Supplementary Data

A systematic review investigating the relationship between animal-source food consumption and stunting in children aged 6-60 months in low- and middle-income countries

Supplemental Materials: Search terms, quality assessment tools, data collection and methods, and results.

Supplemental Material 1. Search terms

Search Strategies for Peer-Reviewed Literature Databases

PubMed

((((((((("growth disorders"[MeSH Terms]) OR "growth disorder*"[Text Word]) OR "stunted growth"[Text Word]) OR "stunting"[Text Word]) OR "head circumference*"[text]))))) AND ((((((((((("child*"[Text Word]) OR "babies"[Text Word]) OR "baby"[Text Word]) OR "toddler*"[Text Word]) OR "preschooler*"[Text Word]) OR "paediatric*"[Text]) OR "pediatric*"[text word]) OR "peadiatric*"[Text Word]) OR "pediatrics"[MeSH Terms]) OR "child, preschool"[MeSH Terms]) OR (("infant"[MeSH Terms]) OR "infant*"[Text Word]))) AND ((((((((("dairies"[text]) OR "dairy"[text])) OR "Dairy Products"[MeSH]) OR "Milk"[MeSH])) OR (((((("Aquaculture"[Text Word]) OR "Animal Husbandry"[Text Word]) OR "Dairying"[Text Word])) OR ((("Aquaculture"[Mesh]) AND "Animal Husbandry"[Mesh]) OR "Dairying"[Mesh]))) OR ((((((((((((((((("offal*"[Text Word]) OR "heart*"[Text Word]) OR "tripe*"[Text Word]) OR "liver*"[Text Word]) OR "blood"[Text Word]) OR "brain*"[Text Word]) OR "kidney*"[Text Word]) OR "game*"[Text Word]) OR "wild"[Text Word])) OR ("flesh food*"[Text Word])) OR (((((("meat*"[Text Word])) OR "red meat"[MeSH Terms]) OR "meat"[MeSH Terms]) OR "meat products"[MeSH Terms]))) OR ("Oxtail*"[Text Word]))) OR (((((((("Fishes"[MeSH Terms]) OR "Fish*"[Text Word]) OR (("Seafood"[MeSH Terms]) OR "Seafood"[Text Word])) OR ((("Shellfish"[MeSH Terms]) OR "Shellfish"[Text Word]) OR "Fish Products"[MeSH Major Topic])) OR (((((("Crustacea"[MeSH Terms]) OR "Crustacea*"[Text Word]) OR "Crab*"[Text Word]) OR "Shrimp"[Text Word]) OR "Crayfish"[Text Word])) OR (("Tuna"[MeSH Terms]) OR "Tuna"[Text Word]))) OR (((((("Rabbits"[MeSH Terms]) OR "Rabbit*"[Text Word]) OR "Hare*"[Text Word])) OR (("Goats"[MeSH Terms]) OR "Goat*"[Text Word])) OR ((((("Swine"[MeSH Terms]) OR "Pig*"[Text Word]) OR "Hog*"[Text Word]) OR "pork"[Text Word])) OR ((((((((((("Birds"[MeSH Terms]) OR "Bird*"[Text Word])) OR ((("Geese"[MeSH Terms]) OR "Goose"[Text Word]) OR "Geese"[Text Word])) OR (("Turkeys"[MeSH Terms]) OR "Turkey*"[Text Word])) OR (("Chickens"[MeSH Terms]) OR "Chicken*"[Text Word])) OR "fowl*"[text]) OR (("Ducks"[MeSH Terms]) OR "Duck*"[Text Word])) OR (("poultry"[MeSH Terms]) OR "poultry"[Text Word]) OR "poultries"[text word])) OR ((((("animal source food"[Text Word]) OR "animal source foods"[Text Word])))) OR ((((("entomophagy"[Text Word]) OR "entomophagy"[Text Word]) OR "Insects"[MeSH Terms]) OR "Insect*"[Text Word])) OR (((((((("Livestock*"[Text]) OR "Livestock"[MeSH Terms]) OR ((((("cow*"[Text Word]) OR "cattle"[MeSH Terms]) OR "beef"[Text Word])))) OR ((("Deer"[MeSH Terms]) OR "Deer"[Text Word]) OR "Venison"[Text Word])) OR ((((("buffaloes"[MeSH Terms]) OR "bison"[MeSH Terms]) OR "buffalo*"[Text Word]) OR "bison*"[Text Word])) OR ((((("sheep"[MeSH Terms]) OR "mutton"[Text Word]) OR "lamb"[Text Word]) OR "sheep"[Text Word])))))) AND (("1980/01/01"[PDat] : "3000/12/31"[PDat]) AND (English[lang] OR French[lang] OR Portuguese[lang] OR Spanish[lang]))

