**Appendix**

**Table 1: The terms used in the electronic bibliographic search of the school nutrition review in SSA[[1]](#footnote-1)**

|  |  |  |
| --- | --- | --- |
| * School nutrition OR
* School-based nutrition OR
* School nutrition policy OR
* School nutrition intervention\* OR
* School feeding OR
* School feeding program\* OR
* School food OR
* School canteen OR
* School cooking OR
* School breakfast OR
* School lunch OR
* School diet\* OR
* School eating OR
* School nutrition education
 | **AND** | * Sub-Saharan Africa OR
* Saharan Africa OR
* Sub-Sahara OR
* Africa OR
* Sahel region OR
* West Africa OR
* East Africa OR
* Southern Africa OR
* Central Africa OR
* SSA (country list):

South Sudan, Angola, Burundi, Congo, Rwanda, Sao Tome, Cameroon/Cameroun, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, Djibouti, Eritrea, Ethiopia, Somalia, Kenya, Tanzania, Uganda, Botswana, Comoros, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Zambia, Zimbabwe, Sudan, Mauritania, Gambia, Ghana, Guinea, Liberia, Nigeria, Sierra Leone, Benin, Burkina Faso, Ivory Coast/Cote D’voire, Guinea Bissau, Mali, Niger, Senegal, Togo, Cape Verde |

