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(Review Article)

PUBLIC HEALTH INTERVENTIONS ADDRESSING MICRONUTRIENT DEFICIENCIES AMONG CHILDREN WITH OBESITY IN THE UNITED KINGDOM: A SYSTEMATIC REVIEW AND NARRATIVE SYNTHESIS

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ABSTRACT

Background: Childhood obesity can coexist with inadequate micronutrient intake or status, creating a double burden in which excess adiposity does not protect against undernutrition. In the United Kingdom, interventions have commonly targeted diet, physical activity and weight, but the extent to which they correct micronutrient deficiencies in children with obesity remains uncertain.

Objective: To synthesise evidence on the effectiveness of UK public health interventions that address micronutrient deficiency in children with obesity, while distinguishing direct micronutrient outcomes from indirect dietary and anthropometric outcomes.

Methods: CINAHL, PubMed, Scopus and Web of Science were searched between 19 and 31 December 2023 using terms for childhood obesity, micronutrients and public health interventions. Eligibility was framed around UK children aged 0-18 years, public health interventions, and measurable micronutrient or dietary outcomes. Study selection followed a PRISMA flow. Randomised and cohort studies were appraised with Critical Appraisal Skills Programme tools, and cross-sectional studies with the Centre for Evidence-Based Medicine checklist. Because designs, populations, interventions and outcomes were heterogeneous, findings were synthesised narratively.

Results: The searches identified 2,166 records; 16 studies were included after deduplication, screening and full-text assessment. Multicomponent family- and community-based programmes reported improvements in BMI z-score, waist circumference, physical activity and fruit and vegetable consumption, but one programme relied on pre-post data with substantial attrition. Large school-based cluster trials generally found no significant improvement in primary BMI, physical activity or fruit and vegetable outcomes, although some secondary behaviours improved. Dietary studies identified low vitamin D or iron intake, high free-sugar intake and socioeconomic variation. Crucially, the included evidence rarely enrolled only children with obesity and seldom measured correction of a confirmed biochemical micronutrient deficiency; consequently, much of the evidence was indirect for the review question.

Conclusion: The evidence supports comprehensive, family-engaged approaches to healthy eating and weight management, but it is insufficient to conclude that current UK public health interventions correct micronutrient deficiencies specifically among children with obesity. Future evaluations should define obesity consistently, measure baseline and follow-up micronutrient biomarkers alongside dietary intake, retain appropriate comparators and assess long-term effectiveness, equity and cost-effectiveness.

Keywords: Childhood Obesity; Micronutrient Deficiency; Public Health Intervention; Dietary Intake; United Kingdom; Systematic Review

1 INTRODUCTION

Childhood obesity is a major public health concern because adverse consequences can begin in childhood and extend across the life course. The research situates the problem within a global rise in excess weight and a substantial UK burden, citing national and international evidence that links childhood obesity with respiratory, musculoskeletal, psychosocial and cardiometabolic complications (Abarca-Gómez et al., 2017; Reilly and Kelly, 2011; Candler et al., 2018; World Health Organization, 2022). These consequences make prevention and early management important, but a focus on body size alone can obscure the quality and micronutrient density of children's diets.

Micronutrient deficiency and obesity are not mutually exclusive. Energy-dense diets may supply excess energy while providing inadequate vitamins and minerals, and the wider food environment can reinforce high intakes of processed foods, free sugars, salt and fat. This coexistence is part of the double burden of malnutrition described in the research: a child can have overweight or obesity while also consuming insufficient micronutrients or showing suboptimal micronutrient status (Black et al., 2013; Wells et al., 2020; Calcaterra et al., 2023). The problem is difficult to quantify because population surveys do not consistently include biochemical measures of micronutrient status, and dietary intake is an imperfect substitute for deficiency (Brown et al., 2021).

The relationship is also biologically and socially complex. Low-quality dietary patterns may contribute to both excess adiposity and low micronutrient intake; obesity-related inflammation or altered metabolism may affect some biomarkers; and restrictive diets used for weight control may reduce nutrient adequacy. Conversely, an observed association between a micronutrient and obesity does not by itself establish that the deficiency caused obesity or that supplementation will reduce adiposity. Iron, vitamin D, zinc, magnesium and other micronutrients, but its evidence base supports a cautious interpretation: shared dietary, socioeconomic and environmental determinants may account for much of the observed overlap (García et al., 2009; Bailey et al., 2015; Calcaterra et al., 2023).

