Scientific Advisory Committee on Nutrition

‘Feeding young children aged 1 to 5 years’

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Annex 10

Contents

Annex 10: Evidence grading (systematic reviews)

The evidence grading process for exposure-outcome relationships with at least 3 primary studies (intervention or prospective cohort studies) in children aged 1 to 5 years included in systematic reviews (with or without meta-analyses) are presented in Tables A10.1 to A10.35. Exposure-outcome relationships for which there were no or 'insufficient' evidence are listed in Table A10.36.

Dietary Energy

Table A10.1 Portion sizes on children's food and energy intake

Outcome	**Food consumption and energy intake**
Number of SR	3 SRs (Ward et al 2015; Mikkelsen et al 2014, Osei-Assibey et al 2012)
Number of primary studies included in SR	6 intervention studies (Ward: 1 pre-post study; Mikkelsen: 2 quasi-experimental; Osei-Assibey: 1 non-randomised controlled trial, 2 within-subject crossover design)
Results of primary studies	All 6 intervention studies (in childcare or preschool settings) reported that serving larger portion sizes increased food consumption (grams or kcal) compared with serving smaller portion sizes. One study reported that doubling an age-appropriate portion size of macaroni and cheese increased consumption (in grams) by 25% ($p<0.001$) and energy intake (kcal) by 15% ($p<0.01$). A second study reported that energy intake from snack foods increased with increasing portion size (small portion mean energy intake: 84 kcal compared with large portion mean energy intake: 99 kcal; $p<0.05$). A third study reported that children ate more snack foods when allowed to self-select compared with when served a standard portion (MD 0.87 portions; $p<0.01$). A fourth study reported that decreasing the energy density of a dish served as part of a school meal by 30% decreased children's energy intake from the dish by 25% and overall lunch energy intake by 18%. The other 2 studies (1 on whole lunch meal, 1 on high fat sugar foods served during lunch) did not report quantitative data.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Ward: moderate. Mikkelsen and Osei-Assibey: low. Publication bias: SRs did not investigate publication bias. Confounding: assessed but findings NR (2 SRs); unclear whether confounding was assessed (1 SR).

Outcome	Food consumption and energy intake
Primary study characteristics	Total number of participants: 436 Study size: n≤40 (4 studies); n=235 (1 study) Study power: information on study power not provided Study duration: 3 to 4 sessions (2 studies); 5 days (1 study); 3 months (1 study); 54 days (1 study). Baseline age: 2 to 5 or 7 (2 studies); 3 to 5 or 6 (2 studies); preschool age not defined (1 study).
Direction of effect	Increase
Grade Justification for grade	Moderate Evidence graded *moderate* based on the consistent direction of findings from primary studies included in the 3 SRs, and large effect size. Evidence downgraded from *adequate* due to non-randomised study designs, small sample sizes, lack of confidence intervals, and lack of information on study power, publication bias, and confounding.

Abbreviations: prospective cohort study (PCS), mean difference (MD), not reported (NR), systematic review (SR)
↑ increase in effect or direct association

Table A10.2 Dietary energy and obesity outcomes

Outcome	BMI
Number of SR	2 SRs (Rouhani et al 2016; Parsons et al 1999)
Number of primary studies included in SR	4 PCS (Parsons: 3 PCS, reported in 4 publications; Rouhani: 1 PCS)
Results of primary studies	Two PCS reported no association between energy intake (EI) at age 2, 3 to 5 years, and BMI 2 years later. A 3rd PCS reported a direct association between change in EI from age 4 to 6 and BMI at age 8 but no association with change in EI before age 4. The 4th PCS, in children aged 3 to 4 years with a follow-up duration of 12 years, reported an inverse association in girls only (10 girls) and no association in boys.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low (both SRs) Publication bias: Rouhani: publication bias not detected for BMI using Begg's adjusted rank correlation test. Parsons: not assessed. As energy intake was not included in its search terms or strategy, its literature search cannot be said to be comprehensive for this exposure. Confounding: Rouhani: assessed confounding as part of risk of bias assessment. Parsons: confounding not assessed. The 2 PCS that reported an association (in either direction) did not adjust for confounding (except SES, in 1 of 2 analyses). The 2 PCS that reported no association adjusted for key confounding factors (sex, age and baseline BMI and physical activity).
Primary study characteristics	Total number of participants: 884 Study size: n<50 (1 PCS), n>100 (2 PCS), n>500 (1 PCS) Study power: information on study power not provided Baseline age: 2 years (2 PCS); 3 to 4 or 5 years (2 PCS) Duration of follow up: 2 to 12 years
Other comments	Uncertain role of TDEI in any relationship between total fat intake and body weight or BMI
Direction of association	Inconsistent

Outcome	**BMI**
Grade	Insufficient
Justification for grade	Results from 4 PCS were inconsistent. The evidence was downgraded to *insufficient* due to the poor quality of the SRs, small sample sizes of the PCS, and inadequate consideration of confounding by the PCS.

Abbreviations: body mass index (BMI), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR), TDEI (total dietary energy intake)

Macronutrients

Table A10.3 Total carbohydrate intake and obesity outcomes

Outcome	BMI
Number of SR	2 SRs (Hornell et al 2013; Parsons et al 1999)
Number of primary studies included in SR	3 PCS (Hornell: 1 PCS; Parsons: 2 PCS)
Results of primary studies	1 study reported an inverse association (unadjusted for TDEI); the other 2 studies reported no association (adjusted for TDEI).
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Hornell: moderate; Parsons: critically low. Publication bias: not assessed (both SRs). As neither SR included 'carbohydrate intake' in their search terms or strategy, the literature search for this exposure cannot be said to be comprehensive. Confounding: Hornell: assessed as part of quality assessment. Parsons: not assessed. All 3 PCS adjusted for baseline child BMI and parental BMI; 2 of 3 studies adjusted for sex
Primary study characteristics	Total number of participants: 328 Study size: n=70, 112 and 146. Study power: Hornell: considered as part of its quality assessment. Baseline age: 2 years (1 PCS); 2 to 8 years (1 PCS); 3 to 5 years (1 PCS) Duration of follow-up: 2 years (1 PCS) and 6 years (2 PCS)
Direction of association	Inconsistent
Grade Justification for grade	Insufficient Evidence downgraded to insufficient due to conflicting findings, uncertain role of TDEI, and literature searches that were unlikely to be comprehensive for this exposure.

Abbreviations: body mass index (BMI), socioeconomic status (SES), prospective cohort study (PCS), systematic review (SR), total dietary energy intake (TDEI)

Table A10.4 Total fat intake and obesity outcomes

Outcome	Change in body weight or BMI (shorter-term: 1 to 3 years follow up)	Change in BMI (longer-term: 6 to 14 years)
Number of SR	1 SR (Naude et al, 2018)	2 SRs (Naude et al, 2018; Parsons et al, 1999)
Number of primary studies included in SR	4 PCS 1 PCS reported 2 outcome measures (body weight and BMI)	3 PCS Naude: 2 PCS; Parsons: 1 PCS
Results of primary studies	All 4 PCS reported no association (3 adjusted or 1 not adjusted for TDEI), although in 1 study the finding (adjusted for TDEI) was borderline statistically significant (p=0.05). Of the 2 PCS for which quantitative data were available, 1 PCS that compared higher total fat intake (>30% energy) compared with lower total fat intake (≤30% energy) reported a mean difference (MD) in change in body weight of 0.2kg per year (95% CI -0.26 to 0.66), and MD in change in BMI of 0.02kg/m^2 per year (95% CI -0.26 to 0.30). The other PCS reported change in BMI of 0.034kg/m^2 (95% CI not reported) per 1% higher energy from total fat (p=0.05).	2 of 3 PCS reported a direct association, unadjusted for TDEI (although 1 study did not report statistics). The 3rd PCS reported no association (adjusted for TDEI).
Quality of SR • AMSTAR 2 • Publication bias • Confounding	<u>AMSTAR 2</u>: high. <u>Publication bias</u>: not assessed due to insufficient number of studies for this outcome. <u>Confounding</u>: assessed as part of risk of bias assessment. 3 of 4 PCS accounted for TDEI and key potential confounding factors (sex, ethnicity, baseline BMI, SES).	<u>AMSTAR 2</u>: Naude: high; Parsons: critically low <u>Publication bias</u>: Naude: not assessed due to insufficient number of studies for this outcome. Parsons: not assessed. As dietary fat intake was not included in its search terms or strategy, its literature search cannot be said to be comprehensive for this exposure. <u>Confounding</u>: Naude: assessed confounding as part of risk of bias assessment. Parsons: not assessed. 2 PCS adjusted for baseline BMI.

Outcome	Change in body weight or BMI (shorter-term: 1 to 3 years follow up)	Change in BMI (longer-term: 6 to 14 years)
Primary study characteristics	Total number of participants: 1234 Study size: 3 of 4 PCS had 130 to 220 participants; 1 PCS had 740 participants (and justified its sample size) Study power: 1 of 4 PCS reported a sample size justification. Baseline age: mostly 3 to 4 years Duration of follow-up: 1 to 3 years	Total number of participants: 294 Study size: n=112 (2 PCS), n=70 (1 PCS) Study power: 1 of 4 PCS reported a sample size justification Baseline age: 2 years (1 PCS); 3 years (1 PCS); 2 to 8 years (1 PCS) Duration of follow-up: 6 to 14 years
Other comments	Significant imbalance in participant numbers between groups in 1 study Uncertain role of TDEI in any relationship between total fat intake and body weight or BMI	None
Direction of association	No association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Limited Evidence was downgraded to limited due to wide confidence intervals, and uncertain role of TDEI	Insufficient Evidence was downgraded to insufficient due to inconsistency in the findings and the uncertain role of TDEI.