Supplementary Data

Supplemental Table 1. Quality assessment of controlled intervention studies

Original criteria from the National Heart, Lung, and Blood Institute Tool	Adjustments made for this systematic review
1. Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	1. No adjustments
2. Was the method of randomization adequate (i.e., use of randomly generated assignment)?	2. No adjustments
3. Was the treatment allocation concealed (so that assignments could not be predicted)?	3. No adjustments
4. Were study participants and providers blinded to treatment group assignment?	4. This was not applicable because the interventions were food-based.
5. Were the people assessing the outcomes blinded to the participants' group assignments?	5. No adjustments
6. Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?	6. No adjustments
7. Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	7. No adjustments
8. Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?	8. No adjustments
9. Was there high adherence to the intervention protocols for each treatment group?	9. No adjustments
10. Were other interventions avoided or similar in the groups (e.g., similar background treatments)?	10. No adjustments
11. Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	11. No adjustments
12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	12. No adjustments
13. Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?	13. No adjustments
14. Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?	14. No adjustments

Supplementary Data

Supplemental Table 2. Quality assessment tool for observational cohort and cross-sectional studies.

Original criteria from the National Heart, Lung, and Blood Institute Tool	Adjustments made for this systematic review	
1. Was the research question or objective in this paper clearly stated?	1. No adjustment	
2. Was the study population clearly specified and defined?	2. No adjustment	
3. Was the participation rate of eligible persons at least 50%?	3.No adjustment	
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	4. No adjustment. Note: each of the two questions were assessed individually.	
5. Was a sample size justification, power description, or variance and effect estimates provided?	5. No adjustment	
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	6. This question was changed to: If this is a longitudinal cohort, are there multiple measures over time? For cross-sectional, this question was answered as no as per NHLBI guidance.	
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	7. Question was excluded due to insufficient available evidence in this topic.	
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	8. This criteria was specified to this review and split into two questions that were assessed individually.	8a. Comprehensiveness of instrument(s) used to measure food exposure: (1) Food weighing; (2) combination of 24 hour recall *and* FFQ; (3) 24 hour recall-multiple days; (4) 24 hour recall-single day; (5) FFQ.[1]
		8b. What category of variable quantification was used for animal source food intake: (1) continuous-quantities; (2) continuous-frequency; (3) ordinal; or (4) binary?[2]
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	9. No adjustment	
10. Was the exposure(s) assessed more than once over time?	10. No adjustment	
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and	11. No adjustment	

[1] The comprehensiveness of instruments used was rated from (1) most comprehensive to (5) least comprehensive. Studies that used multiple instruments were judged as being more comprehensive than the individual rating of the highest rate instrument.
[2] The variable quantification was rated from (1) highest to (5) lowest.

implemented consistently across all study participants?	
12. Were the outcome assessors blinded to the exposure status of participants?	12. The question was excluded because the assessment of the exposure status of participants was largely part of a more inclusive dietary data collection tool.
13. Was loss to follow-up after baseline 20% or less?	13. Revised to add: if this is a longitudinal cohort that is designed to look at these outcomes.
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	14. No adjustment

Supplementary Data

Supplemental Table 3. Dietary data collection methods in the longitudinal cohorts and cross-sectional studies.

First author Year Study design	Dietary data collection methods	Child age at data collection
Allen 1992 *Longitudinal Cohort*	Food weighing, observation, maternal recall, food record	Data collected once per month at age 18 to 30 mo
Aramburú 2014 *Cross Sectional*	24 h recall	Age range: 6 to 23 mo
Campbell 2016 *Longitudinal Cohort*	24 h recall	Ages 6, 12, 15, and 18 mo
Daraphaek 2013 *Cross-Sectional*	24 h recall	Age range: 12 to 59 mo
Diana 2017 *Longitudinal Cohort*	Food weighing, maternal report	Data collected over 48 h at age 9 mo
Fierstein 2017 *Cross-Sectional*	24 h recall	Age range: 6 to <24 mo
Jin 2014 *Cross-Sectional*	Food Frequency Questionnaire (FFQ)	Age range: 6 to 60 mo; FFQ for previous 7 d
Leonard 2000 *Longitudinal Cohort*	24 h recall	Age varied (data collected at baseline)
Marquis 1997 *Longitudinal Cohort*	FFQ	Data collected monthly from age 12 to 15 mo; FFQ for previous month
Miller 2016 *Longitudinal Cohort*	24 h recall	Age varied (data collected at baseline and time points 12, 24, 48 mo)
Ntab 2005 *Longitudinal Cohort*	24 h recall and FFQ	Age varied (data collected at last study time point); FFQ for previous 7 d

Supplementary Data

First author Year Study design	Dietary data collection methods	Child age at data collection
Semba 2011 *Cross- Sectional*	FFQ	Age range: 6 to 59 mo; FFQ for previous 7 d
Walker 1990 *Cross- Sectional*	24 h recall	Age range: 9 to 24 mo; Data collected over 48 h
Zhao 2016 *Cross- Sectional*	FFQ	Age range: 6 to 36 mo; Time period for FFQ NR

Supplementary Data

Supplemental Table 4. Dietary interventions and compliance measures in the randomized controlled trials.

