Impact evaluation of an added milk intervention to a micronutrient fortified school feeding program: An effectiveness pilot trial in Yemen.

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Background

Globally, 20% of deaths are caused by unhealthy diets [1]. Micronutrient deficiencies impair children's physical and psycho-social development [2]. Undernutrition during school age and adolescence has long-term consequences and for girls can affect the survival of their children [3]. Attention to nutrition during all phases of child and adolescent development is essential to ensure that children can thrive over the 8,000 days spanning infancy to adulthood, and to protect investments made earlier in the life cycle [4].

School feeding is a multi-sectoral intervention with impacts across education, health and nutrition dimensions that is widely implemented; globally, programs reach about 368 million children for a total investment of $70 billion a year [5]. Despite these investments, there is limited data on the diets and nutrition status in school age children, particularly in low- and middle-income countries (LMICs). In these contexts, school feeding not only provides important contributions to children's daily food and micronutrient intake [6], but can also work as a platform to improve food choices and diets [7].

In parallel, in 2016, one in six children globally, or approximately 360 million children, lived in conflict-affected areas, with these figures increasing steadily over the last two decades (Bahgat et al., 2017). Conflicts exposure can have devastating direct and indirect effects on children's development and well-being, with long-term consequences on children's life course outcomes, as well as on the next generation (Akbulut-Yuksel, 2014; Akresh, Bhalotra, Leone, & Osili, 2017; Blattman & Miguel, 2010; Justino, Leone, & Salardi, 2014; Shemyakina, 2011). School feeding programmes have been a key safety net scaled-up to protect vulnerable populations during conflict and related humanitarian crises (Aurino et al., 2019). However, the evidence on the effectiveness of school feeding programs during conflict is limited.

Country Context

Even before the onset of the current civil war in early 2015, Yemen was one of the poorest countries in the world. The 2021 Human Development Index ranked the country 183 out of 191 countries and territories (UNDP, 2022). The World Food Programme (WFP) estimates that currently 17 million Yemeni (half the population) are food insecure and 2.2 million preschool children are acutely malnourished (World Food Programme, 2023a). In 2022, 17% of school children in Yemen received school meals (WFP, 2022) and in 2023, the humanitarian response will cover only 8% of the needs of education sector, leaving it with the second highest unmet need (OCHA, 2023). WFP provides nutritious snacks (imported or locally procured), either fortified date bars or fortified high energy biscuits, to 1.55 million school children. There is an urgent need to understand how to improve access to nutritious school meals to support students and schools throughout the country.

Study overview

The study is a cluster randomized controlled trial aimed at evaluating the effectiveness and cost-efficiency of adding a daily drink of milk to an ongoing school feeding program. The trial will be conducted over one school year.

Study design

Study objectives

The impact evaluation includes a cluster randomized controlled effectiveness trial aimed at evaluating the cost, cost-efficiency and impact of adding a daily drink of milk to an ongoing school feeding program. The duration of the study is one school year (~7 months). The study is designed to inform the potential scale-up of school feeding operations in Yemen.

The primary research questions of the study include:

1. What is the impact of adding milk to the school feeding programme on primary school children's daily dietary diversity and consumption of nutritious foods?
2. What is the cost and cost efficiency of adding milk to the school feeding programme relative to global benchmarks?

The secondary research questions of the study include:

3. What is the impact of adding milk to the school feeding programme on children's cognition?
4. What is the impact of adding milk to the school feeding programme on school children's nutritional status?
5. What is the impact of adding milk to the school feeding programme on school attendance and learning?

The tertiary, exploratory research questions of the study include:

6. Does adding milk to the school feeding programme affect children's health including incidence and duration of gastrointestinal illnesses?
7. Does adding milk to the school feeding programme influence maternal mental health?