Abbreviations: body mass index (BMI), mean difference (MD), prospective cohort study (PCS), randomised-controlled trial (RCT), socioeconomic status (SES), systematic review (SR), total dietary energy intake (TDEI)

Table A10.5 Total protein intake and obesity outcomes

Outcome	BMI
Number of SR	2 SRs (Hornell et al, 2013; Parsons et al, 1999)
Number of primary studies included in SR	5 PCS (Hornell: 4 PCS; Parsons: 1 PCS)
Results of primary studies	All 5 PCS reported a direct association; 3 of 5 studies adjusted for TDEI. 2 PCS also reported a direct association between protein intake (% energy) at ages 1 to 2 and overweight at ages 5 (p=0.05, 1 PCS) and 7 years (OR 2.39; 95% CI 1.14 to 4.99, 1 PCS).
Quality of SR AMSTAR 2 Publication bias Confounding	AMSTAR 2: Hornell: moderate; Parsons: critically low. Publication bias: not assessed (both SRs). Parsons: not assessed. As protein intake was not included in its search terms or strategy, its literature search cannot be said to be comprehensive for this exposure. Confounding: Hornell: confounding assessed as part of quality assessment. Parsons: confounding not assessed. All 5 PCS adjusted for multiple confounding factors. 3 of 5 PCS adjusted for sex and baseline BMI; 2 of 5 studies adjusted for SES; 3 of 5 studies adjusted for intakes of other macronutrients (as % energy in 2 studies; and absolute intake in grams in 1 study); 4 of 5 studies adjusted for parental BMI.
Primary study characteristics	Total number of participants: 659 Study size: 4 of 5 studies had <150 participants. In 1 study, 60% of the cohort was lost to follow up. Study power: 1 of 5 PCS reported a sample size justification. Baseline age: 12 months (2 PCS); 17 to 18 months (1 PCS); 2 years (1 PCS); 2 to 8 years (1 PCS) Duration of follow-up: 4 of 5 studies had follow-up durations of >4 years
Other comments	Quantitative details not reported for 3 of 5 studies Uncertain role of TDEI in this relationship
Direction of association	Direct association
Grade Justification for grade	Moderate For BMI: there are consistent findings in 5 PCS of moderate quality. The uncertain role of TDEI in this relationship prevented grading the evidence as adequate. For overweight: there were only 2 PCS hence this was graded as insufficient.

Abbreviations: body mass index (BMI), odds ratio (OR), prospective cohort study (PCS), randomised-controlled trial (RCT), systematic review (SR), total dietary energy intake (TDEI) ↑ increase in effect or direct association.

Table A10.6 Animal protein intake and timing of puberty

Outcome	Age of menarche or voice break
Number of SR	1 SR (Hornell et al 2013)
Number of primary studies included in SR	3 PCS
Results of primary studies	All 3 PCS reported an inverse association between animal protein intake at age 3 to 5 years and age at menarche or voice break; in 1 PCS the association did not reach statistical significance (p=0.06); 1 study reported that girls with animal protein intakes 1 SD above the mean reached menarche 0.63 years earlier than girls with intakes below 1 SD; no quantitative data available for the third study
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: moderate Publication bias: not assessed Confounding: assessed as part of the quality assessment. 2 of 3 PCS adjusted for TDEI or a measure of body size
Primary study characteristics	Total number of participants: 3457 Study size: n=67, 92 and 3298 Study power: SR considered as part of its quality assessment. No PCS performed or reported performing power calculations Baseline age: age 3 years (1 PCS), 3 to 4 years (1 PCS), 3 to 5 years (1 PCS)
Other comments	Data in 1 PCS from participants born in the 1930s to 1940s potentially limiting the generalisability of the findings to young children today
Direction of association	Inverse association
Grade Justification for grade	Limited Evidence graded limited based on a limited number of primary studies included in the SR (3 PCS).

Abbreviations: prospective cohort study (PCS), standard deviation (SD), systematic review (SR), total dietary energy intake (TDEI)
↓ decrease in effect or inverse association.

Micronutrients

Table A10.7 Iron fortification and serum ferritin

Outcome	Serum ferritin (children with anaemia or high prevalence of anaemia)
Number of SR	2 SRs (Matsuyama et al 2017; Pratt et al, 2015)
Number of primary studies included in SR	3 trials (Matsuyama: 2 RCTs; Pratt: 1 randomised trial)
Results of primary studies	1 RCT reported no difference in change from baseline for serum ferritin (unadjusted for CRP) between intervention milk and control milk groups after 6 months intervention. 1 RCT reported an increase in serum ferritin (unclear whether adjusted for CRP) in the intervention milk group compared with the control milk group after 1 year intervention. 1 randomised trial reported no change in serum ferritin (adjusted for CRP) in the group that received iron-fortified micronutrient powder after 4 months' intervention. However, as all comparison groups in this trial received iron (at different doses), there was effectively no control group.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Matsuyama: moderate; Pratt: critically low Publication bias: not assessed (both SRs) Confounding: Matsuyama: noted if there were imbalances at baseline between groups that could affect outcomes.
Primary study characteristics	Intervention strategy: fortification with iron and other micronutrients (zinc and vitamin A in all 3 trials). Fortificants were milk or formula (2 trials) and porridge powder (1 trial) Sample size: n=115, 750, 2666 Study power: information on study power not provided Study duration: 4 months (1 trial), 6 months (1 trial), 12 months (1 trial) Baseline age: 20 to 36 months
Other comments	Studies conducted in UMIC (2 trials) and LMIC (1 trial)

Outcome	Serum ferritin (children with anaemia or high prevalence of anaemia)
	ITT analysis (1 trial); PP analysis (2 trials) Bias from funding sources of the 2 milk studies: low or unclear risk
Direction of effect	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence downgraded due to: - 1 trial had no control group - lack of information on study power and lack of assessment of publication bias - adjustment for CRP (inflammation) either not done or unclear - indirectness of interventions (all examined the effect of iron fortification with other micronutrients) - unclear generalisability of findings to UK population

Abbreviations: C-reactive protein (CRP), intention-to-treat (ITT), lower middle income country (LMIC), per protocol (PP), randomised-controlled trial (RCT), systematic review (SR), upper middle income country (UMIC)

Table A10.8 Iron fortification and prevalence of anaemia

Outcome	Anaemia prevalence (children with anaemia or high prevalence of anaemia)
Number of SR	1 SR (Pratt et al, 2015)
Number of primary studies included in SR	3 trials (2 cluster-RCTs, 1 RCT)
Results of primary studies	All 3 trials reported a reduction in the prevalence of anaemia after 2 to 12 months' intervention. Both cluster-RCTs reported a greater reduction in anaemia prevalence in the intervention group than in the control group after 2 and 12 months' treatment (treatment effect: p=0.02 in 1 study; p<0.001 in the second study), with adjustment for cluster effects. The RCT also reported a greater reduction in anaemia prevalence in the intervention group after 6 months' treatment (41% to 12%; p<0.001) compared with the control group (30% to 24%; p=0.40). It also reported that treatment with the fortified milk intervention was inversely associated with being anaemic after 6 months' intervention (p<0.03) although it is unclear what the outcome measure (RR or OR) was.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low Publication bias: not assessed Confounding: not assessed
Primary study characteristics	Intervention strategy: fortification with iron and other micronutrients (zinc, vitamin A and vitamin C in all 3 trials; folic acid in 2 trials). Milk was used in 2 trials and micronutrient powder ('Sprinkles') in 1 trial Sample size: n=115, 795, 2283 Study power: information on study power not provided Study duration: 2 months (1 trial); 6 months (1 trial); 12 months (1 trial) Baseline age: 6 to 36 months
Other comments	Studies conducted in UMIC (2 trials) and LMIC (1 trial) PP analysis (3 trials) Both cluster-RCTs adjusted for cluster effects Bias from funding sources of the milk studies not assessed

Outcome	Anaemia prevalence (children with anaemia or high prevalence of anaemia)
Direction of association	Inverse association
Grade	Limited
Justification for grade	Evidence downgraded due to: - PP analysis could overestimate effect sizes - lack of assessment of publication bias or potential bias from funding sources - indirectness of interventions (all examined the effect of iron fortification with other micronutrients) - unclear generalisability of findings to UK population

Abbreviations: C-reactive protein (CRP), lower middle income country (LMIC), per protocol (PP), randomised-controlled trial (RCT), systematic review (SR), upper middle income country (UMIC)
↓ decrease in effect or inverse association.

Table A10.9 Vitamin D fortification (of milk or formula) and vitamin D status

Outcome	Vitamin D status
Number of SR or MA	1 SR (Hojsak et al 2018)
Number of primary studies included in SR or MA	3 RCTs
Results of primary studies	All 3 RCTs reported that vitamin D-fortified milk or formula increased serum vitamin D or decreased the risk of vitamin D deficiency (defined as serum 25(OH)D <50nmol/l in the studies) compared with the control group (non-fortified cows' milk in 2 RCTs, red meat in 1 RCT). Only 1 RCT assessed the intervention effect in the context of seasonal shifts in vitamin D status (winter versus summer months in Northern Europe). Quantitative data was not reported for any of the studies. Average (mean or median) baseline vitamin D status of the children in the intervention groups in the 3 RCTs ranged from 54 to 70nmol/l.
Quality of SR or MA • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low Publication bias: not assessed. However, as 'vitamin D' was not included in the search strategy of the SR, the literature search for this exposure cannot be said to be comprehensive. Confounding: not assessed
Primary study characteristics	Total number of participants: 635 Study size: n=92, 225 and 318 Study power: information on study power not provided Duration of follow-up: 20 weeks (2 RCTs), approximately 6 months (1 RCT) Baseline age: 12 to 20 months (1 RCT); 1 to 3 years (1 RCT); 2 to 6 years (1 RCT) Countries: HIC (UK, Germany, the Netherlands and New Zealand)
Other comments	Main research question of SR was to evaluate the nutritional composition of 'Young child formula' (that is formula milks targeted at children aged 1 to 3 years) and their nutritive role in European children. SR did not quality assess included studies ITT analysis (1 RCT), PP analysis (1 RCT), analysis unclear (1 RCT)

	2 of 3 RCTs funded by industry
Direction of effect	Increase
Grade	Limited
Justification for grade	Evidence downgraded due to the lack of quantitative data to judge effect sizes and confidence intervals, a literature search that is not comprehensive for vitamin D as an exposure or intervention, and lack of accounting for possible bias from industry funding of the RCTs.