UK responses to childhood obesity have included school-based programmes, family and community weight-management services, food and nutrition initiatives, and broader policy strategies. Schools provide access to large numbers of children and can shape meals, health education and physical activity. Families influence food purchasing, portion size and participation, while community programmes can combine nutrition, activity and behavioural support. Yet interventions delivered in a single setting may be constrained by wider commercial, social and economic environments. The long history of obesity policies in England therefore does not guarantee consistent implementation or measurable population impact (Jebb et al., 2013; Theis and White, 2021).

A further difficulty is outcome selection. Many obesity interventions measure BMI, BMI z-score, waist circumference, physical activity or self-reported diet. These outcomes are relevant to obesity prevention, but they are not equivalent to correction of a micronutrient deficiency. A study that increases fruit and vegetable intake may plausibly improve diet quality, yet without dietary reference comparisons or biochemical testing it cannot show that a deficient child became replete. Similarly, a reduction in BMI does not demonstrate improved iron, vitamin D or other micronutrient status.

The research was developed to address this evidence gap by reviewing UK public health interventions at the intersection of childhood obesity and micronutrient deficiency. The review question was: what is the effectiveness of UK public health interventions targeted at addressing micronutrient deficiencies among children with obesity?

2 METHODS

This systematic review was reported in accordance with the PRISMA (Page et al., 2021; Siddaway et al., 2019: (Alabi et al., 2026)). This was a systematic review with narrative synthesis because the included studies varied substantially in design, population, intervention, exposure and outcome (Odubia, Anthony, et al., 2025).

The question was structured with a PIO adaptation of PICO. The intended population was children aged 0-18 years in the United Kingdom who were medically classified as having obesity. Eligible interventions were population- or setting-level public health approaches addressing childhood obesity and micronutrient deficiency. Eligible outcomes included measurable micronutrient status, dietary intake and related indicators. Clinical treatments directed solely at an individual patient, studies conducted outside the UK and studies reporting outcomes unrelated to micronutrients were intended to be excluded. Single-arm intervention studies were permitted.

Table 1: Eligibility framework

Element	Operational definition
Population	UK children aged 0-18 years; intended focus on medically classified obesity.
Intervention	Public health interventions addressing childhood obesity and micronutrient deficiency; single-arm studies permitted.
Comparator	Usual practice or control where available; not required for single-arm service evaluations.
Outcomes	Biochemical micronutrient status, dietary intake, or related nutrient indicators; obesity and behavioural outcomes extracted as secondary evidence.
Exclusions	Adults, non-UK studies, individual clinical treatment without a public health approach, and outcomes unrelated to micronutrients.

The eligibility framework was narrower than the set of studies ultimately included. Several included studies enrolled unselected schoolchildren, young children, elite youth athletes or infants rather than exclusively children with obesity. Several also measured food intake, adiposity or behavioural outcomes without verifying micronutrient deficiency. .

CINAHL, PubMed, Scopus and Web of Science were searched from 19 to 31 December 2023. Search concepts covered obese or overweight children, paediatric adiposity, public health or nutritional interventions, micronutrient deficiency, dietary supplementation, nutrition education, food fortification and related outcomes. Boolean operators, phrase searching, truncation and database-specific adaptations were used.

Database records were exported to EndNote for deduplication. Titles and abstracts were screened against the stated population, geography, intervention and outcome criteria, followed by full-text assessment. The PRISMA account recorded 2,166 database records, removal of 1,158 duplicates and 272 records judged ineligible before screening, 736 records screened, 296 full texts assessed and 16 included studies. The review was completed by one reviewer, which increases the possibility of selection and interpretation error.

Data were extracted into a standardised table covering author and year, study design, purpose, sample size and age, UK location, intervention or exposure, duration, outcomes, main findings and limitations. The research applied Critical Appraisal Skills Programme tools to randomised and cohort studies and a Centre for Evidence-Based Medicine checklist to cross-sectional studies (Critical Appraisal Skills Programme, 2024).

A narrative synthesis grouped findings by intervention setting and evidential role: family or community weight management; school-based prevention; dietary and micronutrient intake; parental and early-life influences; and implementation or economic considerations. Direction and size of effects were retained when reported. Interpretation prioritised controlled comparisons over uncontrolled pre-post change and biochemical micronutrient outcomes over self-reported intake. No new statistical analysis was undertaken, reflecting the challenges of combining complex interventions with dissimilar outcomes (Higgins et al., 2019).