Program impact pathways (PIP) for the school feeding intervention

School feeding programs are generally designed with multiple objectives, including increasing school enrolment, attendance and learning achievement for school children, to improve the health and nutritional status of school children, and to support the incomes of recipient households. School feeding programmes can also provide platforms to reach other key lifecycle age groups, including pre-schoolers and young adolescents, particularly girls. School feeding programmes are relatively easy to scale-up in a crisis, providing an explicit or implicit transfer to households, equivalent to the value of the food that is distributed, and provide a benefit per household typically of around 10% of household total expenditures, or more in the case of take-home rations [8]. The program impact pathways (PIPs) for school feeding in each of the above areas are complex, and the impact of interventions is heterogeneous and context specific [9], [10]. The evidence base on the impact of school feeding on educational outcomes is fairly well-established and involves two main channels. The first focuses on school access and participation (e.g., enrolment, attendance, and drop-out). The second focuses on learning ability (e.g., attention, cognition) through improved intake of key nutrients. The PIP for school feeding and nutrition outcomes also involves two pathways operating through different levels of the food environment (figure 1, see Annex 2 & 3 for more detailed PIPs). The first is a direct pathway centered on the contribution of school feeding to daily food and nutrient intake, which critically depends not only on the quality of the school feeding transfers, but also on household decision making on the allocation of food. Improved food and nutrient intake can contribute to improved physical (e.g., height, weight, micronutrient status) and psychosocial (e.g., attention, motivation, cognition) health and nutrition outcomes. The second pathway involves complementary school health and nutrition services provided in school that address health and nutrition outcomes directly (e.g., deworming or malaria control) or

indirectly by improving nutrition knowledge, attitudes and practices (e.g., nutrition education on healthy food choices).

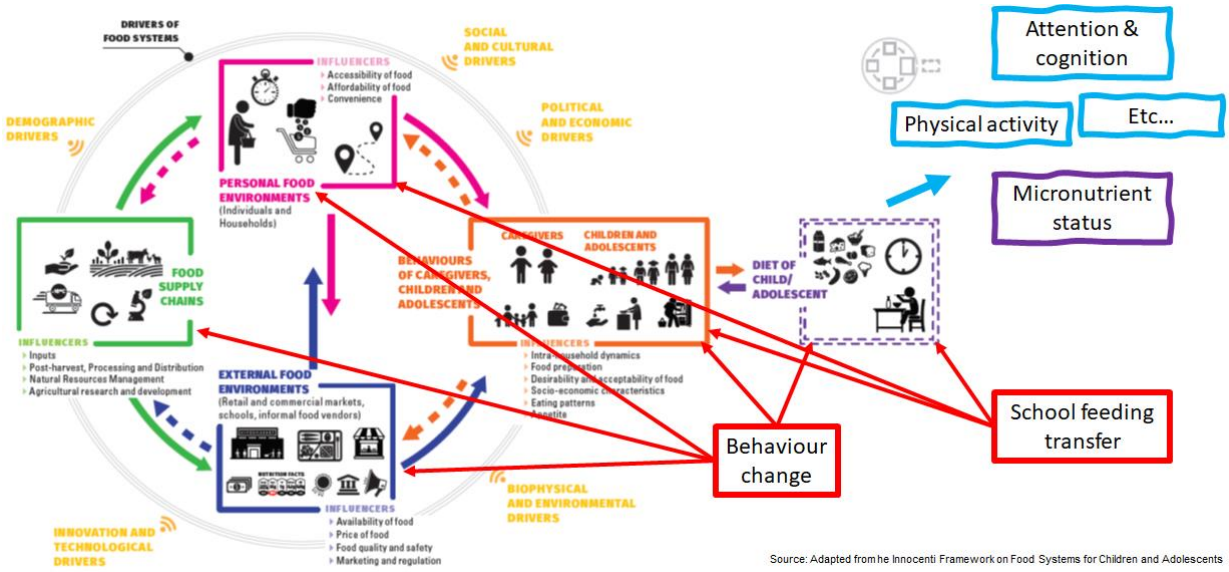

Figure 1: A systems view on the role of school feeding in improving diets & nutrition (Adapted from UNICEF, 2021.)