Abbreviations: randomised-controlled trial (RCT), systematic review (SR), high income country (HIC)
↑ increase in effect or direct association.

Foods, dietary components, and dietary patterns

Table A10.10 Total dairy and BMI

Outcome	BMI
Number of SR	1 SR (Dougkas et al, 2019)
Number of primary studies included in SR	3 PCS
Results of primary studies	2 PCS reported an inverse association. The third study PCS reported no association
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: low Publication bias: not assessed Confounding: 3 of 3 studies that reported a direct association adjusted for sex, baseline BMI or weight, ethnicity or SES; while 3 of 4 studies that reported no association adjusted for sex and baseline BMI
Primary study characteristics	Total number of participants: 789 Study size: range 92 to 362 participants Study power: information on study power not provided Baseline age: 18 months to 3 years Duration of follow-up: 8 years follow up
Other comments	Two of the 3 studies used a dataset from the same longitudinal cohort study.
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence graded insufficient because only 2 independent PCS

Abbreviations: body mass index (BMI), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR)

Table A10.11 Diet quality (‘unhealthy’ dietary pattern) and body fat

Outcome	**Body fat**
Number of SR	1 SR (Costa et al 2018)
Number of primary studies included in SR	3 PCS
Results of primary studies	Two studies found a positive association (in 292 and 4750 participants); the third study (in 585 participants) reported the same association only in boys and no association for girls although the direction of the association was the same
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: moderate Publication bias: not assessed Confounding: All studies adjusted for age; two also adjusted for sex, maternal education, maternal BMI and TDEI; other potential confounders (non-consistent) included body composition measures, socioeconomic status, birth weight, gestational age, pubertal status, physical activity, other dietary patterns
Primary study characteristics	Total number of participants: 5627 Study size: n=292, 585 and 4750 Study power: no information on study power provided although the SR did attempt to extract this information Baseline age: 3 to 4.8 years Duration of follow-up: from age 4.8 to 18 years
Direction of association	Direct association
Grade Justification for grade	Limited The evidence was graded as limited as there were 3 PCS with some evidence for the same direction of association.

Abbreviations: body mass index (BMI), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR)
↑ increase in effect or direct association.

Table A10.12 Diet quality ('Unhealthy' dietary pattern) and IQ

Outcome	IQ
Number of SR	1 SR (Tandon et al, 2016)
Number of primary studies included in SR	3 PCS (of which 2 used a dataset from the same cohort of children)
Results of primary studies	All studies found inverse association
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low Publication bias: not assessed Confounding: All studies adjusted for maternal age, education, social class, marital status; Two studies adjusted for maternal tobacco smoking during pregnancy, family income, ethnicity, number of children (<16 years old) living in the family home; One study adjusted for age at IQ testing, duration of breastfeeding, other dietary pattern scores, HOME score, housing tenure and life events
Primary study characteristics	Total number of participants: 12,984 Study size: n=1366, 3966 and 7652 participants Study power: no information on study power provided although the SR did attempt to extract this information Baseline age: 6 months to 4 years Duration of follow-up: age of 8 and 15 years
Other comments	None
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence graded insufficient because there were only 2 independent PCS

Abbreviations: intelligence quotient (IQ), prospective cohort study (PCS), systematic review (SR)

Table A10.13 Non-sugar sweeteners (NSS) intake and body weight

Outcome	**Body weight**
Number of SR or MA	1 SR with MA (WHO et al 2022)
Number of primary studies included in MA	2 PCS included in MA; 1633 participants
Results of primary studies	Per daily serving of NSS (in drinks) was not associated with later body weight (kg) MD 0.03 (95% CI -0.14 to 0.21); p=0.72
Quality of SR • AMSTAR 2 • Study power • Publication bias • Confounding	AMSTAR 2: moderate Statistical approach: random-effects model. Heterogeneity: I^2=0 Study power: no information on study power Publication bias: not assessed as <10 studies included in MA Confounding: SES (2 PCS), baseline BMI z-score (1 PCS), physical activity (1 PCS), total dietary energy intake (2 PCS).
Primary study characteristics	Study size: n>200 (1 PCS); n>1300 (1 PCS) Baseline age: 2-5 (1 PCS); 2-6 (1 PCS) Duration of follow-up: 8 months (1 PCS), 1.5 years (1 PCS)
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence was graded insufficient due to the small number of primary studies (n=2).

Abbreviations: meta-analysis (MA), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR)

Drinks

Table A10.14 Total milk consumption and BMI

Outcome	**BMI z-score**
Number of SR	1 SR (Dougkas et al 2019)
Number of primary studies included in SR	4 PCS
Results of primary studies	All 4 PCS reported no association Only 2 of the PCS reported effect size and standard errors, the other 3 PCS only reported p-values
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: low Publication bias: not assessed Confounding: All 4 PCS adjusted for sex and demographic factors (ethnicity); 3 adjusted for socioeconomic status; 2 adjusted for TDEI and 2 adjusted for consumption of non-dairy beverages.
Primary study characteristics	Total number of participants: 11,992 Study size: n>850 (1 PCS), n>8000 (2 PCS) Study power: no information on study power provided Baseline age: 1 to 5 years Duration of follow-up: 8 months (1 PCS); 1 year (2 PCS); 4 years (1 PCS)
Direction of association	No association
Grade Justification for grade	Limited Evidence was graded limited due to the lack of quantitative findings (including confidence intervals) and inconsistency in adjustment for confounders.

Abbreviations: body mass index (BMI), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR)
Null = no association or effect.

Table A10.15 Whole milk compared with reduced fat milk consumption and odds of overweight/obesity

Outcome	BMI z-score and odds of overweight or obesity
Number of SR/MA	1 SR with MA (Vanderhout et al 2020)
Number of primary studies included in MA	3 PCS (2 from the same longitudinal cohort) in children aged 1 to 5 years; 18,152 participants [To note that 2 PCS were meta-analysed together with a third PCS in older children aged 10 to 13 years. It was therefore decided to assess the PCS in children aged 1 to 5 years separately – see next row]
Results of primary studies	2 PCS considered BMI z-score. - 1 PCS reported that higher consumption of whole milk (per daily serving) at age 2 years was associated with lower BMI z-score at age 3 years (beta coefficient -0.09 units; p=0.02), adjusted for TDEI, baseline BMI z-score, non-dairy beverage intake, TV viewing, maternal BMI and education and paternal BMI. - 1 PCS reported that every 1% increase in milk fat intake at age 4 years was associated with lower BMI z-score at age 5 years (beta coefficient -0.139; 95% CI -0.173 to -0.105; p<0.001), adjusted for sex, ethnicity and SES 2 PCS considered odds of overweight or obesity. - 1 PCS reported that cows' milk fat intake (whole, reduced-fat, 1%) at age 2 years was not associated with odds of incident overweight at age 3 years (all p>0.05), adjusted for TDEI, baseline BMI z-score, non-dairy beverage intake, TV viewing, maternal BMI and education and paternal BMI. - 1 PCS reported that children who consumed reduced-fat (skim or 1%) milk at age 2 years had a higher odds of becoming overweight or obese at age 4 years compared with children who consumed whole or 2% milk (OR overweight 1.63; 95% CI 1.23 to 1.86; OR obese 1.65; 95% CI 1.31 to 2.06; all p<0.001), adjusted for sex, ethnicity, SES, juice and SSB consumption, number of glasses of milk daily. The same PCS reported that children with normal weight at age 2 years who consumed skim or 1% milk had a higher odds of becoming overweight or obese at age 4 years compared with children who consumed whole or 2% milk (OR 1.57; 95% CI 1.03 to 2.42).
Quality of SR • AMSTAR 2 • Study power • Publication bias • Confounding	AMSTAR 2: low Study power: no information on study power provided Publication bias: possible publication bias (of meta-analysed studies) as demonstrated by funnel plot and Egger's test. Confounding: assessed as part of quality assessment (all SRs). See above for details of confounders at the individual study level. The review authors commented that confounding and reverse causality "are plausible alternative explanations" of the results (that "parents of children who have lower adiposity might choose higher-fat milk to increase weight gain").

Primary study characteristics	Study size: n>850 (1 PCS); n>8000 (2 PCS) Baseline age: 2 to 4 years (3 PCS) Duration of follow-up: 1 to 2 years
Other comments	One SR author received an unrestricted research grant from Dairy Farmers of Canada (2011-2012)
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence was graded insufficient because there were only 2 independent cohorts. There was also the possibility of reverse causation and publication bias.

Abbreviations: body mass index (BMI), odds ratio (OR), prospective cohort study (PCS), socioeconomic status (SES), sugar-sweetened beverage (SSB), systematic review (SR), total dietary energy intake (TDEI)

Table A10.16 100% fruit juice and BMI

Outcome	Change in BMI (or BMI z-score)
Number of SR	1 SR (Frantsve-Hawley et al 2017)
Number of primary studies included in SR	6 PCS
Results of primary studies	3 PCS (in 10,938 participants) reported a direct association (including a dose-response association in 1 study), all unadjusted for TDEI; 3 PCS (in 16,854 participants) reported no association, of which 2 adjusted for TDEI
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: moderate Publication bias: not assessed Confounding: 3 of 3 studies that reported a direct association adjusted for sex, baseline BMI or weight, ethnicity or SES; while 2 of 3 studies that reported no association adjusted for sex and baseline BMI
Primary study characteristics	Total number of participants: 27,792 Study size: n<150 participants (1 PCS); n<1000 (1 PCS); n>1000 (2 PCS); n>8500 (1 PCS); n>15000 (1 PCS) Study power: no information on study power provided Baseline age: mostly 2 to 4 years Duration of follow-up: The studies that reported an association had longer follow-up durations (mostly 2 to 6 years) than the studies that reported no association (6m to 2 years).
Direction of association	Direct association (non-TDEI adjusted) No association (TDEI-adjusted)
Grade Justification for grade	Limited Unadjusted for TDEI: 3 of 3 PCS of moderate quality reported a direct association between fruit juice consumption and BMI – the evidence was graded limited. Adjusted for TDEI: 3 of 3 PCS reported no association between fruit juice consumption and BMI – the evidence was also graded limited.