3 RESULTS

The four databases yielded 2,166 records: 228 from CINAHL, 330 from PubMed, 116 from Scopus and 1,492 from Web of Science. After 1,158 duplicates and 272 records marked ineligible before screening were removed, 736 titles and abstracts were screened. Of these, 440 were excluded because the design or location was inappropriate. Full texts were assessed for 296 reports; 280 were excluded for population, publication type, intervention outcome or quality reasons. Sixteen studies were included in the narrative synthesis (Figure 1).

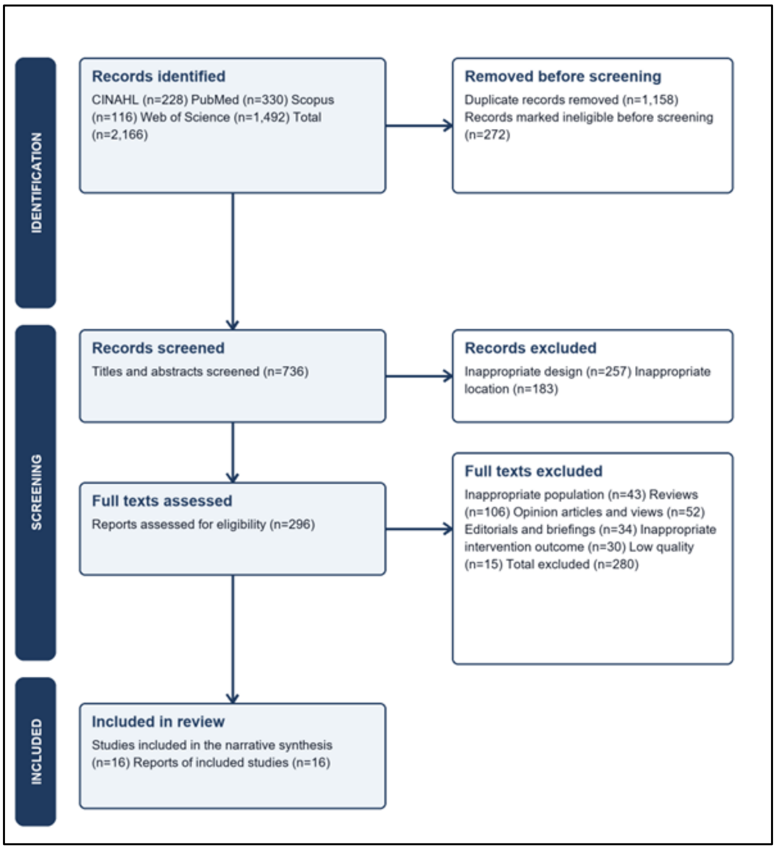

Figure 1: PRISMA flow of study identification, screening and inclusion

The included evidence was heterogeneous. It comprised individual and cluster randomised trials, repeated-measures service evaluations, retrospective cohort analysis, cross-sectional surveys, a pilot study and dietary analyses. Samples ranged from 59 elite youth football players to 5,163 children receiving a school weight-management service. Ages ranged from infancy to 19 years, and intervention or observation periods ranged from a few days of dietary recording to several years of follow-up.

Only a subset directly examined children already living with overweight or obesity.

Table 2: Intervention-oriented studies

Study/design	Population	Intervention	Main findings and limitations
Adab et al. (2018a,b); cluster RCT	1,392-1,467 children, 5-7 years; West Midlands schools	WAVES; school/family healthy eating and physical activity; 12 months	No significant BMI-z difference at 15 or 30 months; no consistent secondary-outcome benefit. Base-case ICER £46,083/QALY. Interschool delivery variation; not a micronutrient-deficiency trial.
Sacher et al. (2010); RCT	116 children with obesity, 8-12 years; five UK sites	MEND: family-based diet, activity and behaviour programme	Lower BMI z-score (-0.24) and waist z-score (-0.37) than controls at 6 months (both $p<0.0001$); benefits maintained among those followed. Selective dropout and short follow-up; no biochemical micronutrient outcome.
Smith et al. (2013); repeated measures	440 children with overweight/obesity, mean 6.1 years; 37 UK sites	MEND 5-7; 10-week community service	Among 62% assessed post-programme, BMI fell 0.5 kg/m2 and waist 0.9 cm; activity and fruit/vegetable intake

