Food aid for nutrition: A landscape review of current research and implications for future studies

Location: Global

What we know: A large body of research exists that examines the formulation and effectiveness of food-aid products tailored to address nutrition problems, such as wasting and micronutrient deficiencies.

What this article adds: A review was undertaken to synthesise a sample of recent research on specialised nutritious foods (SNFs) used to impact nutrition to highlight themes and identify under-researched areas. A standardised search identified 142 manuscripts published between January 2011 and July 2018, and 33 clinical trials active as of July 2018. Study characteristics were collected to identify patterns and themes. Published and ongoing research has been narrowly focused on rural Africa and few studies have examined the use of SNFs in humanitarian crises. Most research has dealt with the absolute or comparative effectiveness of SNF products based on how they are formulated or programmed in addressing a narrow range of nutrition outcomes. More research is needed on SNF programming, particularly in emergency contexts and urban settings, prevention of rather than treatment of nutritional deficits, and poor outcomes. Research is also needed on the cost-effectiveness of alternative programme approaches (especially multi-sector interventions), the long-term nutrition and health impacts of SNFs, behavioural programming components, causes of relapse, and relevant but atypical outcome measures, such as body composition and cognitive outcomes.

Introduction
Advancements in the formulation of specialised nutritious foods (SNFs), including ready-to-use therapeutic foods (RUTFs) and fortified blended foods (FBFs), have revolutionised food aid. This has both derived from and led to an expanding evidence base on these products. In 2011, a review of the United States Government’s food-aid agenda undertaken by the Food Aid Quality Review (FAQR) on behalf of the United States Agency for International Development Office of Food for Peace (USAID/FFP) (Webb et al, 2011) called for new rigorous research activities to investigate the programming, cost-effectiveness and innovative formulations of SNFs in the context of wider food-assistance strategies. More recently, other entities, including the No Wasted Lives Coalition and the Scaling Up Nutrition movement (SUN), have unveiled research agendas calling for more evidence on key topics, from the role of specific nutrients in preventing and treating undernutrition to intergenerational undernutrition and alternative outcome measures (Webb et al, 2017; Caiafa et al, 2017; Walton et al, 2018). To support these demands for policy-relevant evidence, the current review synthesises published and ongoing research conducted from 2011 until July 2018 to identify common themes and map areas for further exploration.

Methodology
A tailored search of PubMed and Web of Science conducted in August 2018 identified relevant publications from January 1 2011 to July 31 2018.1 One author compiled and reviewed these, removing duplicates and those not meeting the inclusion criteria,2 yielding 142 publications for analysis.3 Ongoing studies were identified through REFINE (Research Engagement on Food Interventions for Nutritional Effectiveness; www.REFINEnutrition.org), a public platform that maps SNF research by routinely searching six international clinical trial registries (available at www.REFINEnutrition.org). REFINE was searched in July 2018, yielding 33 ongoing studies for analysis. Information was then extracted from each publication and clinical trial registry.4 When multiple publications drew from a single research study, each publication was considered a discrete entry.

Findings: The landscape of food-aid research since 2011

Research context
Of the publications considered, over half (61%) took place in Africa and 39% in Asia.5 More than half (60%) took place in rural contexts and one quarter in urban and semi-urban settings. Only nine published studies (6%) were conducted in an emergency context, such as after a natural disaster or in a refugee camp. Ongoing trials at the time of review mirror these geographic foci: Africa (52%) and Asia (33%) (Figure 3). Of trial registration records that provided information about the proposed study context (n=12), six are based in rural contexts, four in urban or semi-urban contexts, and two in both rural and urban contexts.

Research objectives and outcomes
Most publications assessed SNF effectiveness in addressing specific nutrition outcomes (75%). Almost half of these studies aimed to treat acute malnutrition (49%), with twice as many focusing on severe acute malnutrition (SAM) compared to moderate acute malnutrition (MAM) treatment (n=30 and n=17, respectively). Of ongoing studies, about half (45%) are effectiveness trials for treating acute malnutrition, among which eight (53%) study SAM treatment, five study MAM and four study both SAM and MAM.