Existing evidence on the effects of school feeding includes a systematic review assessing the impact of onsite meal programs on nutrition outcomes in programmes in LMICs [13]. The meta-analysis included 8 studies and found significant effects in weight gain (0.25 kg per year in RCTs, 0.73 kg in CBAs) and height (0.25 cm per year in RCTs, 1.47 cm per year in CBAs). A recent trial conducted in Ghana examined the effects of providing 8.8g milk protein per day given as milk powder alongside a multiple micronutrient–fortified porridge over a 9-month period[11]. A randomized, double-blind, placebo-controlled clinical trial in healthy children aged 6–9y was conducted comparing supplements consisting of 8.8 g milk protein/d, 4.4 g milk protein/d or 4.4 g milk protein + 4.4g rice protein/d of the protein from milk and half from rice) or a control/placebo of 0.2g multiple micronutrient powder blended in a small amount of sucrose. All supplements were served with 300g of porridge at school every morning. The porridge ingredients included rice or maize flour, water, sugar, and salt and provided approximately 150 kcals of energy and 3g protein. Study outcomes included anthropometric, body-composition measures and cognition measures completed at enrolment and after 4.5 and 9mo. The results suggested that consumption of 8.8 g milk protein/d improved cognitive function compared with other supplements and led to the increase of lean body mass, but not more linear growth. The meta-analysis in [12] included an RCT in Kenya [13]where 12 schools were randomized to one of four feeding interventions: Meat, milk, energy or control (no feeding). Feeding continued for seven school terms (21 mo). Study results suggested that supplementation with animal source food had positive effects on children's cognitive performance, weight gain, and height gain but only in the subgroup of children with a lower baseline height-for-age. In addition, plasma vitamin B-12 concentrations were significantly greater in the meat and milk groups, but no significant improvements were observed for the other micronutrients observed, potentially due to malaria and other infections (Siekmann et al. 2003).

The High-Energy biscuit school feeding program in southern Yemen

The provision of school feeding through the High Energy Biscuits (HEB) targets primary school students in grades 1 to 9. In the 2022-2023 school year, HEBs were distributed to 726,596 students (55% boys and 45% girls) in Aden attending 1,676 schools in 39 districts. The HEBs are fortified with micro-nutrients (Table 1). HEBs are imported from Jordan, Egypt or procured locally produced locally through a competitive tendering process. Upon inspection and clearance at the Port of Aden the biscuits are transported and stored in warehouses in the main cities. Targeted schools receive two months' supply. Storekeepers are contracted in each school by the Ministry of Education and receive incentive from WFP and regular training on proper storage standards. The distribution of biscuits takes place daily according to the number of students attending the school. The classroom supervisors submit attendance to the storekeeper. The treasurer checks the number of students attending, and then the biscuits are distributed. The school director reviews and approves the daily distribution reports. Monthly reports are sent to the permanent supervisors at the Ministry of Education directorate.

The added milk intervention

The ultra-high temperature (UHT) milk will be added to the existing HEB programme and also target school students in grades 1 to 9. The milk is fortified with key micronutrients, including vitamins A and calcium. See Table 2 for all nutritional facts.

Outcome indicators

The main study outcomes are summarised in Table 3.

Design of the randomised evaluation

The impact evaluation involves a cluster randomized controlled trial (cRCT) design that will be implemented in 40 schools supported by the WFP school feeding program in Yemen.

Study site

The geographical area for intervention was targeted based on food insecurity (Integrated Food Security Phase Classification (IPC) severity), malnutrition and education considerations as well as ease of logistics/distribution.

Study population

The primary reference group for this study is primary school aged children aged 6–8 years old enrolled in schools supported by the school feeding program. A secondary reference group includes their caregivers.

Inclusion criteria

- Children aged 6-8 years at baseline enrolled in schools involved in the study
- Adult caregivers (≥18 years of age) of children aged 6-8 included in the study

Exclusion criteria

- Household head, child, parent or guardian unwilling to participate in the study

Randomised design

In the effectiveness trial, working closely with school feeding program implementers during detailed planning stages, schools will be randomly assigned to one of two treatment groups for a phased-in implementation:

1) School milk (intervention) group: Schools where the additional milk program will be implemented alongside the standard school feeding program for 7m academic year.

2) Standard of care (control) group: Schools with the standard school feeding for the duration of the trial.

The 40 schools will be selected from a pool of schools receiving the HEB program. Following the trial period, schools in the intervention group will continue receiving the school meal intervention and schools in the control group will also receive the milk intervention.

Randomisation procedure

Clusters will be allocated to the study groups using a restricted randomisation procedure. In this case, the restricted randomisation involves modelling allocation using a set of school-level variables to maximise balance across the two study groups. Variables will be selected based on their potential influence on the main study outcomes and their potential influence on participation in the interventions [28]. The school-level variables will be drawn from data from the Ministry of Education database, including: population size, number of teachers, number of classrooms, etc. A program will be developed using Stata 17 [29] to randomly allocate clusters to two different groups stratifying by sub-county. The algorithm will regress selection into the intervention group based on the school-level variables. The algorithm will test 5,000 random allocations and then selected the permutation that minimises the r^2 for the predicted selection.