			improved. No control group and 38% attrition.
Kipping et al. (2014); cluster RCT	2,221 children, 9-10 years; 60 schools	AFLY5; activity, sedentary behaviour and fruit/vegetable programme; 12 months	No difference in three primary outcomes; some self-reported secondary behaviours improved. General school population; micronutrient status not measured.
Lloyd et al. (2018); cluster RCT	1,244 children, 9-10 years; 32 schools	Healthy Lifestyles Programme; 24 months	BMI SDS difference -0.02 (95% CI -0.09 to 0.05; p=0.57). Limited influence on school policy/environment; no direct micronutrient outcome.
Sanders et al. (2022); retrospective cohort	5,163 children, 4-19 years; county-wide service	School weight-management intervention; approximately 6 weeks	Mean BMI SDS decreased by 0.07; no subgroup difference by sex, deprivation, ethnicity or initial weight category. Uncontrolled routine data and non-consent limit causal inference.
Gatenby (2011); pilot	147 children, 8-11 years; two primary schools	Free healthy school meals compared with packed lunches	Packed lunches supplied more energy, fat, sugar, salt and micronutrients; meal uptake differed by school affluence. Small sample and food diaries; not restricted to obesity.
Singhal et al. (2010); RCT follow-up	243 children born small for gestational age; 10 UK hospitals	Nutrient-enriched versus control infant formula; follow-up to 6-8 years	Enriched formula and faster early weight gain were associated with greater later fat mass. Nutrient component responsible could not be isolated; indirect for deficiency treatment in children with obesity.

Table 3: Nutritional, dietary and contextual evidence included in the research

Study/design	Population	Exposure or focus	Main findings and limitations
Er et al. (2018); cross-sectional	150 children, 2-4 years; English nurseries	Nursery diet quality and accelerometer-measured activity	Few met fruit/vegetable or activity recommendations; diet guideline adherence was not associated with zBMI. Cross-sectional and potential participation bias.
Gibson and Boyd (2008); cross-sectional	1,688 UK children, 4-18 years; NDNS	Added sugars and micronutrient intake/status	Highest added-sugar consumers averaged 14% lower micronutrient intake; plasma selenium inversely associated with added sugar (r=-0.17; p<0.0001). Self-reported intake and incomplete blood sampling.
Naughton et al. (2017); dietary assessment	59 male elite footballers, 13-18 years	Seven-day food diaries	Younger squads exceeded the free-sugar reference; fibre was low across squads; most micronutrient reference intakes were met. Single academy, male-only, possible under-reporting.
Syrad et al. (2016); cohort dietary analysis	2,336 children aged 21 months; UK	Three-day diet diaries	Vitamin D and iron inadequacy persisted in a proportion of children despite generally high energy/protein intake. Volunteer, higher-SES and predominantly White sample; not restricted to obesity.
Whitton et al. (2011); cross-sectional survey	462 children, 4-18 years; UK NDNS	Food consumption and nutrient intake comparisons	Forty-six percent of girls aged 11-18 years had iron intake below the lower reference intake. Cross-sectional self-report and under-reporting concerns.

Dalrymple et al. (2020); dietary-pattern analysis	482 three-year-olds born to mothers with obesity	Dietary patterns and body composition	Processed/snacking pattern associated with obesity (OR 1.53, 95% CI 1.07-2.19); healthier patterns associated with lower adiposity. Recall bias and indirect adiposity measures.
Potter et al. (2018); cross-sectional	217 parent-child dyads, 5-11 years; Bristol	Parent and child portion-size beliefs	Parental ideal and maximum tolerated portions predicted child BMI; child-reported portions did not. Parent gender and other feeding practices were not assessed.

Community and family-based weight management produced the most consistently favourable anthropometric findings. In the MEND trial involving 116 children aged 8-12 years, the intervention group had lower waist-circumference z-score (-0.37) and BMI z-score (-0.24) than controls at six months, both p<0.0001, alongside improvements in self-esteem, activity, sedentary behaviour and cardiovascular fitness (Sacher et al., 2010). Improvements were maintained at 12 months among assessed participants, although selective dropout and limited follow-up constrained certainty.

The service evaluation of MEND 5-7 involved 440 children, of whom 274 (62%) completed post-programme assessment. Mean BMI fell by 0.5 kg/m2, waist circumference by 0.9 cm and the corresponding z-scores by 0.20; physical activity, sedentary time, parenting self-efficacy, psychological symptoms and the proportion of parents and children consuming at least five portions of fruit and vegetables also improved (Smith et al., 2013). These findings show feasibility and favourable change in routine delivery, but the absence of a concurrent comparison group and 38% attrition mean that causation and effect size are uncertain.