**Table 2: Characteristics of included studies**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author/Year/ Country** | **Aim of study** | **Design** | **Duration** | **Participants** | **Intervention** | **Measures** | **Findings**  |
| Kugo et al., 2018(39) Kenya  | Test alternative Mass Drug Administration approach which integrates deworming into school meals while addressing malnutrition  | Placebo- RCT[[2]](#footnote-2)  | 2 mo[[3]](#footnote-3) | N[[4]](#footnote-4) = 324 Age: 5-12yr[[5]](#footnote-5) Weight: (24.9 kg[[6]](#footnote-6); mean)BMI: NR[[7]](#footnote-7) | Participants either received 400mg Albendazole, n =119; Maize meal porridge with pawpaw seeds, n=103; or Maize meal porridge without pawpaw seeds, n =102. Children in the albendazole group also received plain maize meal porridge without pawpaw seed. Each child received 300ml of the porridge every day, constituting a dose of 10g of carica papaya seeds per child per/d[[8]](#footnote-8) | parasitology in faeces, haemoglobin concentration and anthropometry  | Papaya seed fortified porridge had a significant positive effect on children’s fungal infections and better nutritional outcome |
| De Villiers et al., 2016(34) South Africa | Determine whether nutrition knowledge, self-efficacy and eating behaviour improved after a ‘Health Kick' intervention | Cluster RCT | 3 yr | N = 998Age: (9.9yr; mean) Weight: 27% overweight, EXP[[9]](#footnote-9); 34% overweight, CON[[10]](#footnote-10)BMI: NR | Educators identified their own school health priorities and ways to address them. Schools were provided with nutrition resources, including curriculum guidelines and the South African food-based dietary guidelines. Children completed a questionnaire comprising nutrition knowledge, self-efficacy and behavioural items. | nutrition knowledge, attitude and self-efficacy, BMI[[11]](#footnote-11) | Intervention showed significant improvement in nutrition knowledge, self- efficacy but not in nutrition behaviour change |
| Van der Hoeven et al., 2015(43)South Africa | Assess the effect of African leafy vegetable (ALV) consumption on Fe, Zn and vitamin A status | Parallel group RCT  | 3 mo | N = 239 Age: 6–12yr Weight: 3.5% overweight, EXP; 2.5% overweight, CONBMI: NR | Participants received either a 300g cooked ALV dish and school meal starch (n=86) or normal school meal (n=81) 5x/wk[[12]](#footnote-12) for 3mo. ALV in the dish consisted of amaranthus cruentus (at least 80%) and the remainder of Cleome gynandra, Cucurbita maxima or Vigna unguiculata. Nutrient content and consumer acceptance of the ALV dish were also determined. | dietary intake, anthropometry, biochemical indicators (fe, zn or vitamin B deficiency) | ALVs were unable to improve micronutrient status. |
| Taljaard et al., 2013(44)South Africa | Investigate the effects of micronutrients and sugar, alone and in combination, in a beverage on growth and cognition | Double blind, 2x2 factorial RCT | 8.5 mo | N = 414 Age: 6–11yrWeight: 14% underweight, 8.5% wastedBMI: NR | Participants consumed beverages containing (1) micronutrients with sugar, (2) micronutrients with a non-nutritive sweetener, (3) no micronutrients with sugar or (4) no micronutrients with a non-nutritive sweetener for 8·5mo.  | biochemical indicators, anthropometry, cognition  | Beverage fortified with micronutrients, positively affects school children’s cognition. |
| Zeba et al., 2006(36) Burkina Faso | Assess the impact on vitamin A of adding red palm oil (RPO) to school lunch in two test zones | pre-post-test at Kaya RCT at Bogande | 12 mo | N = 623; Age: (8.5yr; mean)Weight: NRBMI:NRBAZ: -1.0 | A 15ml RPO was added to school lunch 3x/wk in Kaya. In Bogandé, there were: 8 negative controls with only regular school lunch (G1); 8 positive controls where participants received a single 60mg vitamin A capsule at the end of the school year (G2); and 8 schools with RPO through the school year (G3). Serum retinol was measured at baseline and exactly 12mo later.  | serum retinol,   anthropometry | RPO as food supplement for vitamin A is effective in the reduction of vitamin A deficiency |
| Oosthuizen et al., 2011(45)South Africa | Improve dietary intake patterns and food choices | CBA[[13]](#footnote-13) | 9 wk[[14]](#footnote-14) | N = 172Age: 9-13yrWeight: NRBMI: NR | Participants were grouped into experimental group where nutrition education programme was implemented over one school term (n=81), and a CON (n =91). Testing of nutrition knowledge, using a validated 24-hour recall, occurred pre-and post-intervention, and in the long term, with the experimental group only.  | dietary intake patterns, nutrition knowledge  | Although nutrition knowledge improved, it did not reflect in dietary intake patterns; intake of fruits and vegetables were low. |
| Abrams et al., 2003(50)Botswana | Examine efficacy of a micronutrient fortified beverage in improving nutritional status | CBA | 8 wk | N = 263Age: 6-11yr Weight: (25kg; mean, EXP); (23.6kg;mean, CON)BMI: 15.2kg\m2 | Participants were given seven 419 kJ/240ml servings weekly of either fruit-ﬂavored beverage [EXP, n=145] fortiﬁed with 12 micronutrients or a control, an isoenergetic placebo drink [CON, n=118] for 8wk. The CON group received the same beverage without micronutrients. | growth, hematologic (Hb, retinol, ferritin, vitamin B-12, folate and riboflavin status) | Micronutrient-fortiﬁed beverage can significantly prevent micronutrient deﬁciencies |
| Ash et al., 2003(49)Tanzania | Describe the main effects of orange-flavoured micronutrient-fortified beverage on anaemia, iron & vitamin A status, and growth | Double-blind RCT | 6 mo | N = 774 Age: 6-11yrWeight: (20.65; BMI)BMI: 20.65kg\m2 | Children were assigned to receive one serving of fortified beverage or an unfortified beverage 5d/wk. Fortified and unfortified sachets had a blue or green label for identification and contained identical powder which provided 90 kcal in each 25g sachet. The content of a sachet was mixed with 250 mL boiled water to make a pleasant-tasting, orange-flavoured beverage.  | anthropometry, biochemical (hematologic, anaemia, vitamin A, iron status) | A fortified beverage improved hematologic, anthropometric measures and significantly lowered prevalence of anaemia and vitamin A deficiency |
| Ebo & Boye, 2006(48)Nigeria | Investigate the effect of a school-based nutrition education program on nutrition knowledge and food choices | CBA | 3 wk | N = 197 Age: (10.4yr; mean)Weight: NRBMI: NR | The control (n= 102) received no nutrition education while the experimental group (n= 95) received 40 minutes of nutrition education, 4d/wk for 3wk. Nutrition knowledge scores and a 3-day food records were collected at pre-and-post intervention periods. | nutrition knowledge, healthy food choices | Nutrition education improved nutrition knowledge and healthy food choices.  |
| Jemmot et al., 2011(47)South Africa | Test efficacy of school-based cognitive behavioural health promotion (HP) intervention to increase fruit and vegetable KAB[[15]](#footnote-15). | Cluster RCT | 12 mo | N = 1057Age: 9-18yrWeight: NRBMI: NR | One school in each pair of 9 matched schools was randomized to either a cognitive-behavioural HP intervention or to a control group of HIV/STD risk-reduction intervention. The HP intervention aimed to encourage KAB, to practice healthful behaviours, including fruit and vegetable consumption, nutritional value of variety of foods and their health effects. | fruit & vegetable consumption with FFQ | Cognitive-behavioural intervention can increase self-reported HP behaviours, (especially, fruit & vegetable consumption)  |
| Lagerkvist et al., 2018(46)Nigeria  | Analyse how specific goal setting promoted dietary behaviour change in consumption of pro-vitamin A rich orange-fleshed sweet potato (OFSP) meal | Cluster RCT | 4 wk | N = 556Age: 7–12yr Weight: NRBMI: NR | A meal based on OFSP, rich in pro-vitamin A, was introduced as a complement to an existing school meal. Three days before the study, nutrition education was held in each classroom for 1hr[[16]](#footnote-16). Teachers were trained to inform participants about: (a) the 5 food groups, their main nutrients and functions; (b) importance of a balanced diet; (c) the food pyramid; (d) healthy food choices; and (e) incorporating OFSP in foods. Participants were called by name to either receive their own goal card (reminder treatment) or no-reminder treatment card before eating. | baseline intentions, anticipated feelings, food intake  | Type of incentives matters, not the emotional eﬀects after eating. Emotions are more related to the eating situation than to the type of goals set for the behaviour.  |
| Whaley et al., 2003(42)Kenya | Test the impact of animal source food on cognitive development  | Cluster RCT | 21 mo | N = 555 Age: (7.63yr; mean)Weight: 20.14kg; meanBMI: NR | Twelve schools were randomized into one of 4 feeding interventions: 3 of which received a fortiﬁed local staple-based snack (Githeri meal) that provided 240 kcal in the ﬁrst school year and 313 kcal for the remainder of study period. The groups—designated as (i) Meat-Githeri n=134, (ii) Milk-Githeri, n=144, and iii) Energy-Githeri, n=148 and CON, n=129. Cognitive tests were administered at baseline and during every other term of feeding.  | cognition, anthropometry, food intake, family measures, SES[[17]](#footnote-17), school attendance | Supplementation with animal source food plays a key role in the cognitive development of school children. |
| Van Stuijvenberg et al.2001(38)South Africa | Determine the effect of biscuit with red palm oil (RPO) on vitamin A status and to compare with the effect of biscuit with β-carotene from synthetic source | Single blind RCT | 3 mo | N = 400, Age: 5-11yr Weight: 25.2kg, EXP mean; (25.8kg, CON mean)BMI: NR | Participants were randomly assigned to: (i) A control group receiving a placebo biscuit without β-carotene, n=14; (ii) a biscuit with synthetic β-carotene as a vitamin A forticant, n=146; (iii) a biscuit with refined RPO as a source of β-carotene, n=145. Vitamin A status was assessed at baseline and after 3mo. The biscuits of all 3 groups were similar in macronutrient composition, in taste and appearance.  | anthropometry,full blood count, Serum retinol  | Biscuit with RPO is as effective as a biscuit with synthetic β-carotene.  |
| Van Stuijvenberg et al.1999(37)South Africa | Determine the effect of micronutrient-fortified biscuits on the micronutrient status ofprimary school children | Single blindRCT | 12 mo | N = 228, Age: 6–11yrWeight: 26.4kg, EXP mean; 24.9kg, CON meanBMI: NR | Micronutrient status was assessed in school children before and after consumption of biscuits (fortified with iron, iodine, and β-carotene, n =115). It was compared with a control (n =113) who consumed nonfortified biscuits. The shortbread biscuits were designed to provide 50% of the recommended dietary allowances of iron (5 mg ferrous fumarate), iodine (60 mg potassium iodate), and β-carotene (2.1 mg). | anthropometry,cognitive function, growth and morbidity assessed as secondary outcomes | Fortification of biscuits with Iron, iodine and β-carotene resulted in a significant improvement in micronutrient and anthropometric status. |