Sample size and power

Power calculations based on available clusters in targeted districts and resource availability suggested 20 clusters (schools) per intervention arm and 30 households (with index children 6-8) per cluster. The primary outcomes of the trial include the 10-food group dietary diversity score in primary school children (6-8 years). For this outcome, assuming an inter cluster correlation coefficient (ICC) of 0.05, a sample size of 30 children per school leads to a minimum detectable effect size (MDES) of 0.26 SDs[1].

The sampling of households will be conducted through a school level listing of children enrolled in the targeted schools. Households with children aged 6-8 years will then be randomly selected for participation in the survey. Sample selection will be stratified by household vulnerability status.

Data collection

Prior to the baseline survey, all children enrolled in the 6-8y (primary) groups in the 40 schools selected for the trial will be listed including information on age, gender, and school grade. Children will then be randomly selected for participation in the survey, where the selection will be stratified by gender.

The study includes child-, caregiver-, household- and school-level data collection (Table 4). The household questionnaire will collect data at the household level and for each relevant household member separately (main caregiver and children 6-8 y). Two survey rounds are envisioned, one pre-intervention baseline at the beginning of the school year (~October 2023) and an endline at the end of the school year (~May 2024).

Methods of analysis

The randomised design allows for the identification of causal impacts of interventions using comparisons of mean outcomes between the randomised treatment arms at end-line. The

[1] For the other child level outcomes, calculations based on aggregate cognition score based on the cRCT design (ICC=0.15, parameter based on data on a cognition score in this age group in Ghana) suggested a Minimum Detectable Effect Size (MDES) of 0.34 SDs; this is a likely upper bound for MDES more broadly, as other study outcomes generally tend to have ICCs that are lower than this.

analysis will follow the intention to treat approach. The single difference model specification has the following form:

$$Y_{i1} = \beta_0 + \beta_1 T_i + \beta_2 Y_{i0} + \varepsilon_i$$

where Y_{i0} is the outcome variable at baseline, $Y_{i1}$is the outcome variable at endline and T_i is a dummy variable for the treatment. This (ANCOVA) estimator has been shown to provide more efficient estimates of program impact than difference-in-difference estimators when autocorrelation of outcomes is low[14]. To account for c-RCT design and the level of clustering of the outcome under analysis, we will employ multi-level regression models [15]. The multi-level models will use both fixed effects with dummy variables for each intervention and random effects at the school level (unit of randomisation) to take into account clustering and to estimate the standard error in an unbiased manner. Alternative fixed effect models with standard errors clustered at the school level will also be considered. Primary analyses will be unadjusted for baseline covariates. In addition to the unadjusted primary analyses, we will report a set of adjusted estimates, conditional on baseline covariates described in a statistical analysis plan that will be developed prior to the baseline survey. The purpose of the adjustments include accounting for imbalances at baseline and reducing variance. The intent to treat analysis strategy we will employ will include attempts to follow up all individuals in the study, the development of a main analysis that is valid under a stated plausible assumption on missing data, and sensitivity analysis to explore the effects of departures from the assumption underlying the main analysis. Data management, data cleaning and statistical analyses will be conducted using Stata, SAS and R. Results will be reported following the guidelines established in the CONSORT guidance for cluster-randomized trials [16]

Heterogeneity analysis

The data will allow for subgroup analyses, including child sex, age and poverty/vulnerability status. The impacts of school feeding are heterogeneous and context specific. School meals, for instance, have been associated with improvements in school participation of girls where there are large gender disparities in access to education, and with improvements in linear growth in early primary school age, and in younger siblings. In addition, we will undertake further exploratory heterogeneity analyses using machine learning methods.

Process evaluation, cost and cost efficiency analysis

A light-touch, theory-driven, mixed methods process evaluation will be conducted as part of the endline survey data collection to provide evidence on program implementation quality, fidelity and uptake. We will work closely with the program implementers to identify indicators for the key processes across the supply chain and PIPs for the intervention, including indicators for meal quality and food safety across operations.

