research

Malnutrition in Chinese infants
p 143

SGLT-2 inhibitors and recurrent nephrolithiasis
p 146

Malnutrition falls among China's young children

ORIGINAL RESEARCH Cross sectional study

Malnutrition in infants aged 6-23 months in China's poorest rural counties from 2016 to 2021

Huo J, Huang Y, Jing Sun J, et al

Cite this as: *BMJ* 2024;387:e079499
Find this at doi: 10.1136/bmj-2024-079499

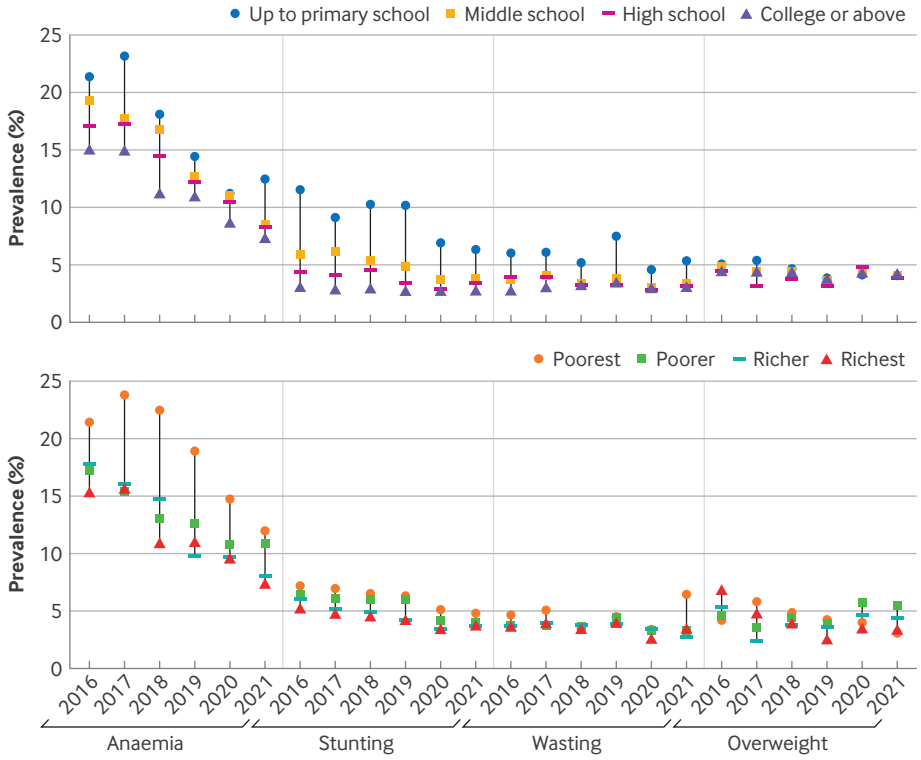
Study question What are the underlying factors contributing to inequalities in the health of infants aged 6-23 months in the poorest rural areas of China, and how effective has China's poverty alleviation programme, initiated in 2013, been at reducing malnutrition among these children?

Methods In this cross sectional study, six consecutive surveys were conducted annually from 2016 to 2021 in 116 counties across 19 provinces, representing China's 832 poorest counties. The main outcome measures were prevalence of anaemia, stunting, wasting, and overweight. All outcomes were stratified by quarters of county gross domestic product (GDP) and mothers' educational level.

Study answer and limitations Overall, 210 088 infants aged 6-23 months were included. From 2016 to 2021, decreases in prevalence were reported for anaemia (from 18.3% to 8.9%); stunting (7.5% to 4.1%); wasting (4.7% to 3.7%); and overweight (3.1% to 2.8%). Differences in child growth by county GDP quarter were small and decreased over time. However, growth differences related to education persisted: infants of mothers educated up to primary school level had twice the risk of stunting (adjusted rate ratio 2.29 (95% confidence interval 1.87 to 2.81)) and wasting (1.73 (1.40 to 2.13)) compared with infants of mothers with a college degree. For all outcomes, differences related to sex and education were largest at 6 months of age. It was not possible to establish causality owing to the cross sectional design of this study.

What this study adds China's poverty alleviation programme has made progress in reducing malnutrition among infants aged 6-23 months in the poorest rural areas. Future child malnutrition policies should focus more on maternal care and interventions during the breastfeeding period and earlier.

Funding, competing interests, and data sharing Funded by the China National Natural Science Foundation Excellent Young Scientist Program. No competing interests declared. Individual participant data will not be publicly available but may be requested 9-36 months after publication.