School-based trials were less encouraging for primary outcomes. In the WAVES cluster trial, differences in BMI z-score between the intervention and control groups were -0.075 (95% CI -0.183 to 0.033) at 15 months and -0.027 (95% CI -0.137 to 0.083) at 30 months, with no significant improvement in anthropometric, dietary, physical activity or psychological outcomes (Adab et al., 2018a; Adab et al., 2018b). A later follow-up in a subset suggested a small difference, but the economic evaluation estimated an incremental cost-effectiveness ratio of £46,083 per quality-adjusted life-year in the base case, and the intervention was not considered cost-effective.

Similarly, the Healthy Lifestyles Programme included 1,244 children aged 9-10 years and found an adjusted between-group difference in BMI standard deviation score of -0.02 (95% CI -0.09 to 0.05; p=0.57) at 24 months (Lloyd et al., 2018). The AFLY5 cluster trial found no difference in its three primary outcomes: moderate-to-vigorous physical activity, sedentary time, or fruit and vegetable consumption (Kipping et al., 2014). Some self-reported secondary outcomes, including weekend screen time, snack servings and high-energy drink servings, improved, but these did not establish an effect on micronutrient deficiency.

A retrospective evaluation of a large school-based weight-management service reported a mean change in BMI standard deviation score of -0.07 after a six-week programme among 5,163 children, with statistically significant pre-post changes in BMI-related measures (Sanders et al., 2022). Change did not differ significantly by sex, area deprivation, ethnicity or initial weight category. Because the study had no control group and used routine service data with substantial non-consent, the result indicates association with programme completion rather than definitive effectiveness.

Dietary studies documented micronutrient-related vulnerabilities. In the Gemini cohort, most micronutrient intakes exceeded dietary reference values, but vitamin D and iron remained concerns: 84% of children did not meet the vitamin D reference nutrient intake and 6% did not meet the lower reference nutrient intake for iron even when supplements were considered (Syrad et al., 2016). In national survey data, 46% of girls aged 11-18 years had mean iron intakes below the lower reference nutrient intake (Whitton et al., 2011). These findings identify potential inadequacy, but neither study tested an intervention among children selected for obesity and deficiency.

Analysis of UK dietary survey data showed that children in the highest added-sugar quintile consumed, on average, 14% less micronutrients than those in the lowest quintile; zinc, magnesium, iron and vitamin A intakes were lower, and plasma selenium was inversely associated with added sugars (r=-0.17; p<0.0001) (Gibson and Boyd, 2008). Among elite youth football players, free-sugar intake exceeded the UK reference value in the younger groups, dietary fibre was below recommendations across squads, and most micronutrient reference intakes were nevertheless met (Naughton et al., 2017). Both studies relied heavily on recorded or self-reported intake, which can misclassify usual consumption and cannot confirm biochemical deficiency.

Other studies illustrated the importance of context. In two primary schools, children bringing packed lunches consumed more energy, fat, sugar, salt and micronutrients than children receiving a free school meal, but lower meal consumption in the less affluent school reduced the expected nutritional benefit (Gatenby, 2011). Nursery food quality was not associated with zBMI in a cross-sectional study, and few children met fruit, vegetable and physical-activity recommendations (Er et al., 2018). These results suggest that food provision alone is insufficient if acceptability, consumption, family circumstances and the wider environment are not addressed.

Parental and early-life evidence was also indirect but informative. Parents' perceptions of their child's BMI predicted the portions they considered ideal or maximally acceptable, whereas children's own portion beliefs did not predict BMI (Potter et al., 2018). A study of dietary patterns among three-year-old children born to mothers with obesity found that a processed/snacking pattern was associated with greater odds of obesity (OR 1.53, 95% CI 1.07-2.19), while healthier patterns were associated with lower adiposity measures (Dalrymple et al., 2020). Trials of nutrient-enriched formula in infants born small for gestational age linked faster early weight gain with greater later fat mass, but could not isolate whether protein, energy or micronutrients drove the effect (Singhal et al., 2010).

Across the evidence base, risk-of-bias concerns included attrition, lack of blinding where behavioural interventions made blinding difficult, self-reported diet or activity, cross-sectional designs, residual confounding, limited socioeconomic or ethnic representativeness, single-site samples, short follow-up and variation in intervention fidelity. Statistical heterogeneity was accompanied by conceptual heterogeneity: BMI, food consumption, micronutrient intake and biochemical micronutrient status were sometimes treated as if they were interchangeable. They are not, and this limits the certainty of any conclusion about micronutrient-deficiency correction.