Costs and cost-efficiency analysis

During the process evaluation, cost data will also be collected retrospectively following an ingredients approach using a semi-structured questionnaire. Financial costs capture actual expenditures in terms of programme implementation on an annual basis. Economic costs include the opportunity costs of community members, teaching staff and other stakeholders involved in the intervention provision. For cost data collection, we will capture all cost incurred by implementing partners, for both inputs (personnel, capital equipment, supplies, overhead) and activities (start up and disaggregated recurrent activities). We will use a mixed methods approach that combines using financial expense reports obtained by project records, and micro-costing for

all resources used that are not captured in the financial analysis. We will capture information on time use by project staff using interview and focus group discussion. Similarly, we will collect time use data and out of pocket expenses for volunteers and project participants. We will combine financial and economic costs to estimate the cost per participant using an excel based costing model. Given that the pilot nature of the milk distribution, we will develop scale-up scenarios to account for potential economies of scale. Opportunity costs of preschool staff and community members will be calculated using local pay scales. Capital costs will be annuitised over the useful life of all relevant school-level assets using a discount rate of 3% as per World Bank recommendations. Annuitisation enables an equivalent annual cost to be estimated and reflects the value in-use of capital items, rather than reflecting when the item was purchased. Process and output data covering the adequacy of the service delivery will be collected from monitoring visits on a quarterly basis using standardised data collection forms. Output data will be combined with the costs to provide estimates of cost-efficiency metrics, including costs per beneficiary, kilocalories, iron, and vitamin A delivered. Cost and cost efficiency metrics will be compared with benchmarks for school feeding programs globally [17]. Sensitivity analysis will be undertaken to account for uncertainties in the economic evaluation.

Data flow and management

All data will be collected using tablets preloaded with questionnaires programmed using CAPI software. The data cleaning will include the creation of anonymized versions of the data sets. The data files in Stata format containing identifying information from the baseline survey will be held only on the PI's computers, for use in tracking and identifying baseline survey respondents during the follow-up surveys. The data will be processed, cleaned and documented by the research assistants working under close guidance of the PIs. The documentation will include questionnaires, data variable labels, value labels and a codebook, to assist in the analysis. Field notes from the fieldwork coordinator and team leaders describing the data collection process will also be stored. Within 12 months of the end of the project, the anonymized data will be made publicly available on the IFPRI web site. Users of the data will be asked to provide information on how the data are expected to be used, to help IFPRI track use of the data for research purposes.

Ethical considerations and trial oversight

All research procedures will be conducted in accordance with the Declaration of Helsinki and according to International Conference on Harmonisation GCP guidelines. The Institutional Review Board of IFPRI will provide initial and ongoing review and approval of the study protocol. Adverse events and serious adverse events will be reported to both boards, according to their respective reporting requirements. A trial steering group will provide oversight of the trial.

Informed consent

Informed consent will be requested from each of the participants using a standardised form. All the data collection tools will be written in Arabic and English, and the enumerators will speak the local language. Each enumerator will be asked to read the consent statement in full form, slowly and in local language to the participant. The consent forms will describe the purpose of the research, as well as the activities involved, potential risks and benefits and other relevant information. Enumerators will then ask if the consent and assent statements were understood and if there are any questions. At this time the informant will be given the opportunity to refuse and understand that they may also be able to refuse the study at any time during the survey with no repercussions to them or their family. Assent for children will be provided by themselves and

consent provided by their parents or legal guardians. An informed assent and consent form will be signed by the child and by their parent or legal guardian.

Withdrawal
Participants will be free to withdraw at any stage of the process by informing the research team, local authority or programme staff.

Confidentiality
All participants will be assigned an identifying number (a unique ID code), under which all information will be stored. Databases used for analysis will only link information to the unique ID code, not to the participants' names or any other identifying information. Individual information will never appear in a published report. Only a limited number of IFPRI staff mentioned below will have access to the data files with personally identifiable information to minimize risk. Files with personally identifiable information will be stored on password protected computers in encrypted folders. All published data sets will include no personal references to individuals. All identifying information will be destroyed within 5 years upon project completion.

Benefits
School meal interventions have been shown to have multiple benefits in terms of enrolment, attendance, nutrition, cognition and learning of participants. Beyond receipt of the school meal itself, the potential benefits of participating in the survey include study participants' gaining knowledge of their height and weight. To facilitate this, participants will be provided with their results immediately following the conclusion of the anthropometry assessment. Beyond the potential individual benefits, the findings of the study will contribute to our understanding of how school feeding programs can increase children's education, health, and nutrition outcomes which may have wider benefits for similar households in Yemen and other countries.