Abbreviations: body mass index (BMI), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR), total dietary energy intake (TDEI)

Table A10.17 Sugar-sweetened beverages and obesity outcomes

Outcome	Odds of overweight or obesity	Change in BMI (or BMIz or WHZ)
Number of SR or MA	1 SR (with MA) (Te Morenga et al 2012)	2 SRs (Frantsve-Hawley et al, 2017; Luger et al, 2017)
Number of primary studies included in SR/MA	7 estimates from 5 PCS included in the MA; 7225 participants	7 PCS (Frantsve-Hawley: 5 PCS; Luger: 2 PCS)
Results of MA or primary studies	MA reported an increased odds of being overweight or obese between the highest and lowest SSB consumption (servings per day or per week) OR 1.55 (95% CI 1.32 to 1.82) All point estimates in the same direction, with overlapping confidence intervals 4 of 5 PCS adjusted for TDEI	All 5 PCS (in 29,481 participants) reported a direct association (all unadjusted for TDEI). 2 PCS (in 1381 participants) reported null association (adjusted for TDEI)
Quality of SR or MA • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: moderate Statistical approach: random-effects model Heterogeneity: I^2=0 Publication bias: not assessed Confounding: confounders were acknowledged, but impact of potential confounding bias not assessed. 4 of 5 studies adjusted for baseline BMI or body weight. Other confounders adjusted for by most studies included age, sex, dietary intake and physical activity.	AMSTAR 2: Frantsve-Hawley: moderate; Luger: low Publication bias: not assessed (both SRs) Confounding: Of the 5 PCS reporting a direct association, all 5 adjusted for sex, 4 studies adjusted for SES, but only 1 study adjusted for baseline body size (WHZ).
Primary study characteristics	Sample size: n=120 to 548 (4 PCS), n=7157 (1 PCS)	Sample size: n<100 (2 PCS), n>200 (1 PCS), n=500 to 2000 (2 PCS), n>4000 (1 PCS), n>9000 (1 PCS), n>10000 (1 PCS)

Outcome	Odds of overweight or obesity	Change in BMI (or BMIz or WHZ)
	Study power: no information on study power provided Baseline age: mostly under 5 years. 84.7% weighting of MA in children aged 1 to 5 years. Duration of follow up: 1 to 8 years (4 studies ≤2 years).	Study power: no information on study power provided Baseline age: mostly 2 to 5 years Duration of follow up: 6 months to 12 years
Direction of association	Direct association	Direct association (unadjusted for TDEI) Not enough evidence to draw conclusions and recommendations (adjusted for TDEI)
Grade Justification for grade	Adequate Evidence graded adequate based on the large association, lack of heterogeneity between studies, and adequate accounting for key confounding factors	Moderate Evidence for a direct association between SSB consumption and change in BMI (or BMIz or WHZ), unadjusted for TDEI, graded *moderate* based on 5 large and moderate quality PCS with consistent findings. Given that most of the PCS did not adjust for baseline body size, upgrading to *adequate* was not warranted. Insufficient evidence for any association between SSB consumption and change in weight status, adjusted for TDEI, because only 2 PCS adjusted for TDEI.

Abbreviations: body mass index (BMI), body mass index z-score (BMIz), meta-analysis (MA), odds ratio (OR), prospective cohort study (PCS), systematic review (SR), total dietary energy intake (TDEI), weight-for-height z-score (WHZ)

Eating and feeding behaviours

Table A10.18 Food fussiness and BMI

Outcome	BMI z-score
Number of SR	2 SRs (Brown et al 2016; Kininmonth et al 2021)
Number of primary studies included in SR	3 PCS (Brown: 1 PCS; Kininmonth: 2 PCS)
Results of primary studies	All 3 PCS (n=697) reported no association between food fussiness and later BMI z-score. Quantitative details were reported for 1 PCS. That PCS reported no association between children's eating behaviours (including food fussiness) at ages 2 to 4 years (mean age 3.3 years) and BMI z-score at ages 3 to 5 years (mean age 4.3 years) (R^2_{Change}=0.01; p=0.707) All 3 PCS adjusted for child baseline BMI z-score, maternal BMI and education or household income.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Brown: moderate; Kininmonth: critically low Publication bias: not assessed Confounding: assessed as part of quality assessment (both SRs). See above for details of confounders.
Primary study characteristics	Study size: n>150 (1 PCS); n>200 (1 PCS); n>300 (1 PCS) Study power: None of the PCS reported performing power calculations or justifying sample sizes. Baseline age: 14 months to 5 years Duration of follow-up: 12 months (2 PCS); 30 months (1 PCS) Exposure: food fussiness measured by the Child Eating Behaviour Questionnaire (CEBQ)
Direction of association	No association
Grade Justification for grade	Limited Despite the lack of reporting of quantitative findings to judge confidence intervals and the lack of justification of sample sizes, evidence was not downgraded due to consistency of findings across the PCS and adequate adjustment for child baseline BMI.

Abbreviations: body mass index (BMI), meta-analysis (MA), prospective cohort study (PCS), systematic review (SR)

Table A10.19 Feeding practices (collective)* on increasing consumption of fruit or vegetables

Outcome	Vegetable consumption (short term, ≤8 months)
Number of SR or MA	2 SRs with MAs (Hodder et al 2020; Nekitsing et al 2018)
Number of primary studies included in MA	Hodder: 19 RCTs, 2140 participants included in main MA. 15 RCTs (number of participants not reported) included in subgroup MA in children aged 1 to 5 years. Nekitsing: 30 intervention studies (12 RCTs, 6 cross-over, 6 between-subjects, 3 within-subjects, 3 pre-post designs), 4017 participants
Results of MA	Hodder subgroup MA in children aged 1 to 5 years: SMD 0.58; 95% CI 0.34 to 0.83; p<0.00001 (15 trials, number of participants not reported). All point estimates favoured the intervention with overlapping confidence intervals. Hodder main MA in children up to age 5 years: SMD 0.50; 95% CI 0.29 to 0.71; p<0.0001. Equivalent to an increase of 5.30g (95% CI 3.08 to 7.53g) of as-desired vegetable consumption. 11 of 13 point estimates favoured the intervention with overlapping confidence intervals. 76% weighting of MA in children aged ≥12 months to 5 years. Hodder main MA sensitivity analysis after exclusion of studies at high risk of bias: SMD 0.54; 95% CI 0.18 to 0.90; p=0.004; 8 RCTs, 701 participants. Hodder main MA sensitivity analysis of studies with low attrition or high attrition with ITT analysis: SMD 0.49; 95% CI 0.22 to 0.77; p=0.0004; 11 RCTs, 971 participants. Nekitsing MA of 30 studies: SMD 0.40; 95% CI 0.31 to 0.50; p<0.001. 29 of 30 effect estimates favoured the intervention with overlapping confidence intervals. Nekitsing MA of 44 intervention arms across 30 studies: SMD 0.42 (95% CI 0.33 to 0.51); p<0.001
Quality of SR or MA • AMSTAR 2 • Statistical approach • Heterogeneity • Overlap of primary studies • Publication bias	AMSTAR 2: Hodder: high; Nekitsing: low Statistical approach: random-effects model (both MAs). Nekitsing: pooled results from different study types (RCTs, between-subjects, within-subjects, pre-post designs) Heterogeneity: Hodder main MA: I^2=77%; Hodder subgroup MA: I^2=72%; Nekitsing: I^2=73.4% (MA 30 studies); I^2=69.1% (MA of 44 intervention arms) Overlap of primary studies: 3/30 studies in Nekitsing also included in Hodder main MA.

• Confounding	Publication bias: Hodder: no evidence of publication bias. Nekitsing: Funnel plot asymmetry and results of Egger's test suggested presence of publication bias. Imputing estimates from missing studies would reduce the overall effect size to SMD 0.31 (95% CI 0.21 to 0.41). Confounding (NRSI): Nekitsing: 23 of 30 studies were rated 'strong' on confounding using the Effective Public Health Practice Project quality assessment tool (3 of 30 were rated 'moderate', 4 of 30 rated 'weak')
Primary study characteristics	Study size: Hodder: 10 RCTs, n<100; 6 RCTs, n<200; 3 RCTs, n>200. Nekitsing: n=12 to 902 across the 30 studies. Study power: Hodder: noted whether RCTs included information on sample size calculations. Study duration: Hodder: mostly ≤6 months (mean duration 8.3 weeks); Nekitsing: ≤8 months Baseline age: Hodder: ≤5 years; Nekitsing: mean age 3.8 years (from 19 studies that reported mean age) Interventions: Hodder: repeated exposure, pairing of vegetables with positive stimuli or like foods. Nekitsing: educational (parental/teaching staff/child); taste exposure, pairing, food provision, reward interventions, modelling, choice offering, visual presentation.
Direction of effect	Increase
Grade Justification for grade	Moderate Findings from the subgroup MA in children aged 1 to 5 years was supported by the main MA and sensitivity analyses by Hodder et al (2020) in children aged <5 years as well as the findings from the MA by Nekitsing et al (2018). Evidence of a small effect size and non-specificity of interventions (varied feeding practices) prevented the evidence from being graded *adequate*.