4 DISCUSSION

This review found a coherent but qualified pattern. Multicomponent family- and community-based programmes can improve weight-related and behavioural outcomes for some children, while large school-based prevention programmes generally produced little or no change in primary anthropometric or dietary outcomes. Nutritional surveillance studies identified shortfalls in vitamin D, iron, fibre and overall dietary quality, and showed that high free-sugar or processed-snack patterns may displace nutrient-dense foods. However, the evidence did not directly answer the stated question with sufficient precision: very few studies simultaneously required obesity, established micronutrient deficiency, delivered a targeted public health intervention and reassessed micronutrient status.

The distinction between efficacy and indirect relevance changes the interpretation. The MEND studies are encouraging because they involved children with overweight or obesity and integrated diet, activity, behaviour and family participation (Sacher et al., 2010; Smith et al., 2013). Yet their reported nutrition outcome was mainly fruit and vegetable consumption rather than correction of a defined deficiency. One was an RCT with a modest sample and selective loss to follow-up; the other was an uncontrolled service evaluation. These studies support comprehensive weight management, but not a firm claim that MEND treats micronutrient deficiency.

The more rigorous school cluster trials provide a useful counterweight to optimistic pre-post results. WAVES, HeLP and AFLY5 were well-positioned to influence large groups, but their main BMI, activity and dietary outcomes were largely null (Adab et al., 2018b; Kipping et al., 2014; Lloyd et al., 2018). School reach is therefore not the same as intervention potency. Competing influences outside school, inconsistent implementation, limited dose, and the difficulty of changing household or commercial food environments may dilute effects. Positive secondary outcomes should be viewed as signals for programme refinement rather than substitutes for unsuccessful primary outcomes.

The findings also show why micronutrient intake and micronutrient status must be separated. Food diaries and dietary recalls can identify groups whose estimated intake falls below reference values, but under-reporting is common and biochemical status is influenced by absorption, inflammation, supplement use and physiological need. Conversely, a normal average intake does not rule out deficiency in a vulnerable subgroup. Future interventions should specify which deficiency is targeted, use an appropriate biomarker where feasible, measure diet with a validated method, and report obesity and micronutrient outcomes separately.

Family involvement appears important because parents shape food availability, portion size, participation and maintenance. The portion-size findings from Potter et al. (2018) and behavioural changes reported in MEND support family engagement, but family responsibility should not obscure structural determinants. Household income, food prices, local retail environments, school meal uptake and culturally patterned diets can influence both obesity and nutrient adequacy. The school-meal pilot's socioeconomic contrast illustrates how the same formal provision can produce different nutritional exposure when children consume different amounts (Gatenby, 2011).

4.1 Implication of the study

For practice, the evidence favours integrated assessment. Weight-management services should avoid assuming that excess weight equates to adequate nutrition. Dietary history should consider meal patterns, food variety, free sugars, fibre and sources of vitamin D, iron and other nutrients relevant to age and risk. When clinical signs, restricted diets or other risk factors justify it, referral for appropriate micronutrient assessment may be needed. Interventions should combine practical dietary support with physical activity and behavioural strategies, engage families, and use follow-up long enough to assess maintenance. These implications are compatible with the reviewed evidence, but they should not be interpreted as evidence for universal supplementation, which was not established by the included studies.

For policy, the mixed results caution against relying on schools alone. Schools remain valuable platforms for equitable reach, meal standards, education and referral, but programmes require coordination with families, local authorities, health services and wider food-policy measures. Evaluation should be embedded from the outset, include implementation fidelity and participation, and report distributional effects by socioeconomic position and ethnicity. The WAVES economic findings also show the need to examine opportunity costs and scalability rather than judging an intervention only by statistical change.

Future research should use designs aligned with the review question. A strong evaluation would enrol or report a prespecified subgroup of children with obesity and a confirmed micronutrient deficiency, define the public health intervention and comparator clearly, and measure both biochemical and anthropometric outcomes at baseline and follow-up. Cluster randomisation may suit school or community delivery, but adequate numbers of clusters, intention-to-treat analysis and transparent handling of missing data are necessary. Where randomisation is not feasible, a controlled interrupted time-series or prospective cohort with careful confounder adjustment would be stronger than an uncontrolled pre-post design.