Risks
There are no known risks related to the research methods involved. The survey will not involve highly sensitive or distressing topics, but there will be questions relating to experiences of stress and anxiety. Some questions may be considered sensitive by respondents. Study respondents will be reminded that they can refuse to answer any questions or participate in any assessments, thus minimizing any potential risks. All efforts will be made to ask potentially sensitive questions in private, out of sight or earshot from others. Interviewers will be alert for signs of discomfort or reluctance. The methods of anthropometry assessment are non-invasive and virtually risk free. However, participants may find them uncomfortable and will therefore be reminded that they can refuse any of the assessments without ramifications for their participation in the study or their relationship with study staff and institutions.

There is also very minimal risk of breach of confidentiality associated with participation in the study. All participants will be assigned an identifying number (a unique ID code), under which all information will be stored. All identifying information of the respondents will be destroyed no later than 5 years upon the completion of the study.

Given the minimal risks posed by this study and the potential benefits to the individuals to receive school meals and gain insight into their own nutritional status and the potential benefits related to understanding how school feeding programs these types of programs work to improve children's education, health, and nutrition outcomes, it is thought that the benefits outweigh the risks.

Collaboration Management and Research Capacity Strengthening

The project will be undertaken through a collaboration led by IFPRI, HSAGroup, WFP Tetrapak and other partners (annex 1). The team provides intellectual leadership across a range of disciplines including epidemiology, nutrition, and economics. The planned project management includes weekly team meetings based on Google's Objectives and Key Results (OKR) framework that allow for efficient task management, whilst at the same time allowing team members to participate in setting and reviewing targets for the project activities on a quarterly basis. We will complement the weekly team meetings with quarterly project updates and annual review meetings with a trial steering group including the Co-PI across all the partner organizations.

Timeline

See figure 3 for high-level project plan.

Budget

The total budget for this study is summarised in Table 5.

	2023						2024												
Activity	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**...**
Research activities																		
Detailed study design, kick-off workshop, and planning with implementing partner																		
IRB																		
Data collection (impact evaluation)																		
Data collection (process evaluation+costing)																		
Data cleaning and analysis																		
Dissemination (workshop)																		
Dissemination (peer-reviewed publications)																		
Implementation activities																		
Intervention implemtnation (HSA/WFP)																		

Figure 3: High-level project-plan.

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Table 1: Nutrition details of the high energy biscuits

Nutrient	Content per 100 grams
Energy (kcal)	440
Carbohydrates (g)	89.6
Protein (g)	9.0
Fat (g)	15.0
Iron (mg)	11.0
Zinc (mg)	5.7
Vitamin D (mcg)	1.9
Vitamin A-Retinol (mcg)	250
Vitamin C (mg)	20
Vitamin B12 (µg)	2.2
Vitamin B6 (mg)	1.1

Table 2: Nutrition details of the added milk intervention

Nutrition Facts				**حقائق تغذوية**
Number of servings per container 1				عدد الحصص في العبوة ١
Serving size 100ml				حجم الحصة ١٠٠مل
Amount per 100ml				الكمية لكل ١٠٠مل
Calories		**62**		**السعرات الحرارية**
(*Daily value 3%)				(*نسبة الاحتياج اليومي ٣٪)
		%Daily Value* *نسبة الاحتياج اليومي%		
Total Fat	**3.47 g**	**5%**	٣,٤٧ غ	الدهون الكلية
Saturated Fats	**1.75 g**	**9%**	١,٧٥ غ	دهون مشبعة
Trans Fats	**0 g**	**-**	٠ غ	دهون *متحولة*
Cholesterol	**4.9 mg**	**2%**	٤,٩ مغ	كوليسترول
Sodium	**15.9 mg**	**1%**	١٥,٩ مغ	صوديوم
Total Carbohydrates	**4.46 g**	**2%**	٤,٤٦ غ	الكربوهيدرات الكلية
Dietary Fibers	**0.19 g**	**1%**	٠,١٩ غ	الألياف الغذائية
Total Sugars	**4.26 g**	**5%**	٤,٢٦ غ	سكريات كلية
Includes 0 grams of added sugar		**-**		يتضمن ٠ غرام سكر مضاف
Protein	**3.17 g**	**6%**	٣,١٧ غ	بروتين
Calcium	**71.2 mg**	**7%**	٧١,٢ مغ	كالسيوم
Vitamin A	**124mcg**	**15%**	١٢٤مكغم	فيتامين أ
Vitamin D3	**1mcg**	**7%**	١مكغم	فيتامين د٣
Vitamin B2	**0.12mg**	**14%**	٠,١٦مغ	فيتامين ب٢
***% Daily Value (DV) tells you how much a nutrient contributes to a daily diet 2000 calories a day.**				*تدل نسبة الاحتياج اليومي على المغذيات مبنية على نظام غذائي محتوي على ٢٠٠٠ سعرة حرارية.