Abbreviations: intention-to-treat (ITT), meta-analysis (MA), non-randomised studies of intervention (NRSI), randomised controlled trial (RCT), standardised mean difference (SMD), systematic review (SR)

*Repeated exposure, pairing with positive stimuli, infant feeding practices, reward interventions, modelling, parental/child nutrition educational interventions

Table A10.20 Repeated taste exposure on increasing vegetable consumption

Outcome	Vegetable consumption (short term, <12 months)
Number of SR or MA	1 SR with MA (Nekitsing et al, 2018)
Number of primary studies included in subgroup MA	10 intervention studies (study design not specified) in subgroup MA, participants NR
Results of subgroup MA	SMD 0.57 (95% CI 0.43 to 0.70); p=NR. Meta-regression analysis of the 10 studies: Beta coefficient 0.035 (95% CI 0.00 to 0.06); p=0.01 Children require 8 to 10 exposures for a significant improvement in vegetable consumption
Quality of SR or MA • AMSTAR 2 • Statistical approach • Heterogeneity • Publication bias • Confounding	AMSTAR 2: low Statistical approach: random-effects model Heterogeneity: I^2=52% Publication bias: funnel plot asymmetry and results of Egger's test suggested presence of publication bias. Confounding (NRSI): confounding assessed but unclear to what extent the studies included in the subgroup MA were subject to confounding.
Primary study characteristics	Study size: unclear Study power: no information on study power provided Study duration: ≤8 months Baseline age: <5 years (mean age NR)
Other comments	MA pooled results from different study types (RCTs, between-subjects, within-subjects, pre-post designs)
Direction of effect	Increase
Grade Justification for grade	Moderate Evidence of publication bias prevented the evidence from being graded adequate.

Abbreviations: meta-analysis (MA), not reported (NR), non-randomised studies of intervention (NRSI), randomised controlled trial (RCT), standardised mean difference (SMD), systematic review (SR) ↑ increase in effect or direct association

Table A10.21 Repeated taste exposure and pairing versus control on increasing vegetable consumption

Outcome	Vegetable consumption (short term, <12 months)
Number of SR or MA	1 SR with MA (Nekitsing et al 2018)
Number of primary studies included in subgroup MA	8 intervention arms (study design not specified) in subgroup MA, 358 participants
Results of subgroup MA	SMD 0.43 (95% CI 0.26 to 0.61); p=NR.
Quality of SR or MA • AMSTAR 2 • Statistical approach • Heterogeneity • Publication bias • Confounding	AMSTAR 2: low Statistical approach: random-effects model Heterogeneity: I^2=NR Publication bias: funnel plot asymmetry and results of Egger's test suggested presence of publication bias. Confounding (NRSI): confounding assessed but unclear to what extent the studies included in the subgroup MA were subject to confounding bias
Primary study characteristics	Study size: unclear Study power: no information on study power provided Study duration: ≤8 months Baseline age: <5 years (mean age NR)
Other comments	Pooled results from different study types (RCTs, between-subjects, within-subjects, pre-post designs)
Direction of effect	Increase
Grade Justification for grade	Moderate Evidence of publication bias together with small effect sizes prevented the evidence from being graded *adequate*.

Abbreviations: meta-analysis (MA), not reported (NR), non-randomised studies of intervention (NRSI), randomised controlled trial (RCT), standardised mean difference (SMD), systematic review (SR) ↑ increase in effect or direct association

Table A10.22 Adult modelling on children’s food acceptance or consumption

Outcome	Food consumption
Number of SR	2 SRs (Mura Paroche et al 2017, Ward et al, 2015)
Number of primary studies included in SR	6 intervention studies Ward: 2 quasi-experimental studies; Mura Paroche: 3 intervention studies (study design not specified) and 1 PCS.
Results of primary studies	Of the 5 intervention studies: 2 quasi-experimental studies reported that modelling by teachers (silently or enthusiastically) did not increase acceptance or consumption of foods (including vegetables and fruit) compared with simple exposure; a third study reported that parental modelling (among other prompting techniques) did not increase consumption of an unfamiliar fruit or vegetable compared with a neutral prompt. Two additional studies reported that adult modelling was effective in increasing child acceptance or consumption of unfamiliar foods compared with simple exposure. One of these studies reported that the modelling effect did not differ by age or early feeding practices while the other study reported that the effect was strongest in girls and when the modeller was the child’s mother (rather than a ‘visitor’). The PCS reported that maternal modelling of healthy eating was inversely associated with child food fussiness 1 year later in adjusted analyses.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	<u>AMSTAR 2</u>: Ward: moderate; Mura Paroche: critically low. <u>Publication bias:</u> SRs did not investigate publication bias. <u>Confounding:</u> Ward: confounding assessed but findings NR; Mura Paroche: unclear whether confounding was assessed.
Primary study characteristics	<u>Study size</u>: n<80 (4 studies); n<100 (1 study); n>100 (1 study) <u>Study power</u>: no information on study power provided <u>Study duration</u>: 1 year (1 study); 3 days (1 study), unclear (4 studies). <u>Baseline age:</u> preschool age undefined (2 studies) 12 to 36 months (1 study), mean age 3.3 years (1 study) 14 to 48 months (1 study), 2 to 5 years (1 study).
Other comments	Mura Paroche: insufficient quantitative data to judge effect sizes.
Direction of effect	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Inconsistent

	Three intervention studies reported no difference in effect on children's food acceptance or consumption between adult modelling compared with simple exposure or a neutral prompt while 2 intervention studies reported that adult modelling increased children's food acceptance or consumption compared with simple exposure or modelling of different foods (compared with the target food). The PCS reported an inverse association between modelling of healthy eating and child food fussiness. All studies were short term (up to 1 year).

Abbreviations: not reported (NR), systematic review (SR)

Table A10.23 Peer modelling on children's food acceptance or consumption

Outcome	**Food consumption**
Number of SR	2 SRs (Mura Paroche et al, 2017; Mikkelsen et al, 2014)
Number of primary studies included in SR	3 intervention studies Mikkelsen: 1 quasi-experimental study; Mura Paroche: 2 studies (study design not specified).
Results of primary studies	All 3 studies reported that peer modelling led to increased consumption or acceptance for the modelled food (fruit, vegetables, plain crackers) that were either unfamiliar (fruit), not preferred by the child at baseline (vegetable) or for which preference or acceptance status was not reported (crackers). One study reported that girl models were more effective than boy models at increasing acceptance of unfamiliar fruit in children (both genders) but the effect had disappeared 1 month after the study.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Mikkelsen: low; Mura Paroche: critically low. Publication bias: SRs did not investigate publication bias. Confounding: Mikkelsen: confounding assessed but findings NR; Mura Paroche: unclear whether confounding was assessed
Primary study characteristics	Study size: n<40 (2 studies); n>50 (1 study) Study power: no information on study power provided Study duration: 2 sessions (1 study), 4 days (1 study), unclear (1 study) Baseline age: 2 to 4 years (1 study), 3 to 6 years (1 study), 2.5 to 6.5 years (1 study)
Other comments	Mura Paroche: insufficient quantitative data to judge effect sizes.
Direction of effect	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence downgraded due to the lack of quantitative data to judge effect sizes, small sample sizes, and lack of information on study power, publication bias, and confounding.

Abbreviations: not reported (NR), systematic review (SR)

Excess weight and obesity

Table A10.24 Rapid early weight gain or growth and adult BMI

Outcome	**Adult BMI**
Number of SR	1 SR (Brisbois et al 2012)
Number of primary studies included in SR	2 PCS
Results of primary studies	Both PCS found a direct association between rapid early growth at age 1 to 7 years and higher adult BMI.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low Publication bias: not assessed Confounding: both PCS adjusted for potential confounding factors including sex, gestational age, maternal weight, maternal smoking and SES.
Primary study characteristics	Total number of participants: 940 Study size: n=679 and 261 Study power: no information on study power provided Baseline age: 1 to 7 years Duration of follow up: Ages at follow up were ages 18 to 50 years (1 PCS) and 20 to 40 years (1 PCS)
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence graded as insufficient due to number of PCS

Abbreviations: body mass index (BMI), not reported (NR), prospective cohort study (PCS), SES (socioeconomic status), systematic review (SR)

Table A10.25 Age at adiposity rebound and adult BMI or risk of obesity

Outcome	Adult BMI or risk of obesity
Number of SR	1 SR (Brisbois et al 2012)
Number of primary studies included in SR	4 PCS
Results of primary studies	All 4 PCS reported an inverse association. One PCS reported a RR for obesity at age 26 years of 5.91 per year earlier rebound (95% CI 3.03 to 11.55); the magnitude of the association was not reported for the other 3 PCS
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low Publication bias: not assessed Confounding: one PCS adjusted for sex, the other 3 PCS were unadjusted
Primary study characteristics	Total number of participants: 1406 Study size: n=158, 164, 458 and 626 Study power: no information on study power provided Baseline age: under 5.5 years Duration of follow up: not reported for 3 out of 4 studies, but to be included in the SR primary studies had to have an outcome measure in adulthood (>18 years)
Direction of association	Inverse association
Grade Justification for grade	Limited Evidence was graded limited due to the small number of studies (4 PCS) of limited quality (no study adjusted for the key confounder baseline BMI)

Abbreviations: body mass index (BMI), prospective cohort study (PCS), relative risk (RR), socioeconomic status (SES), systematic review (SR)
↓ decrease in effect or inverse association.

Table A10.26 Child BMI or weight status and adult BMI, overweight or obesity

Outcome	Adult BMI, overweight or obesity
Number of SR	1 SR (Brisbois et al 2012)
Number of primary studies included in SR	11 PCS
Results of primary studies	All 10 of 11 PCS reported a direct association with adult BMI. 4 of the 10 PCS reported that a higher BMI in childhood was associated with a higher risk of adult overweight or obesity. 2 PCS were male only cohorts and one was a female only cohort. One PCS reported an association in girls but not boys
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: critically low Publication bias: not assessed Confounding: 8 PCS were unadjusted for potential confounding factors. 1 PCS was 'adjusted' but details were not provided, 1 adjusted for age, 1 adjusted for parental weight status and one adjusted for family income, pre-gestational weight, maternal height, weight gain during pregnancy and age
Primary study characteristics	Total number of participants: 4296 Study size: 3 PCS had <200 participants, 5 PCS had 200 to 500 participants, and 3 had >500 Study power: no information on study power provided Baseline age: 3 months to 5 years Duration of follow up: ages at follow up 18 to 35 years (4 PCS); NR or unclear (7 PCS)
Other comments	Statistics or quantitative details were reported for 5 of 11 PCS
Direction of association	Direct association
Grade Justification for grade	Adequate Evidence was graded adequate due to the large number of studies (10 PCS), large study sizes in several PCS (3 had n>500) and the consistent direction of the results. Adjusting for confounding factors is unnecessary for a predictive association. However, the lack of optimal adjustments limits the ability to make causal inferences.