4.2 Strength and limitations

This review searched four major databases, documented a PRISMA-style selection pathway, included diverse UK settings and used design-specific appraisal tools. Bringing intervention and nutritional-surveillance evidence together highlights the gap between obesity prevention and micronutrient-deficiency treatment. The critical reclassification of direct and indirect evidence also prevents favourable BMI or diet findings from being misrepresented as proof of micronutrient correction. Limitation's incudes the fact that the review was conducted by a single reviewer; the search was restricted by time and the UK setting; grey literature and publication bias were not comprehensively addressed; and no registered protocol was reported. Search-date and year-filter descriptions were inconsistent.

5 CONCLUSION

UK evidence supports the plausibility of multicomponent, family-engaged approaches to improving diet, activity and weight-related outcomes in children, but it does not establish that existing public health interventions correct micronutrient deficiencies among children with obesity. Controlled school-based trials were largely null for their primary outcomes, favourable community findings were limited by design or attrition, and nutritional studies were mostly observational. The central priority is therefore not simply to add more obesity programmes, but to align intervention targets with valid outcome measures: identify deficiency, measure it directly where appropriate, evaluate change against a credible comparator, and assess sustainability, equity and value.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

There is no competing-interest in this research.

Data availability

All evidence synthesized in this manuscript was drawn from the studies

REFERENCES

[1] Abarca-Gómez, L., Abdeen, Z.A., Hamid, Z.A. et al. (2017) Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2,416 population-based measurement studies. The Lancet, 390(10113), 2627-2642.

[2] Adab, P., Barrett, T., Bhopal, R. et al. (2018a) The West Midlands ActiVe lifestyle and healthy Eating in School children (WAVES) study: a cluster randomised controlled trial testing clinical effectiveness and cost-effectiveness. Health Technology Assessment, 22(8), 1-608.

[3] Adab, P., Pallan, M.J., Lancashire, E.R. et al. (2018b) Effectiveness of a childhood obesity prevention programme delivered through schools, targeting 6- and 7-year-olds: cluster randomised controlled trial (WAVES study). BMJ, 360, j3984.

[4] Bailey, R.L., West, K.P. and Black, R.E. (2015) The epidemiology of global micronutrient deficiencies. Annals of Nutrition and Metabolism, 66(Suppl. 2), 22-33.

[5] Black, R.E., Victora, C.G., Walker, S.P. et al. (2013) Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet, 382(9890), 427-451.

[6] Brown, K.H., Moore, S.E., Hess, S.Y. et al. (2021) Increasing the availability and utilization of reliable data on population micronutrient status globally: the Micronutrient Data Generation Initiative. American Journal of Clinical Nutrition, 114(3), 862-870.

[7] Calcaterra, V., Verduci, E., Milanta, C. et al. (2023) Micronutrient deficiency in children and adolescents with obesity: a narrative review. Children, 10(4), 695.

[8] Candler, T.P., Mahmoud, O., Lynn, R.M., Majbar, A.A., Barrett, T.G. and Shield, J.P.H. (2018) Continuing rise of type 2 diabetes incidence in children and young people in the UK. Diabetic Medicine, 35(6), 737-744.

[9] Critical Appraisal Skills Programme (2024) CASP tools and checklists. CASP UK-OAP Ltd.

[10] Dalrymple, K.V., Flynn, A.C., Seed, P.T. et al. (2020) Associations between dietary patterns, eating behaviours, body composition and adiposity in 3-year-old children of mothers with obesity. Pediatric Obesity, 15(5), e12608.

[11] Er, V., Dias, K.I., Papadaki, A. et al. (2018) Association of diet in nurseries and physical activity with zBMI in 2-4-year-olds in England: a cross-sectional study. BMC Public Health, 18, 607.

[12] García, O.P., Long, K.Z. and Rosado, J.L. (2009) Impact of micronutrient deficiencies on obesity. Nutrition Reviews, 67(10), 559-572.

[13] Gatenby, L.A. (2011) Children's nutritional intake as part of the Eat Well Do Well scheme in Kingston-upon-Hull: a pilot study. Nutrition Bulletin, 36(1), 87-94.

[14] Gibson, S. and Boyd, A. (2008) Associations between added sugars and micronutrient intakes and status: further analysis of the National Diet and Nutrition Survey of Young People aged 4 to 18 years. British Journal of Nutrition, 101(1), 100-107.

[15] Higgins, J.P.T., López-López, J.A., Becker, B.J. et al. (2019) Synthesising quantitative evidence in systematic reviews of complex health interventions. BMJ Global Health, 4(Suppl. 1), e000858.

[16] Jebb, S.A., Aveyard, P.N. and Hawkes, C. (2013) The evolution of policy and actions to tackle obesity in England. Obesity Reviews, 14(Suppl. 2), 42-59.