First author Year	Intervention	Comparator	Compliance Measurement
Bauserman 2015	• Caterpillar Cereal o Ingredients: caterpillar, corn, palm oil sugar, salt o Ages 6 to 12 mo: 30 g/d o Ages 12 to 18 mo: 45 g/d • Educational messages on complementary feeding	• Usual diet • Educational messages on complementary feeding	• Scheduled and unscheduled home visits monthly • Collection of unused food sachets • Maternal report
Ionnatti 2017	• One medium egg/d (~50 g)	• Usual diet	• Study staff reminders during weekly home visits
Krebs 2012	• Beef (lyophilized) o Ages 6 to 11 mo: equivalent to 30 g/d cooked meat (70 kcal/d) o Ages 12 to 18 mo: equivalent to 45 g/d cooked meat (105 kcal/d)	• Rice-soy cereal (micronutrient fortified) o Ages 6 to 11 mo: 70 kcal/d o Ages 12 to 18 mo: 105 kcal/d	• Empty food packets counted at weekly visits • Maternal report
Lartey 1999	• Weanimix plus fish powder, by weight: 80% Weanimix, 20 % fish powder (anchovies)[3] o Weanimix content: 75% maize, 15% soybeans, 10% peanuts • Koko plus fish powder, by weight: 80% Koko (fermented maize dough powder), 20% fish powder	• Weanimix alone • Weanimix plus vitamins and minerals o Vitamin mineral premix plus added iron, potassium, calcium, and phosphorus o Two fortification levels: one for subjects consuming ≤60 g/d Weanimix and one for subjects consuming >60 g/d	• Monthly 24 h recalls for 3 d (2 weekdays, 1 weekend day) • 12 h weighed food records for ~50% of subjects (randomly selected)
Lin 2008	• Fish-fortified thickened maize porridge o Base porridge preparation: 27 g whole corn flour in 100 g water with 10 g fish powder added o 70 g porridge per serving with 2.5 teaspoons (tsp) (2 g/tsp) fish powder added o Ages 6 to 9 mo: 2 servings/d o Ages 9 to 18 mo: 3 servings/d	• Micronutrient-fortified soy/peanut spread o 20% soy flour, 35% sugar, 26% peanut paste, 17% soy oil, 2% vitamin and mineral mix that included iron, zinc and selenium o Ages 6 to 9 months: 5 tsp (4 g/tsp) 2 times/d o Ages 9 to 18 mo: 5 tsp 3 times/d	• "Fortnightly visits by the health aides, who visually ascertained if the appropriate amount of food had been consumed."

[3] Mothers in each group were provided with 500 g/wk of the study food; child intake varied by food group and age.

Supplementary Data

First author Year	Intervention	Comparator	Compliance Measurement
Long 2011	• Recipes for all study groups were altered after the first four months of the study[4] • Millet porridge with whole ultra-heat-treated milk o One serving (270 kcal) per day, 5d/wk for 5 mo o Recipe for first 4 mo of the study: 20.2 g unfermented millet, 10.1 g fermented millet, 12.2 g sugar, 4 g margarine, 121.4 g milk o Recipe for second half of the study: 20.2 g unfermented millet, 10.1 fermented millet, 14.2 g sugar, 6 g margarine, 121.4 g milk • Millet porridge with minced meat (beef) o One serving (270 kcal) per day, 5d/wk for 5 mo o Recipe for first 4 mo of study: 20.3 g unfermented millet, 10.1 g fermented millet, 13.1 g sugar, 4.8 g margarine, 48.7 g minced beef o Recipe for second half of study: 20.3 g unfermented millet, 10.1 g fermented millet, 16.1 g sugar, 8.8 g margarine, 53.7 g minced beef	• Plain millet porridge o One serving (270 kcal) per day, 5d/wk for 5 mo o Recipe for first 4 mo of study: 33.9 g unfermented millet, 17.1 g fermented millet, 13.8 g sugar, 6.2 g margarine o Recipe for second half of study: 33.9 unfermented millet, 17.1 fermented millet, 13.8 g sugar, 6.2 g margarine	• Feedings were supervised by a research assistant and leftovers were measured and recorded
Tang 2014	• Boiled minced pork o 60 g daily	• Multiple-micronutrient-fortified cereal • Locally produced, non-fortified cereal • Cereal quantities NR	• Pork compliance method NR • Leftover cereals were weighed weekly at control food distribution site

[4] "When porridge samples were analysed for nutrient content during the study to ensure that they were isoenergetic, the meat and milk porridges contained less energy than the plain porridge. Additional sugar and margarine were added to the meat and milk recipes to make all porridges isoenergetic. More ground meat was added to the second version of the porridge because during the fine grinding of the meat, a layer of fat was found sticking to the side of the blender bowl, resulting in a greater amount of waste than originally calculated. This change took effect 4 months after the beginning of the study; thus the first cohort of children consumed the second version of the porridge for 1 month, while the second cohort consumed the second version of the porridge for the duration of their participation."