**Table 3: Ratings of included studies on the EPHPP risk of bias assessment tool**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Kugo et al., 2018(39) | De Villiers et al.,2016(34) | Van der Hoeven et al., 2015(43) | Taljaard et al., 2013(44) | Zeba et al., 2006(36) | Oosthuizen et al.,2011(45) | Abrams et al., 2003(50) | Ash et al., 2003(49) |
| * **Selection bias**
* Are individuals selected to participate in study likely to be representative of target population?
* What % of selected individuals agreed to participate?
 | Very likely  | Very likely | Somewhat likely | Somewhat likely | Very likely | Very likely | Somewhat likely | somewhat likely |
| * **Study design**
* Was the study described as randomized?
* If yes, was the method of randomization described?
* If yes, was the method appropriate?
 | YesYesYes | YesYesYes | YesYesYes | YesYesYes | YesYesYes | YesNo- | No-- | YesYesYes |
| * **Confounders**
* Were there important differences between groups prior to the intervention?
* If yes, indicate the % of relevant confounders that were controlled (either in the design or analysis)?
 | NoCan’t tell | NoCan’t tell | NoCan’t tell | NoCan’t tell | NoCan’t tell | Can’t tellCan’t tell | NoCan’t tell | NoCan’t tell |
| * **Blinding**
* Was (were) the outcome assessor(s) aware of intervention or exposure status of participants?
* Were the study participants aware of the research question?
 | Can’t tellNo | Can’t tellCan’t tell | NoNo | NoNo | No No  | Can’t tellNo | NoNo | NoNo |
| * **Data collection method**
* Were data collection tools shown to be valid?
* Were data collection tools shown to be reliable?
 | YesYes | YesYes | YesYes | YesYes | YesYes | YesYes | YesYes | YesYes |
| * **Withdrawals and dropouts**
* Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?
* Indicate % of participants completing the study. (If the % differs by groups record the lowest).
 | Yes75% | NoNo | YesYes | YesNo | YesNo | Yes43% | Yes84.5% | Yes93% |
| **Global rating/** overall score for this paper | **Strong**  | **Moderate**  | **Strong**  | **Strong**  | **Strong**  | **Moderate** | **Strong**  | **Strong**  |
| **Study** | Ebo & Boye, 2006(48) | Jemmot et al., 2011(47) | Lagerkvist et al., 2018(46) | Whaley et al., 2003(42) | Stuijvenberg et al., 2001(38) | Stuijvenberg et al., 1999(37 ) |  |  |
| * **Selection bias**
* Are individuals selected to participate in study likely to be representative of target population?
* What % of selected individuals agreed to participate?
 | Somewhat likely | Very likely | Very likely | Somewhat likely | Very likely | Very likely  |  |  |
| * **Study design**
* Was the study described as randomized?
* If yes, was the method of randomization described?
* If yes, was the method appropriate?
 | No-- | YesYesYes | YesYesYes | YesYesYes | YesYesYes | YesYesYes  |  |  |
| * **Confounders**
* Were there important differences between groups prior to the intervention?
* If yes, indicate the % of relevant confounders that were controlled (either in the design or analysis)?
 | NoCan’t tell | NoCan’t tell | NoCan’t tell | NoCan’t tell | NoCan’t tell | Can’t tellCan’t tell |  |  |
| * **Blinding**
* Was (were) the outcome assessor(s) aware of intervention or exposure status of participants?
* Were the study participants aware of the research question?
 | Can’t tellCan’t tell | NoNo | Can’t tellNo | YesNo | YesNo | YesNo |  |  |
| * **Data collection method**
* Were data collection tools shown to be valid?
* Were data collection tools shown to be reliable?
 | YesYes | YesYes | YesYes | YesYes | YesYes | YesYes |  |  |
| * **Withdrawals and dropouts**
* Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?