Abbreviations: body mass index (BMI), not report (NR), prospective cohort study (PCS), systematic review (SR)
↑ increase in effect or direct association.

Table A10.27 Child BMI and adult coronary heart disease

Outcome	**Adult coronary heart disease**
Number of SR or MA	1 SR with MA (Llewellyn et al 2016)
Number of primary studies included in subgroup MA	3 PCS
Results of subgroup MA	Subgroup MA reported no association (OR: 0.97; 95% CI: 0.85 to 1.10)
Quality of SR or MA • AMSTAR 2 • Statistical approach • Heterogeneity • Publication bias • Confounding	AMSTAR 2: critically low Statistical approach: random-effects model Heterogeneity: medium heterogeneity (I^2=52%) Publication bias: SRs did not investigate publication bias Confounding: No information provided on adjustment for confounders. Authors stated that when available, results from models adjusted for potential confounders were used and that most studies were adjusted for key confounders, but no further details were provided on the degree of adjustment performed in these 3 PCS.
Primary study characteristics	Total number of participants: not reported Study size: not reported Study power: no information on study power provided Baseline age: ≤6 years Duration of follow up: not reported
Direction of association	No association
Grade Justification for grade	Moderate Evidence graded moderate based on the total number of primary studies included in the SR with MA (3 PCS)

Abbreviations: meta-analysis (MA), odds ratio (OR), prospective cohort study (PCS), systematic review (SR)
Null = no association or effect.

Table A10.28 Child BMI and adult stroke

Outcome	Adult stroke
Number of SR or MA	1 SR with MA (Llewellyn et al 2016)
Number of primary studies included in subgroup MA	3 PCS
Results of subgroup MA	Subgroup MA reported no association (OR: 0.94; 95% CI: 0.75 to 1.19)
Quality of SR or MA • AMSTAR 2 • Statistical approach • Heterogeneity • Publication bias • Confounding	AMSTAR 2: critically low Statistical approach: random-effects model Heterogeneity: medium heterogeneity (I^2=58%) Publication bias: SRs did not investigate publication bias Confounding: No information provided on adjustment for confounders. Authors stated that when available, results from models adjusted for potential confounders were used and that most studies were adjusted for key confounders, but no further details were provided on the degree of adjustment performed in these 3 PCS
Primary study characteristics	Total number of participants: not reported Study size: not reported Study power: no information on study power provided Baseline age: ≤6 years Duration of follow up: not reported
Direction of association	No association
Grade Justification for grade	Moderate Evidence graded moderate based on the total number of primary studies included in the SR with MA (3 PCS) and the medium heterogeneity.

Abbreviations: meta-analysis (MA), odds ratio (OR), prospective cohort study (PCS), systematic review (SR)
Null = no association or effect.

Oral health

Table A10.29 Free sugars intake and dental caries

Outcome	Dental caries
Number of SR	3 SRs (Moores et al, 2022; Moynihan and Kelly, 2014; Hooley et al, 2012)
Number of primary studies included in SR	6 PCS (reported in 7 publications) (Moores: 2 publications; Moynihan and Kelly: 4 publications; Hooley: 1 publication)
Results of primary studies	5 PCS (n=2938) reported an association between higher free sugars intake and increased development of dental caries compared with lower free sugars intake. 1 PCS reported no association (unadjusted). Of the 5 PCS that reported an association, quantitative findings were reported for 4 PCS: 1 PCS reported PR 1.97 (95% CI 1.13 to 3.34) for children with free sugars intake >10% TDEI at ages 1 and 2 years compared with children who complied with the WHO threshold of <5% TDEI from free sugars at ages 1 and 2 years, adjusted for SES, age at time of dental examination and breastfeeding duration. 1 PCS reported OR 2.99 (95% CI 1.82 to 4.91) for children who consumed >10% TDEI from free sugars compared with children who consumed <10% TDEI from free sugars, adjusted for SES, oral hygiene practices (toothbrushing and use of fluoride gel). 1 PCS reported a direct correlation between the amount of sugar consumed and incidence of dental caries (correlation coefficient r=0.4), unadjusted. 1 PCS reported that the sucrose intake of children aged 3 years who developed caries by age 6 was higher than children who remained caries free at age 6 (p=0.026), adjusted for SES, oral hygiene practices and fluoride use. A second publication using the same data from the same PCS reported that the DMFT or dmft scores of children with sucrose intakes ≥10% TDEI and <10% TDEI at age 3 years was statistically significant at ages 9 and 16 years (p=0.014 and p=0.007, respectively) but not at ages 6 and 12 years.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Moores: high; Moynihan and Kelly: high; Hooley: critically low Publication bias: Moynihan: assessed. No evidence of publication bias. Moores and Hooley: not assessed. Confounding: assessed as part of quality assessment (all SRs). See above for details of confounders/moderators at the individual study level.

Primary study characteristics	Study size: n>100 (1 PCS); n>250 (1 PCS); n>350 (1 PCS); n>500 (1 PCS); n>800 (1 PCS); n>900 (1 PCS) Study power: 2 of 6 PCS performed power calculations. Baseline age: 1 year (1 PCS); 1 to 2 years (1 PCS); 18 months (1 PCS); 3 years (2 PCS); 4 years (1 PCS) Duration of follow-up: 1 year (2 PCS); 2 to 3 years (1 PCS); 3.5 years (1 PCS); 4 years (1 PCS); 16 years (1 PCS) Exposures: intakes of sucrose (2 PCS), free sugars (1 PCS), added sugars (3 PCS) Outcomes: caries increment (2 PCS), caries incidence or prevalence (1 PCS), change in decayed, missing, filled teeth/surfaces (dmft/s) (2 PCS), dmfs ≥1 (1 PCS)
Other comments	Studies conducted in HIC (3 PCS) and UMIC (3 PCS)
Direction of association	Direct association
Grade Justification for grade	Adequate Evidence graded adequate due to the relatively large number of studies that reported a direct association (5 PCS) (including 1 for which quantitative findings were not reported), a relatively large effect size reported in 2 PCS, and adequate accounting for key confounding factors.

Abbreviations: decayed, missing, filled teeth/surfaces (dmft/s), high income country (HIC), meta-analysis (MA), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR), total dietary energy intake (TDEI), upper middle income country (UMIC)

Table A10.30 Sugar-sweetened beverage consumption and development of dental caries

Outcome	Early childhood caries (ECC)
Number of SR	1 SR (Moynihan et al 2019)
Number of primary studies included in SR	4 PCS
Results of primary studies	All 4 PCS (n=32,982) reported an association between consuming drinks or liquids containing free sugars at ages 1 to 1.5 years and later development of ECC compared with not consuming drinks or liquids containing free sugars. 1 PCS reported a caries prevalence OR 3.04 (95% CI 1.07 to 8.64), adjusted for age only. 1 PCS reported a caries incidence OR 1.56 (95% CI 1.46 to 1.65), adjusted for SES, toothbrushing frequency and use of a fluoride agent, falling asleep with a bottle 1 PCS reported an ECC experience OR 2.2 (95% CI 1.1 to 4.5) for nightly consumption of sugar-containing drinks and OR 1.5 (95% CI 0.8 to 2.8) for sometimes consuming sugars-containing drinks at night, adjusted for SES and toothbrushing frequency. None of the 3 PCS adjusted for intake of dietary sugars from the rest of the diet. Conversely, 1 PCS reported that not consuming sugar-containing liquids to quench thirst at age 1 was associated with an OR for being caries free of 2.26 (95% CI 1.07 to 4.77). Unclear whether this estimate was adjusted.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Moynihan: moderate Publication bias: Moynihan: assessed. No evidence of publication bias. Confounding: assessed as part of quality assessment. See above for details of confounders/moderators at the individual study level
Primary study characteristics	Study size: n>100 in 1 PCS; n>250 in 1 PCS; n>1300 in 1 PCS; n>30,000 in 1 PCS Study power: none of the PCS reported performing power calculations or justified sample sizes, although 1 PCS included n>30,000 Baseline age: 6 to 18 months (1 PCS); 1 year (1 PCS); 1.5 years (2 PCS) Duration of follow-up: 1 year (1 PCS); 1.5 years (1 PCS); 2 years (1 PCS); 3.5 years (1 PCS) Exposure: ‘Sugar-sweetened beverages’ (SSBs) (2 PCS), ‘sugary drinks’ (1 PCS), ‘sugars-containing liquids’ (1 PCS). Only 1 PCS described what ‘sugar-sweetened beverages’ included.

	Outcome: ECC reported as caries prevalence (1 PCS); caries incidence (2 PCS); ECC experience (1 PCS).
Other comments	All studies conducted in HIC
Direction of association	Direct association
Grade Justification for grade	Limited Evidence graded limited due to the small number of studies (4 PCS) and limited adjustment for key confounding factors (e.g. dietary sugars intake). Evidence not downgraded due to consistency in direction of effect across the studies.