Table 3: Outcome indicators

Type	Domain	Target group	Indicators	Survey round	
				Baseline	Endlines
Primary	Diet	Children 6-8y	Diet diversity score (DDS)	I	I
	Cost and cost efficiency	Program	Cost per beneficiary, cost per nutrient delivered		I
Secondary	Cognition	Children 6-8y	Forward and backward digit span, standard progressive matrices.	T	T
	Learning	Children 6-8y	Literacy and numeracy scores	T	T
	Nutrition	Children 6-8y	Anthropometry (HAZ, BMI)	M	M
	Education	Children 6-8y	Attendance	I	I
	School feeding service	Caregivers, children 6-8y	Perceptions on the school feeding program, willingness to pay	I	I
Tertiary	Mental health	Caregivers	Self-reported depression symptoms		I
	Health	Children 6-8y	Morbidity, caregiver-reported	I	I
Process	School feeding service	Program	Meal quality, quantity, frequency, food safety profile, acceptability		I

Abbreviations: BMI= Body Mass Index, HAZ= Height for Age z-score, I= Interview, M= Measurement, T= Test.

Table 4: Survey modules

Questionnaire	Module	Description
School	Location & access	Identification, location
	Infrastructure	Physical infrastructure, including learning space, water and sanitation, cooking and storage facilities
	Staff	Staff roster, education and training
	Health and hygiene practices	Health and hygiene practices of school staff
	Meal provision	Meal quality, portion sizes, meal planning, management and distribution
Household	Roster	Listing of demographic characteristics of household members
	Housing characteristics	Basic features of the household's primary dwelling place, including infrastructure, access to water and electricity
	Assets	Assets owned
	Shocks	Unexpected events that may have influenced household's well-being and responses taken by household
	Food security	Household vulnerability with respect to food frequency
Caregiver	School feeding	Perceptions on the school feeding programme
	Mental health	Self-reported depressive symptoms checklist
Child	Dietary assessment	Qualitative multipass 24hr recall on food intake for children 6-8y
	Anthropometry	Physical measurements (weight and height) of children.
	Morbidity	Caregiver reported morbidity symptoms for children aged 6-8y
	Executive function, cognition and learning tests	Direct assessment of inhibitory control and memory in children 6-8 years using Assessment of Motivation, Effort, and Self-Regulation (AMES), a tablet-based app to assess executive function
		Assessor report of executive function behaviours using a locally adapted version of the Preschool Self-Regulation Assessment Assessor Report (six items that capture students' behaviour)
	Learning	Literacy and numeracy scores in children 6-8y

Table 5: Budget summary

Budget (total)	**Year 1**		**Year 2**		**Total**
Labor	$ 92,549.41	Labor	$ 106,052.86	Labor	$ 198,602.26
Consultant	96,000.00	Consultant	96,000.00	Consultant	192,000.00
Other Costs	42,512.28	Other Costs	48,853.38	Other Costs	91,365.66
Sub-Total	$ 231,061.69	Sub-Total	$ 250,906.24	Sub-Total	$ 481,967.92
Indirects	42,630.88	Indirects	46,292.20	Indirects	88,923.08
Total	**$ 273,692.57**	**Total**	**$ 297,198.44**	**Total**	**$ 570,891.00**

Annex 1: The trial team

Analysis and writing committee
Aulo Gelli (PI), Lilia Bliznashka, Sikandra Kurdi, Olivier Ecker.

Program team
At WFP: [TBC operations, M&E teams]

At HSA: [TBC operations, M&E teams]

Field Management team
[Add survey team].