Prevalence of anaemia, stunting, wasting, and overweight among infants aged 6-23 months in China's poorest rural counties, by mother's educational achievement (top) and by quarters of gross domestic product (bottom), 2016-21

KEVIN FRAYER/GETTY IMAGES

Future child malnutrition policies should focus more on maternal care and interventions during the breastfeeding period and earlier

COMMENTARY New evidence supports the success of a programme targeting the poorest

Despite some progress, undernutrition remains a major cause of mortality in children in low and middle income countries.[1] No region is currently on track to achieve the sustainable development goal 2.2 target of a 50% reduction in the number of children aged <5 years with stunting from 2015 to 2030.[2] Some countries or subregions, however, have succeeded in substantially cutting the prevalence of undernutrition over the past 15 years or so. Huo and colleagues' linked analysis of cross sectional surveys carried out in the poorest counties of China, for example, documented remarkable progress in the reduction of child undernutrition, thanks to a large programme to alleviate poverty and to improve nutrition in children, including the distribution of micronutrient supplements.[3] Between 2016 and 2021, the prevalence of anaemia among infants aged 6-23 months had decreased by more than half and stunting by more than a third. Although variation according to county income diminished over time, inequities related to maternal education persisted.

Overweight usually increases as undernutrition slowly recedes and income increases

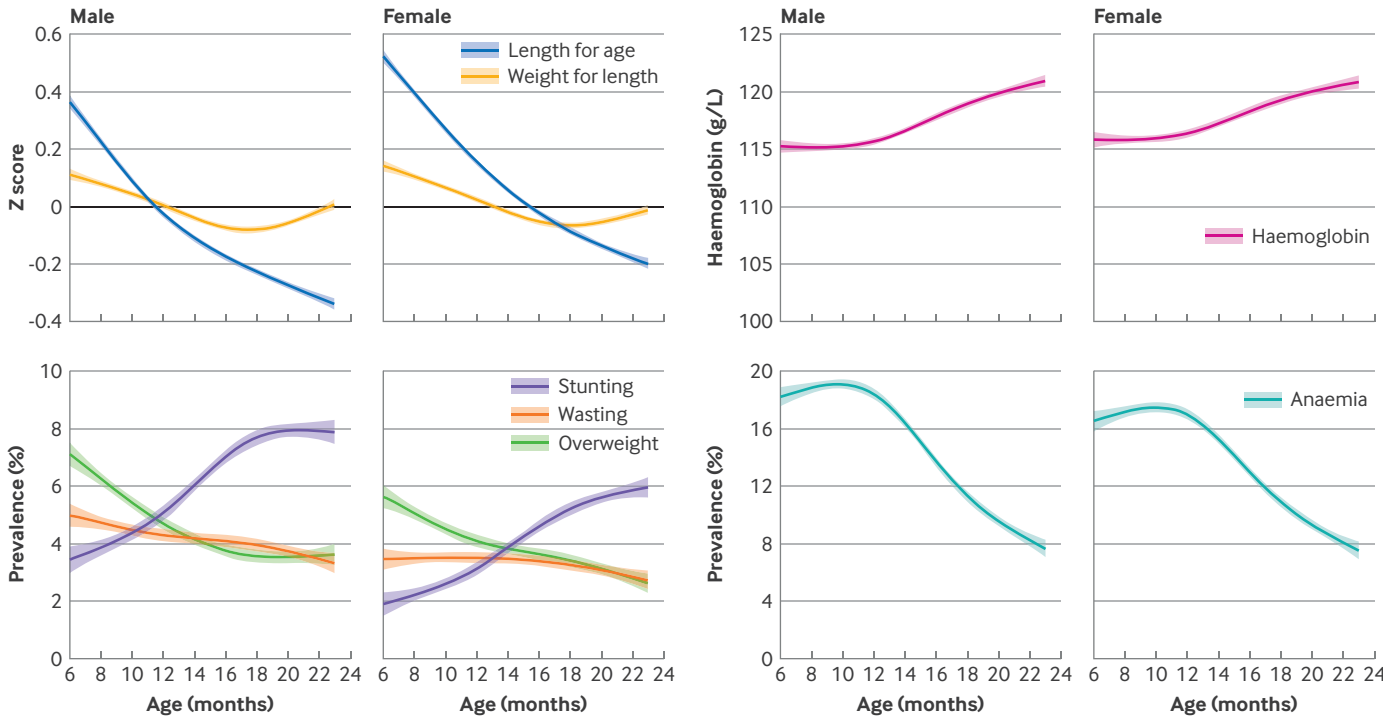
The positive role of maternal education in protecting children's nutritional health is well established.[4] The new study confirmed this finding, showing that infants whose mothers only completed primary school had roughly twice the risk of stunting or wasting compared with infants of mothers with a college degree. Is there a threshold for maternal education as a protection against stunting in infants? One study from East Africa suggested about 10 years of schooling, although thresholds are likely to be context specific.[5]