[17] Kipping, R.R., Howe, L.D., Jago, R. et al. (2014) Effect of an intervention aimed at increasing physical activity, reducing sedentary behaviour, and increasing fruit and vegetable consumption in children: AFLY5 school-based cluster randomised controlled trial. BMJ, 348, g3256.

[18] Lloyd, J., Creanor, S., Logan, S. et al. (2018) Effectiveness of the Healthy Lifestyles Programme to prevent obesity in UK primary-school children: a cluster randomised controlled trial. The Lancet Child & Adolescent Health, 2(1), 35-45.

[19] Naughton, R.J., Drust, B., O'Boyle, A. et al. (2017) Free-sugar, total-sugar, fibre, and micronutrient intake within elite youth British soccer players. Applied Physiology, Nutrition, and Metabolism, 42(5), 517-522.

[20] Page, M.J., McKenzie, J.E., Bossuyt, P.M. et al. (2021) Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. Journal of Clinical Epidemiology, 134, 103-112.

[21] Potter, C., Ferriday, D., Griggs, R.L., Hamilton-Shield, J.P., Rogers, P.J. and Brunstrom, J.M. (2018) Parental beliefs about portion size, not children's own beliefs, predict child BMI. Pediatric Obesity, 13(4), 232-238.

[22] Reilly, J.J. and Kelly, J. (2011) Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. International Journal of Obesity, 35(7), 891-898.

[23] Sacher, P.M., Kolotourou, M., Chadwick, P.M. et al. (2010) Randomized controlled trial of the MEND program: a family-based community intervention for childhood obesity. Obesity, 18(S1), S62-S68.

[24] Sanders, G.J., Marwa, W.L., Wade, B. and Gately, P. (2022) Efficacy of a county-wide schools weight management intervention. Perspectives in Public Health, 142(6), 319-327.

[25] Siddaway, A.P., Wood, A.M. and Hedges, L.V. (2019) How to do a systematic review: a best practice guide for conducting and reporting narrative reviews, meta-analyses, and meta-syntheses. Annual Review of Psychology, 70, 747-770.

[26] Singhal, A., Kennedy, K., Lanigan, J. et al. (2010) Nutrition in infancy and long-term risk of obesity: evidence from two randomized controlled trials. American Journal of Clinical Nutrition, 92(5), 1133-1144.

[27] Smith, L.R., Chadwick, P., Radley, D. et al. (2013) Assessing the short-term outcomes of a community-based intervention for overweight and obese children: the MEND 5-7 programme. BMJ Open, 3(5), e002607.

[28] Syrad, H., Llewellyn, C.H., van Jaarsveld, C.H.M., Johnson, L., Jebb, S.A. and Wardle, J. (2016) Energy and nutrient intakes of young children in the UK: findings from the Gemini twin cohort. British Journal of Nutrition, 115(10), 1843-1850.

[29] Theis, D.R.Z. and White, M. (2021) Is obesity policy in England fit for purpose? Analysis of government strategies and policies, 1992-2020. Milbank Quarterly, 99(1), 126-170.

[30] Wells, J.C.K., Sawaya, A.L., Wibaek, R. et al. (2020) The double burden of malnutrition: aetiological pathways and consequences for health. The Lancet, 395(10217), 75-88.

[31] Whitton, C., Nicholson, S.K., Roberts, C. et al. (2011) National Diet and Nutrition Survey: UK food consumption and nutrient intakes from the first year of the rolling programme and comparisons with previous surveys. British Journal of Nutrition, 106(12), 1899-1914.

[32] World Health Organization (2022) WHO European Regional Obesity Report 2022. Copenhagen: WHO Regional Office for Europe.

[33] Alabi, T. M., Laws, T. A., Adumashi, F. A., Olayiwola, O. O., & Odubia, J. S. (2026). A Comparative Assessment of Nurses' Perceptions and Practices on Hospital Waste Management in Nigeria and South Africa, and their Impact on Nosocomial Infection Risks: A Systematic Review. Journal of Nursing, Midwifery and Allied Health Sciences, 4(1), 19–42. https://doi.org/10.54117/jnmahs.v4i1.50

[34] Odubia, J. S., Anthony, C., Edeh, J. C., Hannatu, M., & Tarbunde, E. (2025). Mental Health in Times of Disease Outbreaks: The Case of African University Students under COVID-19 Quarantine. International Journal of Pharmaceutical Research and Applications, 10(4), 963. https://doi.org/10.35629/4494-1004963980