Indicate % of participants completing the study. (If the % differs by groups record the lowest). | Yes100% | Yes96.7% | Yes86.5% | Yes\_ | Yes91.5% | Yes90.1% |  |  |
| **Global rating /**overall rating for this paper | **Weak**  | **Strong**  | **Moderate**  | **Strong**  | **Strong**  | **Strong**  |  |  |

**Table 4: Intervention focus on outcomes per the number of studies and corresponding participants.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Outcome** | **No. of studies** | **Intervention focus** | **Intervention Participants** | **Control****Participants** |
| Anthropometry | 10 | Deworming & malnutrition (1study), Nutrition KAB[[18]](#footnote-18) (1), micronutrient status (2), growth & cognition (1), vitamin A status (2 studies), nutrition status (1), growth and micronutrient status (1), cognitive development (1),  | 2625 | 1952 |
| Nutrition knowledge | 3 | Nutrition KAB (2 studies), Nutrition behaviour (1study), | 650 | 620 |
| Nutrition behaviour  | 6 | Nutrition KAB (4 studies), micronutrient status (1), dietary behaviour (1) | 2314 | 2279 |
| Biochemical outcomes | 8 | Deworming & malnutrition (1), micronutrient status (2), growth and cognition (1), vitamin A status (2), nutrition status (1), growth & micronutrient status (1) | 1699 | 1325 |
| Cognitive outcomes | 3 | Micronutrient status (1), cognitive development (1), growth & cognition (1) | 738 | 443 |

1. Sub-Saharan Africa [↑](#footnote-ref-1)
2. Randomized Controlled Trial [↑](#footnote-ref-2)
3. Months [↑](#footnote-ref-3)
4. Sample size [↑](#footnote-ref-4)
5. Years [↑](#footnote-ref-5)
6. Kilogram [↑](#footnote-ref-6)
7. Not Reported [↑](#footnote-ref-7)
8. Day [↑](#footnote-ref-8)
9. Experimental group [↑](#footnote-ref-9)
10. Control group [↑](#footnote-ref-10)
11. Body Mass Index [↑](#footnote-ref-11)
12. Week [↑](#footnote-ref-12)
13. Controlled-Before- and-After study [↑](#footnote-ref-13)
14. Weeks [↑](#footnote-ref-14)
15. Knowledge, Attitude and Behaviour [↑](#footnote-ref-15)
16. Hour [↑](#footnote-ref-16)
17. Socio-Economic Status [↑](#footnote-ref-17)
18. Knowledge, Attitude and Behaviour [↑](#footnote-ref-18)