In Huo and colleagues' study, the highest rate of undernutrition was observed among infants aged 6 months.[3] Research indicates that in an estimated 20-30% of children stunting might already be present at birth.[6] Growth status in early childhood reflects, at least partly, the intergenerational origins of stunting. One study of large representative samples of children and mothers from 54 low to middle income countries, reported a robust inverse association between maternal height and mortality, underweight, and stunting in children.[7] Birth weight and maternal height were inversely associated with stunting among 6 month old infants in South Africa.[8] It is therefore important for nutrition and health interventions to target women before and during pregnancy.

Poverty and child malnutrition

Huo and colleagues' study found that differences in infant growth by county gross domestic product (an indicator of wealth) almost disappeared between 2016 and 2021, suggesting that the programme successfully addressed socioeconomic

Hélène Delisle
Helene.delisle@umontreal.ca
See bmj.com for author details



Anthropometric measures (length-for-age z scores, weight-for-length z scores, and haemoglobin concentrations) and prevalence of anaemia, stunting, wasting, and overweight by sex and age among infants aged 6-23 months in China's poorest rural counties, 2016-21

inequalities. Poverty is a major driver of undernutrition.[9] A recent systematic review confirmed that, along with maternal education, household income was among the most consistent factors associated with child malnutrition.[10] Greater wealth is associated with less child food poverty—that is, the inability to access and consume a nutritious and diverse diet.[11] In Huo and colleagues' study, the proportion of infants with a minimally acceptable diet increased over time, which likely reflects reduced poverty; indeed, over the five years of the study period, between 2016 and 2021, the proportion of children in the top fourth of gross domestic product increased, while the proportion of children in the bottom fourth decreased, suggesting that household income had somewhat improved.

Huo and colleagues' study was part of the monitoring and evaluation of the Ying Yang Bao programme, a nutrition intervention targeting the poorest rural areas of China since 2013. The programme includes distribution of a locally produced soy based micronutrient supplement containing iron, zinc, calcium, vitamin A, vitamin D, folate, and vitamins B_1, B_2, and B_6; alongside nutrition education for adult caretakers.

What explains the findings?

An evaluation in 2012 showed reduced anaemia and improved cognitive performance among children in the intervention areas.[12] The extent to which improvements shown in Huo and colleagues' study can be attributed to the Ying Yang Bao programme remains unclear, given its uncontrolled observational design. Notably, however, the proportion of infants with a minimally acceptable diet increased over the study period as mentioned above, and income also seemed to increase; both factors that could have mediated the reported progress. Strong evidence of effect usually requires randomised controlled trials, although plausibility designs are often the only feasible option for evaluating large and complex interventions such as this one, and still provide valuable evidence.[13] In these pragmatic observational designs, the onus is to show the plausibility of an association between the intervention (adequately delivered) and positive public health gain.

Notably, although stunting and wasting declined over the study period, the authors observed no increase in the prevalence of overweight among infants aged 6-23 months. Furthermore, overweight was not associated with maternal education, in contrast with stunting. Overweight usually increases as undernutrition slowly recedes and income increases, leaving a double burden of undernutrition and overweight as a result. The nutrition programme implemented in the poorest rural counties of China may have been successful on both fronts—Huo and colleagues' findings suggest it was associated with a fall in undernutrition during the first two years of life, without an increase in overweight.

Cite this as: *BMJ* 2024;387:q2158

Find the full version with references at http://dx.doi.org/10.1136/bmj. doi: 10.1136/bmj.q2158

Comparative effectiveness of sodium-glucose cotransporter-2 inhibitors for recurrent nephrolithiasis among patients with pre-existing nephrolithiasis or gout

