015. Accessed May 31, 2023. Available from: *https://www.who. int/publications-detail-redirect/who-wer9051-705-711*
6. Ahuja A, Baird S, Hicks JH, et al. Economics of mass deworming programs. *In*: Bundy DAP, Silva Nd, Horton S, et al, editors. Child and Adolescent Health and Develop-ment. 3rd edition. The International Bank for Recons-truction and Development / The World Bank; 2017.
7. National Health Mission, Ministry of Health and Family welfare, Government of India. Operational Guidelines National Deworming Day [Internet]. Accessed May 31, 2023. Available from: *https://nhm.gov.in/images/pdf/NDD/Guidelines/NDD_ Operational _ Guidelines.pdf*
8. Ministry of health and Family Welfare, Government of India. Evidence-based impact of National Deworming Day in India; Oct. 20, 2020. [Internet]. Accessed May 31, 2023. Available from: *https://pib.gov.in/PressReleasePage.aspx?PRID=1666053*
9. Sarkar NR, Anwar KS, Biswas KB, Mannan MA. Effect of deworming on nutritional status of ascaris infested slum children of Dhaka, Bangladesh. Indian Pediatr. 2002;39: 1021-6.
10. Bhoite RM, Iyer UM. Effect of deworming vs Iron-Folic acid supplementation plus deworming on growth, hemo-globin level, and physical work capacity of schoolchildren. Indian Pediatr. 2012;49:659-61.
11. Welch VA, Ghogomu E, Hossain A, et. al. Mass deworming to improve developmental health and wellbeing of children in low-income and middle-income countries: a systematic review and network meta-analysis. Lancet Glob Health. 2017;5:e40-e50.
12. Lo NC, Snyder J, Addiss DG, et al. Deworming in pre-school age children: A global empirical analysis of health outcomes. PLoS Negl Trop Dis. 2018;12:e0006500.
13. Croke K, Hicks J, Hsu E, et al. Meta-analysis and public policy: reconciling the evidence on deworming. NBER Working Paper No. w22382. July, 2016. Accessed May 31, 2023. Available from: *https://ssrn.com/ abstract=2807693*