Abbreviations: early childhood caries (ECC), high income country (HIC), odds ratio (OR), prospective cohort study (PCS), socioeconomic status (SES), sugar-sweetened beverages (SSB), systematic review (SR)

Table A10.31 Breastfeeding ≥12 months compared with <12 months and development of dental caries

Outcome	Early childhood caries (ECC) and severe ECC (S-ECC)
Number of SR	3 SRs (Moynihan et al 2019; Tham et al, 2015; Hooley et al, 2012)
Number of primary studies included in SR	4 PCS (Moynihan: 1 PCS; Tham: 2 PCS; Hooley: 1 PCS).
Results of primary studies	All 4 PCS reported no association between breastfeeding ≥12 months and later ECC or S-ECC risk compared with breastfeeding <12 months. 3 of 3 PCS reported no association between breastfeeding ≥12 months and later ECC development compared with breastfeeding <12 months. Quantitative findings for 2 PCS were reported by the SRs. Of these, 1 PCS reported a mean ratio of decayed, missing, filled surfaces (dmfs) in primary dentition of 0.9 (95% CI 0.6 to 1.3). The other PCS reported an adjusted OR of ECC of 1.09 (95% CI 0.45 to 2.71). Both PCS adjusted for socioeconomic status (SES) and measures of free sugars consumption (e.g. added sugars to bottle, introduction to sweets before age 6 months, consumption of soft drinks). 1 PCS also reported adjusting for oral hygiene practices (toothbrushing and use of fluoride toothpaste or gel). 2 PCS examined the impact of breastfeeding duration on S-ECC risk. 2/2 PCS reported no association between breastfeeding ≥12 months and later S-ECC development compared with breastfeeding <12 months. 1 PCS reported RR for S-ECC of 1.0 (95% CI 0.6 to 1.6); the other PCS reported an adjusted prevalence ratio of 1.39 (95% CI 0.73 to 2.64). Both PCS adjusted for measures of sugars consumption and SES; neither study adjusted for oral hygiene practices.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Moynihan: moderate; Tham: low; Hooley: critically low Publication bias: Moynihan: assessed. No evidence of publication bias. Tham and Hooley: not assessed Confounding: assessed as part of quality assessment (all SRs). See above for details of confounders/moderators at the individual study level
Primary study characteristics	Study size: n>50 (1 PCS); n>300 (1 PCS); n>500 (1 PCS); n>800 (1 PCS) Study power: 1 of 4 PCS reported performing a power calculation or justified its sample size. Duration of follow-up: 2 years (1 PCS); 38 months (1 PCS); 41 to 50 months (1 PCS); 5 years (1 PCS) Outcome: ECC reported as decayed, missing, filled surfaces (dmfs) (1 PCS); and presence of ≥1 decayed filled teeth (dft) (1 PCS). S-ECC reported as dmfs ≥6 (1 PCS); and ≥1 affected maxillary teeth or ≥4 dmfs (1 PCS)
Other comments	Studies conducted in HIC in East Asia (1 PCS) and UMIC (3 PCS)

Direction of association	No association
Grade	Limited
Justification for grade	Evidence graded limited due to the small number of studies (quantitative findings reported for 3 PCS), lack of consideration of study power, lack of adjustment for oral hygiene practices, and uncertain generalisability of the findings to the UK (3 of 4 PCS conducted in UMIC). Evidence not downgraded due to consistency of findings across primary studies.

Abbreviations: breastfeeding (BF); decayed, missing, filled teeth/surfaces (dmft/s), early childhood caries (ECC), high income country (HIC), odds ratio (OR), prospective cohort study (PCS), relative risk (RR), socioeconomic status (SES), severe early childhood caries (S-ECC), systematic review (SR), upper middle income country (UMIC)

Table A10.32 Use of infant feeding bottles to consume liquids containing free sugars and development of dental caries

Outcome	Early childhood caries (ECC) and severe early childhood caries (S-ECC)
Number of SR	2 SRs (Moynihan et al 2019; Hooley et al 2012)
Number of primary studies included in SR	4 PCS (Moynihan: 3 PCS; Hooley: 1 PCS).
Results of primary studies	4 PCS (n=938) reported an association between consumption of liquids containing free sugars (for example, fruit juices/soft drinks/sweetened milk) at ages 12 to 39 months and later development of ECC/S-ECC compared with not consuming liquids containing free sugars. 1 PCS (n=56) reported no association (unadjusted). Of the 3 PCS that reported an association, quantitative results from 2 PCS were reported by the SRs: 1 PCS reported that bottle use for sweetened liquids other than milk at ages 29 to 39 months was associated with OR of ECC 2.47 (95% CI 1.23 to 5.05) at age 41 to 50 months. 1 PCS reported that bottle use for fruit juices/soft drinks at age 12 months was associated with a RR of S-ECC 1.41 (95% CI 1.08 to 1.86) at age 4 years. Both PCS adjusted for SES but neither adjusted for intake of dietary sugars from the rest of the diet. 1 PCS also adjusted for oral hygiene practices (toothbrushing frequency and use of fluoride toothpaste/gel). The third PCS did not report data for the comparator group (children who received milk/water from a bottle) and did not adjust for any confounders.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Moynihan: moderate; Hooley: critically low Publication bias: Moynihan: assessed. No evidence of publication bias. Hooley: not assessed Confounding: assessed as part of quality assessment (both SRs). See above for details of confounders/moderators at the individual study level
Primary study characteristics	Study size: n>250 in 3 PCS; n>50 in 1 PCS Study power: 1 of 4 PCS reported performing a power calculation or justified its sample size. Baseline age: 12 months/1 year (2 PCS); >12 months (1 PCS); 29 to 39 months (1 PCS) Duration of follow-up: 1 year (1 PCS); <2 years (1 PCS); 2 years (1 PCS); 3 years (1 PCS)

	Exposure: Use of bottles for consuming fruit juices or soft drinks (1 PCS); sweetened milk (1 PCS); sweetened liquids other than milk (1 PCS); sugars-containing liquids, unspecified (1 PCS) Outcome: ECC reported as caries incidence (2 PCS); and ≥1 decayed or filled teeth (1 PCS). S-ECC defined as ≥1 cavitated missing or filled smooth surfaces in primary maxillary anterior teeth or decayed (d_{1+}), missing or filled surfaces (dmfs) ≥5 (1 PCS).
Other comments	Studies conducted in HIC (2 PCS) and UMIC (2 PCS)
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence downgraded to insufficient due to the small number of studies that reported an association (3 PCS), including 1 study for which data for the control group was not reported, and lack of adjustment for dietary sugars intake and oral hygiene practices.

Abbreviations: decayed, missing, filled teeth/surfaces (dmft/s), early childhood caries (ECC), high income country (HIC), odds ratio (OR), prospective cohort study (PCS), relative risk (RR), severe early childhood caries (S-ECC), socioeconomic status (SES), systematic review (SR), upper middle income country (UMIC)

Table A10.33 Foods containing free sugars and development of dental caries

Outcome	Early childhood caries (ECC) and severe ECC (S-ECC)
Number of SR	3 SRs (Moynihan et al, 2019; Baghlaf et al, 2018; Hooley et al 2012)
Number of primary studies included in SR	4 PCS (Moynihan: 1 PCS; Baghlaf: 1 PCS; Hooley: 2 PCS)
Results of primary studies	All 4 PCS (n=2427) reported an association between consuming foods containing free sugars at ages 1 to 1.5 years and later risk of ECC or S-ECC compared with not consuming foods containing free sugars. Effect sizes were reported for 2 PCS. 1 PCS reported that nightly consumption of bedtime sweets was associated with increased 1 year's caries increment OR 1.33 (95% CI 1.01 to 1.68) compared with no bedtime sweet consumption, adjusted for oral hygiene practices (toothbrushing and use of fluoride toothpaste or other agents) but not SES or intake of dietary sugars from the rest of the diet or at other times of the day. 1 PCS reported that consumption of foods with a high density of added sugars (50% simple carbohydrates per 100g food) was associated with a RR of S-ECC of 1.43 (95% CI 1.08 to 1.89) compared with not consuming such foods, adjusted for SES and bottle use for fruit juices/soft drinks at age 12 months. Of the other 2 PCS for which no quantitative data were reported, both adjusted for toothbrushing and 1 PCS adjusted for SES.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Baghlaf: high; Moynihan: moderate; Hooley: critically low Publication bias: Moynihan: assessed. No evidence of publication bias. Baghlaf and Hooley: not assessed. Confounding: assessed as part of quality assessment. See above for details of confounders/moderators at the individual study level
Primary study characteristics	Study size: n>100 in 1 PCS; n>300 in 2 PCS, n>1500 in 1 PCS Study power: 2 of 4 PCS either performed power calculations or implied that this was done. Baseline age: 12 months (1 PCS); mean age 1.6 years (1 PCS); 18 to 36 months (1 PCS); 3 to 6 years (1 PCS) Duration of follow-up: 1 year (2 PCS); 1.5 years (1 PCS); 3 years (1 PCS) Exposure: consumption of bedtime sweets (1 PCS); foods with a high density of added sugars (1 PCS); snacking on non-fresh fruits and popcorn (1 PCS); sweet foods, unspecified (1 PCS) Outcome: ECC reported as caries prevalence or incidence (1 PCS); caries increment (dmft) (1 PCS); presence of at least one new lesion, filling or progression of a lesion (1 PCS). S-ECC reported as ≥1 cavitated, missing or filled smooth surfaces in primary maxillary anterior teeth or decayed (d_{1+}), missing or filled surfaces (dmfs) ≥5 (1 PCS).

Other comments	Studies conducted in HIC (3 PCS) and UMIC (1 PCS)
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence downgraded due to heterogeneity of exposures, lack of quantitative data for 2 PCS to judge effect sizes, and limited adjustment for key confounding factors (SES, intake of dietary sugars from rest of the diet).

Abbreviations: decayed, missing, filled teeth/surfaces (dmft/s), early childhood caries (ECC), high income country (HIC), odds ratio (OR), prospective cohort study (PCS), severe early childhood caries (S-ECC), socioeconomic status (SES), systematic review (SR), upper middle income country (UMIC)

Table A10.34 ‘Ultra-processed foods’ (UPF) and development of dental caries

Outcome	Dental caries
Number of SR or MA	1 SR (with MA) (Cascaes et al 2022)
Number of primary studies included in SR/MA	5 PCS (5 estimates included in a subgroup MA); 2401 participants
Results of MA	Highest versus lowest category of UPF consumption associated with later increased of dental caries RR 2.00 (95% CI 1.27 to 3.15). All point estimates in the same direction (>1) with overlapping confidence intervals.
Quality of SR • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: Cascaes: low. Statistical approach: random-effects model. Odds ratios from individual studies were used to calculate a pooled risk ratio. Heterogeneity: I^2=64% Publication bias: not assessed for PCS because there <10 PCS. (To note that there was evidence of publication bias for cross-sectional and case control studies included in the SR). Confounding: assessed as part of quality assessment. All 5 PCS adjusted for at least 2 of the following potential confounding/moderating factors: SES, toothbrushing, fluoride exposure, night time feeding.
Primary study characteristics	Study size: n<100 (1 PCS); n>350 (1 PCS); n>550 (2 PCS); n>600 (1 PCS) Baseline age: mostly under age 5 years (4/5 PCS). 78% weighting of subgroup MA in children aged under 5 years. Study power: no information on study power provided. Duration of follow-up: 1 year (1 PCS), 3 years (1 PCS), 4 years (2 PCS), 6 years (1 PCS) Exposure: primary studies were selected based on whether they examined UPFs as defined by the NOVA food classification system. However, it was the SR authors that applied the concept of UPF to the primary studies. The SR reported that none of the PCS “had based their dietary assessment on food processing” or “had measured UPF in a valid and reliable way”. Exposures included in the studies were the (frequency of) consumption of sugars-containing foods (including sugary cereals, chocolate, sweet confectionery, ice cream), savoury foods (crisps, crispy fried noodles) and carbonated beverages or soft drinks.