Other common effectiveness study outcomes included linear growth and stunting (40%) and underweight (25%). Few studies assessed cognitive or birth outcomes (only 5% and 4%, respectively); none focused on body composition. This is mirrored in ongoing studies, which predominantly assessed linear growth (39%); birth outcomes (18%); and underweight (18%). A subset of published studies also assessed SNF acceptability (n=39; 27%) and household use (n=28; 20%), while one ongoing study is investigating acceptability of a novel SNF. Only 13 (9%) of publications calculated programme cost-effectiveness for nutrition-related outcomes. Ongoing trials also do not substantially address cost-effectiveness, implying that this evidence base will remain underdeveloped for the foreseeable future.

Food aid products
Among publications dealing with product effectiveness (n=106), lipid-based nutrition supplements (LNS) was the most frequently studied SNF (Figure 4). About half examined new SNF formulations (42%). Just over one third com-

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1 See Table 1 in the online version of this article:

2 See Table 2 in the online version of this article:

3 See Figure 1 in the online version of this article:

4 See Table 3 in the online version of this article:

5 See Figure 2 in the online version of this article:
pared multiple SNFs (36%), while another assessed a single product’s effectiveness (32%). Others compared SNFs to a micronutrient supplement (11%) or food (9%). Most studies assessed internationally produced SNFs (75%) and about one third (29%) assessed SNFs manufactured in a facility in the same country or region in which the study took place. Others (11%) compared the effectiveness of animal- and plant-source proteins. Among ongoing product effectiveness trials (n=32), LNS is also the most studied product (Figure 5). Half of these (53%) assess the effectiveness of innovative products: 11 compare a new SNF with an existing product and three compare multiple new SNFs. One trial studies animal- versus plant-source protein.

Target populations

Children aged between 6-59 months were the most common target population in publications (85%), although there were many sub-groups (children aged 6-23 months, 12-59 months, etc.). Four studies targeted infants under six months of age and five targeted children aged 0-59 months. Some targeted pregnant women (8%) and one targeted both mothers and undernourished children. For ongoing studies, children aged 6-59 months are still the most common subjects (64%) and seven trials (21%) target pregnant women. Of these, three also provide interventions to children until their second birthday and one provides interventions to children until their fifth birthday.

Programme delivery

Interventions in publications were overwhelmingly provided through community-based programmes (85%), followed by facility-based/inpatient-based (7%) and school-based programmes (3%). One study transitioned all patients from inpatient to community-based care. Most ongoing studies also focus on community-based programming, with only one examining inpatient treatment.

One quarter of published effectiveness studies evaluated SNF delivery methods, including varied product dosages (n=4); distribution frequencies (n=4); providing food after recovery from acute malnutrition (n=2) or after infection (n=2); combining SNFs with general food rations (n=3); and delivering SNFs through existing health services (n=3). Of ongoing effectiveness studies, three vary SNF dosages and two vary treatment duration. Much still is to be understood about how, in what dosage and for how long SNF products should be delivered to optimise outcomes.

Multi-sector programming

Sixteen per cent of published effectiveness studies explored complementary interventions alongside or compared to an SNF. Most were behaviour-change interventions, including nutrition education or counselling (n=10); child stimulation (n=4); and child-centered counselling (n=2). Of ongoing effectiveness trials, six include a social and behavior-change communication (SBCC) component and two incorporate nutrition education or counselling. One study examined combining a food supplement with home- versus facility-based growth monitoring.

Despite growing interest in the linkages between water, sanitation, and hygiene (WASH), the microbiome and environmental enteric dysfunction (EED) and undernutrition (Cumming et al, 2016), only two published studies included a WASH component and few considered the microbiome. This is therefore a domain requiring further exploration.

Funding and leadership

Published studies reported 76 different funding sources. Governments and private foundations provided financial support for the most studies.6 The main individual funders were USAID (n=14), the Bill and Melinda Gates Foundation (n=13), and Médecins Sans Frontières (n=8).7

Academic institutions directed most published research (n=48), followed by non-governmental organisations (NGOs) (n=23) and research institutes (n=15). This highlights these organisations’ relative capacity to undertake and publish this work and, notably, the significant role international organisations have played in steering the food-aid research agenda. Organisations based in the countries in which the study was conducted led a comparatively small number of published studies (n=26; 18%).