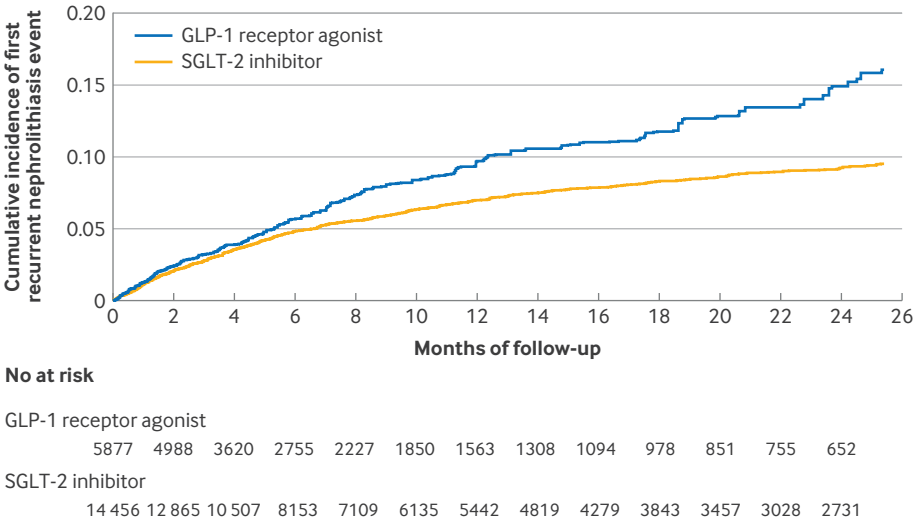
McCormick N, Yokose C, Lu N, et al

Cite this as: *BMJ* 2024;387:e080035
Find this at doi: 10.1136/bmj-2024-080035

Study question How effective are sodium-glucose cotransporter-2 (SGLT-2) inhibitors for the prevention of recurrent nephrolithiasis compared with other contemporary second line glucose lowering agents, in patients with pre-existing nephrolithiasis and type 2 diabetes?

Methods This study used the target trial emulation framework to assess rates of recurrent nephrolithiasis among Canadian patients with type 2 diabetes. A new user cohort study with inverse probability weighting was used to compare the risk of recurrent nephrolithiasis among people with type 2 diabetes and pre-existing nephrolithiasis who initiated an SGLT-2 inhibitor versus a glucagon-like peptide-1 (GLP-1) receptor agonist or dipeptidyl peptidase-4 (DPP-4) inhibitor (an active comparator), including patients with concomitant gout as well as rates of recurrent gout flare-ups.

Study answer and limitations After inverse probability weighting, 1924 recurrent nephrolithiasis events occurred among the 14 456 weighted patients who used an SGLT-2 inhibitor (105.3 per 1000 person years), compared with 853 events among the 5877 weighted patients who used a GLP-1 receptor agonist (156.4 per 1000 person years). The adjusted rate ratio was 0.67 (95% confidence interval (CI) 0.57 to 0.79) and rate difference was −51 (95% CI −63 to −40) per 1000 person years, with a number needed to treat (NNT) of 20. Protective associations persisted for nephrolithiasis requiring emergency department visits, hospital admissions, or procedures, and when an SGLT-2 inhibitor was compared with a DPP-4 inhibitor: rate ratio 0.73 (0.68 to 0.78) and rate difference −38 (−46 to −29) per 1000 person years. Protective associations also persisted among patients with nephrolithiasis and concomitant gout, with a rate ratio of 0.67 (0.57 to 0.79) versus a GLP-1 receptor agonist and 0.63 (0.55 to 0.72) versus a DPP-4 inhibitor. Furthermore, SGLT-2 inhibitor use was associated with a lower rate of gout flare-ups (rate ratio 0.72, 0.54 to 0.95) compared with a GLP-1 receptor agonist, and 0.65 (0.52 to 0.82) compared with a DPP-4 inhibitor. SGLT-2 inhibitors were only assessed in people with type 2 diabetes, and data on the composition of the stones were not available.



No at risk

GLP-1 receptor agonist	5877	4988	3620	2755	2227	1850	1563	1308	1094	978	851	755	652
SGLT-2 inhibitor	14 456	12 865	10 507	8153	7109	6135	5442	4819	4279	3843	3457	3028	2731

Cumulative incidence of first recurrent nephrolithiasis overall among patients initiating an SGLT-2 inhibitor versus a GLP-1 receptor agonist. Cumulative incidence among GLP-1 receptor agonist initiators was adjusted using stabilised inverse probability of treatment weighting, weighted to the respective initiators of SGLT-2 inhibitors. GLP-1=glucagon-like peptide-1; SGLT-2=sodium-glucose cotransporter-2

What this study adds For patients with an existing indication, an SGLT-2 inhibitor could be a useful addition to current nephrolithiasis treatments to simultaneously manage nephrolithiasis recurrence and comorbidities, including gout.

Funding, competing interests, and data sharing
Funded by the National Institutes of Health and Canadian Institutes of Health Research. See full paper on bmj.com for competing interests. The data used in the study are not publicly available.