	Outcome: Subgroup MA outcome was increase in decayed, missing, filled surfaces (dmfs) or decayed, missing, filled teeth (dmft)
Other comments	Studies conducted in HIC (1 PCS) and UMIC (4 PCS)
Direction of association	Not enough evidence to draw conclusions and recommendations
Grade Justification for grade	Insufficient Evidence downgraded due to the indirectness of the exposure: there was no formal assessment of 'ultra-processed foods' using the NOVA classification system by the primary studies, and a lack of robust dietary assessment method for assessing consumption of UPFs.

Abbreviations: decayed, missing, filled teeth/surfaces (dmft/s), high income country (HIC), meta-analysis (MA), prospective cohort study (PCS), relative risk/risk ratio (RR), socioeconomic status (SES), systematic review (SR), upper middle income country (UMIC), ultra-processed foods (UPF)

Table A10.35 Breastfeeding beyond 12 months and malocclusion

Outcome	**Malocclusion and overjet**
Number of SR or MA	1 SR with MA
Number of primary studies included in subgroup MA	3 PCS (419 participants) included in a subgroup MA on odds of malocclusion 2 of the 3 PCS (272 participants) also included in a subgroup MA on odds of overjet
Results of subgroup MA	Subgroup MA reported an inverse association (protective effect) and no heterogeneity for malocclusion (OR 0.38; 95% CI 0.24 to 0.60; p<0.000; I^2=0) and overjet (OR 0.30; 95% CI 0.16 to 0.57; p=0.0003; I^2=0)
Quality of SR or MA • AMSTAR 2 • Publication bias • Confounding	AMSTAR 2: moderate Publication bias: funnel plot asymmetry suggests publication bias favouring studies with significant results. Confounding: assessed as part of quality assessment. 1 of 3 PCS adjusted for non-nutritive sucking habits.
Primary study characteristics	Total number of participants: 419 Study size: n=119, 147 and 153 included in the subgroup MA on malocclusion risk. Study power: considered as part of quality assessment but not reported on. Duration of follow-up: participants followed up at ages 3 to 5 years (2 PCS); unclear (1 PCS)
Other comments	2 of 3 PCS conducted UMIC, and 1 in HIC
Direction of association	Inverse
Grade Justification for grade	Moderate Evidence graded moderate due to the large effect size and lack of statistical heterogeneity. Country of setting of the studies was not considered an important factor for this relationship.

Abbreviations: high income country (HIC), meta-analysis (MA), prospective cohort study (PCS), socioeconomic status (SES), systematic review (SR), upper middle income country (UMIC)
↑ increase in effect or direct association; ↓ decrease in effect or inverse association; null = no association or effect

Evidence gaps identified in the report

Table A10.36 Exposure-outcome relationships for which no systematic review evidence was identified, or systematic review evidence was graded 'insufficient'

Topic area	Exposure or intervention	Outcome
Energy and macronutrients	Energy intake or energy density	Body Mass Index (BMI) or body fat
	Total carbohydrate intake	BMI or body fat
	Total fat intake	Body fat
		Linear growth (age at peak linear growth velocity, height)
		Blood pressure (systolic and diastolic blood pressure)
		Blood lipids (serum total cholesterol, LDL cholesterol, HDL cholesterol, triacyglycerol)
		Age at peak growth velocity
	Saturated fat intake	Blood lipids (serum total cholesterol, LDL cholesterol, HDL cholesterol, triacyglycerol)
		Blood pressure (systolic and diastolic blood pressure)
		Linear growth
	PUFA intake	BMI or body fat
		Blood lipids (serum total cholesterol, LDL cholesterol, HDL cholesterol, triacyglycerol)
		Blood pressure (systolic and diastolic blood pressure)
		Linear growth
	n-3 PUFA intake	BMI or body fat
		Blood lipids (serum total cholesterol, LDL cholesterol, HDL cholesterol, triacyglycerol)
		Blood pressure (systolic and diastolic blood pressure)
		Linear growth
	Total protein intake (all sources)	Risk of overweight and body fat
		Growth (age at adiposity rebound, BMI at adiposity rebound, peak linear growth velocity)
		Timing of puberty (age of menarche, age of onset of pubertal growth spurt; age at peak linear growth velocity)

Topic area	Exposure or intervention	Outcome
		Blood lipids (serum total cholesterol, LDL cholesterol, HDL cholesterol, triacyglycerol)
		Bone health
		Neurodevelopment
	Animal protein intake	BMI or body fat
		Growth (peak linear growth velocity)
		Timing of puberty (age of onset of pubertal growth spurt; age at peak linear growth velocity)
	Vegetable protein intake	BMI or body fat
		Growth (peak linear growth velocity)
		Timing of puberty (age of menarche or voice break; age of onset of pubertal growth spurt; age at peak linear growth velocity)
Micronutrients	Iron fortification (with or without other micronutrients)	Hb concentration (in children without anaemia or with anaemia at baseline)
		Serum ferritin (in children without anaemia or with anaemia at baseline)
		Prevalence of iron deficiency (in children with anaemia at baseline)
		Prevalence of anaemia (in children without anaemia or with anaemia at baseline)
	Iron supplementation	Growth (linear growth and weight gain)
	Iron supplementation	Immune function
	Iron and interactions with other micronutrients or food components	Iron status markers
	Iron deficiency without anaemia	Neurodevelopment or cognitive development
	Iron deficiency anaemia	Neurodevelopment or cognitive development
	Zinc supplementation	Zinc status
	Zinc status	Growth (linear growth and weight gain)
	Salt or sodium intake	Blood pressure (systolic and diastolic blood pressure)
	Vitamin A supplementation or fortification	Vitamin A status markers (serum retinol and vitamin A deficiency)
	Vitamin A status	Ophthalmological outcomes
	Vitamin A status	Immune function

Topic area	Exposure or intervention	Outcome
	Vitamin A status	Growth
	Vitamin A status	Anaemia
	Vitamin D supplementation or status	Bone health indices (bone mineral content, bone mineral density)
	Vitamin C supplementation or status	Any health outcome
Foods	Vegetables and fruit	BMI or body weight
	Total dairy consumption	BMI or body weight
		Linear growth
		Bone health indices
		Blood pressure (systolic blood pressure and diastolic blood pressure)
		Cognitive outcomes
	Cheese consumption	Overweight or obesity
	Cream or crème fraiche consumption	Overweight or obesity
	Yoghurt consumption	Linear growth
	Starchy carbohydrates	Any health outcome
	Non-dairy sources of protein	Any health outcome
	Foods high in saturated fat, salt or free sugars	Any health outcome
	Commercially manufactured foods and drinks marketed for infants and young children	Any health outcome
Food components	Probiotics	Growth (linear growth or weight gain)
	Non-nutritive sweeteners	BMI or body weight
		Type 1 diabetes outcomes
Dietary patterns	Diet quality scores, indices, ‘healthy’ or ‘unhealthy’ dietary patterns	Body composition (BMI)
	Diet quality scores, indices, ‘healthy’ or ‘unhealthy’ dietary patterns	Cognitive development
	Other dietary patterns (characterised by ‘snacking’, ‘ready-to-eat’ or ‘freshly cooked’ foods or ‘traditional’ foods)	Cognitive development
Drinks	Breastfeeding beyond 12 months	Growth (linear growth or weight gain)
		Cognitive and psychological development
	Formula milk consumption beyond 12 months	Any health outcome
	Total milk consumption	Body fat

Topic area	Exposure or intervention	Outcome
	Whole milk consumption	Body composition or weight status
	Reduced fat milk consumption	Body composition or weight status
	Whole milk versus reduced fat milk consumption	Body composition or weight status
	Sugar-sweetened beverages	Cognitive development
Eating and feeding behaviours	Child Eating Behaviour Questionnaire subscales (except food fussiness)	Body composition or weight status
	Children’s eating behaviours: inability to delay gratification	Body composition or weight status
	Children’s eating behaviours: skipping breakfast compared with eating breakfast	Body composition or weight status
	Feeding practices: repeated taste exposure	Acceptance of textures
	Feeding practices: repeated visual exposure	Preference or acceptance (Vegetables and fruit)
	Feeding practices: parental restriction	Energy intake, child weight status
	Feeding practices: use of rewards	Food acceptance or intake
	Feeding practices: verbal encouragement	Food acceptance or intake
	Feeding practices: choice offering	Food acceptance or intake
	Feeding practices: exposure to sweet food	Preference or consumption for sweet foods
	Feeding practices: exposure to SSB or fruit juice	Consumption of SSB or fruit juice
	Feeding practices: pressuring child to eat	Child weight status
	Feeding styles: responsive feeding	Child weight status
	Feeding styles: non-responsive feeding	Child weight status
Excess weight and obesity	Rapid early growth in children aged beyond 12 months	Child or adult body composition or weight status
	Child BMI	Adult diabetes
		Adult breast cancer

Topic area	Exposure or intervention	Outcome
Oral health	Breastfeeding beyond 24 months	Early childhood caries (ECC)
	Bottle milk feeds beyond 12 months	ECC
		Malocclusion risk
	Night time bottle feeding (milk)	ECC
	Foods containing free sugars	ECC
	Dairy or milk consumption	Dental caries
	Child body weight	ECC
	Vitamin D status	Oral health