Discussion: Gaps and next steps in food aid for nutrition research

Using SNFs to impact nutrition demands flexi...
bility in product selection and programming. This review finds that the current research landscape does not offer an adequate empirical foundation to inform efforts to address the myriad causes and manifestations of undernutrition in diverse contexts. While additional studies have taken place since July 2018 and the research landscape may have evolved, the present review highlights a range of gaps and areas for future research that remain ripe for exploration.

Principally, the scope of research in this field has been narrowly focused in both context and objective. Most studies have taken place in stable communities in rural Africa and Asia, which does not necessarily reflect the reality of where SNFs are used: increasingly in semi-urban and urban contexts, emergencies and protracted crises. Assuming the results from studies conducted in stable contexts can be generalised to humanitarian settings implies that impacts of SNF programming, and perhaps composition, can be agnostic of the wider context. SNF research must be expanded to reflect the range of contexts in which SNFs are used.

Regarding study objectives, most studies focus on the SNF product’s absolute or comparative effectiveness in addressing a narrow range of outcomes. More research is needed on alternative outcomes, such as relapse, cognitive outcomes and body composition. Also, prominent food-aid agencies, including the Inter-Agency Working Group for Specialized Nutritious Food Products (2018), are exploring a unified protocol for the entire spectrum of acute malnutrition treatment, instead of separate protocols for MAM and SAM. Yet, as of July 2018, just one publication and two ongoing studies address this, indicating a notable gap in the evidence base to inform this prospective policy shift.

Furthermore, cost-effectiveness information is a significant gap as more funders demand value for money and implementers strive to maximise outcomes with constrained budgets. Limited research in this area may reflect difficulties in calculating cost-effectiveness, including diverse estimation methods and varied costs across contexts. There is therefore also room to develop unified methodologies for calculating and reporting cost-effectiveness.

Despite the relatively narrow focus of SNF research to date, this review shows that research objectives are expanding. Notably, there is a shift towards including interventions to address underlying causes of malnutrition, especially by integrating agricultural and WASH components and investigating the role of the microbiome and EED in nutritional outcomes.

While optimal nutrition during the first 1,000 days is widely acknowledged as critical (Stobaugh et al, 2019), recent research agendas include investigation into the impact of preconception and long-term programming. This review finds limited published research on the preventive, intergenerational effects of food aid. Ongoing trials, conversely, more frequently address nutrition throughout the 1,000 days and beyond, targeting pregnant and lactating women to reach their children, indicating an encouraging expansion of focus.

Research activities have prioritised simple height- and weight-based measures of nutritional health. This allows for more comparison of study results but provides limited information about other metrics of nutritional health, such as body composition or non-anthropometric outcomes. Using these outcome measures is relatively uncharted territory and will require the development of standardised definitions, cut-offs and measurement tools.

Other research gaps that came to light from this exercise include: addressing seasonal undernutrition through prevention; understanding and preventing relapse; alternative SNF formulations using locally available ingredients; plant-versus animal-source protein effectiveness; discerning optimal SBCC messaging to influence infant and young child feeding (IYCF); the comparative or composite impact of cash and SNFs to inform the shift towards cash-based programming in humanitarian response; and the food-safety implications of local production and household preparation of SNFs. Little research explores the long-term effects of SNF consumption in early childhood on later development of overweight or non-communicable diseases (NCDs), an issue of particular concern as countries undergo the ‘nutrition transition’.

Regarding research funding, resources outside academia, government and NGOs remain largely untapped. With nutrition central to several global initiatives, including the Decade of Action on Nutrition and the Sustainable Development Goals, the time is especially ripe for partnering with the private sector, food industries and local businesses and academic institutions. Exploring these relationships will require establishment of institutional structures to protect scientific credibility and integrity. Examples include pooled funding mechanisms, codes of conduct and frameworks for data sharing.

Conclusion

Mapping the research landscape thematically can identify over- and under-studied areas and project what new knowledge may be on the horizon. Such periodic assessments, in tandem with focused efforts on research dissemination and uptake, will keep this field of study on course for delivering food-aid programmes that both maximise impact per dollar and meet the evolving needs of nutritionally vulnerable populations.

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References