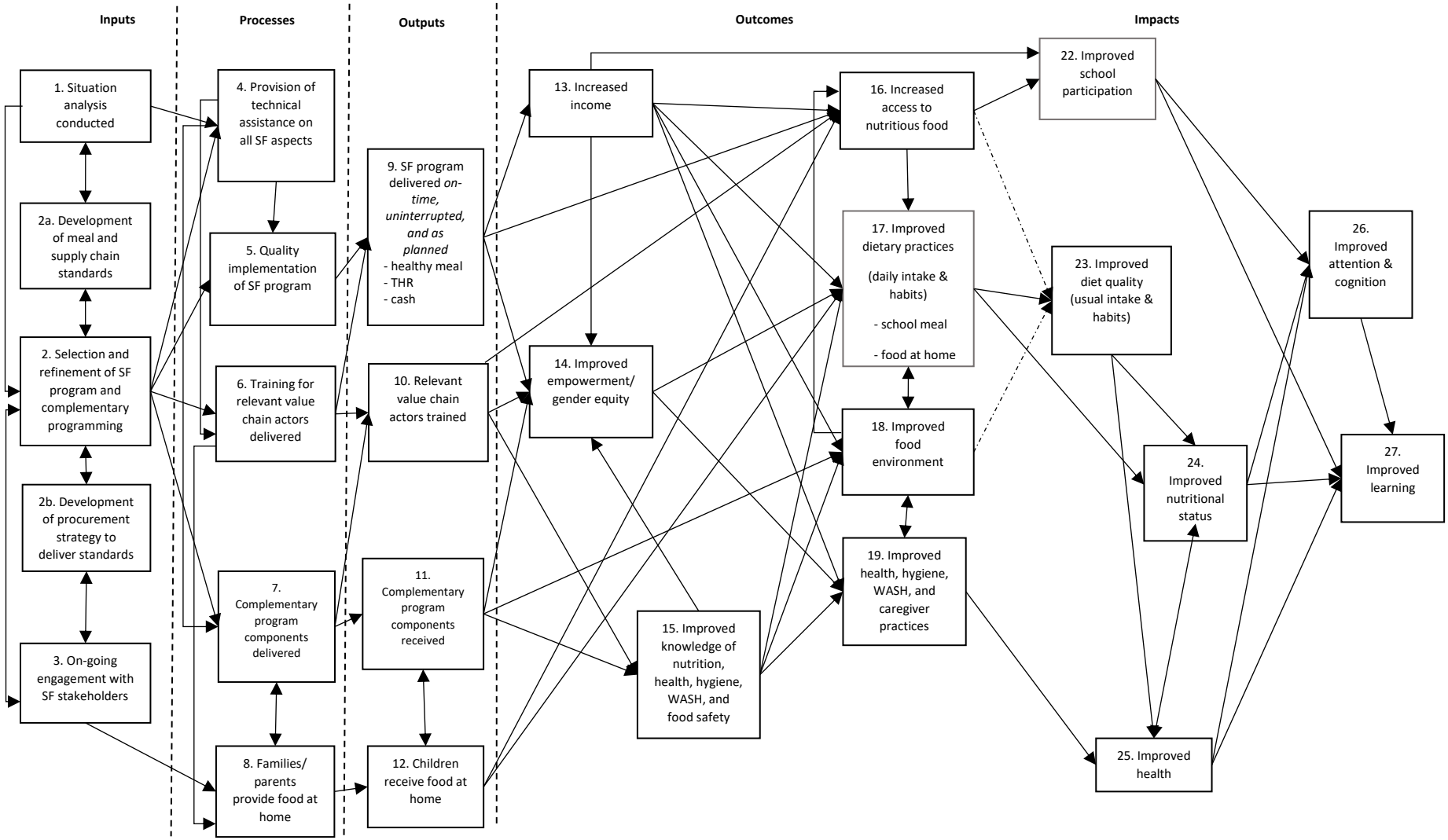
Doctoral student collaborators
(TBC).

Collaborators
Amy Margolies.

Data Management
Odiche Nwabuikwu, TBC.

Trial steering group
IFPRI: (TBC), Harold Alderman, Dan Gilligan, Marie Ruel.

Annex 2: Generic program impact pathway for nutrition-sensitive school feeding programmes (Source: Gelli et al., 2022)



Annex 3: Potential stakeholders and activities in development of meal and procurement standards (Source: Gelli et al., 2022)