

# A systematic review of nutrition interventions for mobile pastoralists

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## GLOBAL

**What we know:** Pastoralist communities are vulnerable to seasonally-driven and shock-related high rates of acute malnutrition.

**What this article adds:** A systematic review was undertaken of studies describing interventions within mobile pastoralist communities to improve child nutrition status. A total of 16 studies were included, drawn from a previous systematic review of health interventions in pastoralist communities and previous Emergency Nutrition Network Field Exchange articles. The results reveal that low levels of education, poverty, poor infant and young child feeding practices and poor health-seeking and hygiene practices are key determinants of child malnutrition in mobile pastoralist communities. Food security is also a contributing factor, especially during drought and conflict, and pastoralists who settle, particularly in regions unsuitable for agronomist lifestyles, have a greater risk of food insecurity. During stable periods, however, there is evidence that children in mobile pastoralist communities can access quality diets. Evidence from intervention studies shows that targeting livestock health can add nutritive value and stability to the milk supply chain, food aid during periods of shock can reduce the levels of child wasting and anaemia and culturally-targeted, community-directed nutrition education may improve child nutrition. More research in this area is needed across a range of contexts.

### Introduction

Pastoralists, defined as populations that practise animal husbandry as their primary economic activity and typically practise some degree of seasonal mobility, inhabit some of the harshest, most remote terrain on earth. These communities migrate with herds of livestock to follow seasonal grazing grounds and water sources. Often not included in routine demographic surveys, their numbers are unknown, however estimates range from 50 to over 300 million individuals globally. The African Union estimates there are 268 million pastoralists on the African continent

alone (Carr-Hill, 2013). Children who live in pastoralist areas are increasingly regarded as some of the most nutritionally vulnerable in the world. Nutrition surveys in Eastern Ethiopia and other pastoralist areas of Africa have long identified seasonally high rates of acute malnutrition (Chotard et al, 2010). Pastoralist populations are vulnerable to shocks that result in nutrition risks such as drought, animal disease, market disruption and the closure of borders and many pastoralists' nomadic livelihoods prevent them from accessing health services designed for sedentary populations. Understanding how

best to reach and improve nutrition in children among mobile pastoralist communities is an important global health priority.

A recent systematic review of health interventions among mobile pastoralists found 140 studies, seven of which included child nutrition outcomes (Wild et al, 2020). Their description of the results focuses largely on the facilitators and barriers to intervention success and, since they include all health interventions, the mention of nutritional interventions is very limited. Given the high rates of malnutrition among children in this community and the limited knowledge synthesis on this topic, in this report we revisit the seven nutrition intervention studies found that search and summarise these alongside a review of all the articles on this topic that have been published in Emergency Nutrition Network (ENN)'s Field Exchange. The purpose of this review was to answer the questions – what types of interventions have been described and what aspects of these interventions have succeeded or failed in improving the nutritional status of children living in mobile pastoralist communities?

### Methodology

We reviewed and described the seven studies identified by a recent search of PubMed/MEDLINE, Scopus, Embase, the Cumulative Index to Nursing and Allied Health Literature (CINAL), Web of Science, the World Health Organization (WHO) Catalog, Agricultural Online Access (AGRICOLA), the Centre for Agriculture and Bioscience International (CABI), the Scientific Electronic Library Online (SciELO) as well as Google Scholar and structured Google searches to query grey literature such as humanitarian

**Table 1** Summary of papers included

Author and year	Country	Population	Objectives	Study design	Findings
<b>Peer reviewed publications</b>					
(Chege et al, 2015)	Kenya	60 mothers of Maasai children <5 years	To investigate the influence of culture on dietary practices among Maasai children	Qualitative focus groups (descriptive)	Nomadism results in animal products being inaccessible to most children since men are away with animals. Animals are rarely slaughtered or sold. Children mainly consume cereals and legumes. (descriptive) (descriptive)
(Gizaw et al, 2016)	Ethiopia	367 children <2 years in a nomadic population	To assess the prevalence of diarrhoea and its association with feeding practices	Cross-sectional survey (descriptive)	Prevalence of diarrhoea was high at 31%. It was associated with sub-optimal breastfeeding practices and eating uncooked foods.
(Vossenauer et al, 2017)	Kenya	882 breastfed children aged -23 months	To formulate age- and context-specific complementary feeding recommendations, based on current diets and assess barriers to uptake of recommendations.	Combination of nutrient gap analysis and ethnographic techniques (descriptive)	Optimising current diets to improve complementary feeding could ensure adequate levels of most nutrients among settled and pastoralist infants/children, but less so among agro-pastoralist communities where use of nutrient-dense foods was limited.
(Seid et al, 2017)	Ethiopia	420 children aged 6-59 months with their caregivers	To assess the determinants of acute malnutrition	Facility-based, unmatched case control study (descriptive)	Rural residence, illiterate father, monthly income of less than 1000 birr and food served together with family were statistically associated with acute malnutrition.
(Le Port et al, 2017)	Senegal	204 children age 2-5 years	To assess whether a dairy value chain could be used to distribute a micronutrient-fortified yoghurt to improve haemoglobin (Hb) and reduce anaemia	Cluster randomised controlled trial (RCT) (intervention)	Anaemia prevalence was very high at baseline (80%) and dropped to 60% at endline with no differences between study groups. Hb increased by 0.55 g/dL, (95%CI 0.27 0.84) more in the intervention compared to the control group after one year.
(Bernard et al, 2019)	Senegal	320 household groups	To reduce variability in milk deliveries and improve children's nutritional status by providing fortified yogurt to milk suppliers	RCT (intervention)	This intervention increased the regularity of milk deliveries and may have improved child Hb status.
(Salehi et al, 2004)	Iran	811 families with children aged <5 years	To assess the impact of a community-based education intervention on child growth	RCT (intervention)	After 12 months, intervention, children had significantly greater gains in weight-for-age (WAZ), height-for-age (HAZ) and weight-for-length (WLZ) than controls.
(Stefanak and Jarjoura, 1989)	Chad	641 malnourished children (WLZ<80% median) <5 years	To assess the impact of centre-based vs take-home supplementary feeding on child weight gain	Unmatched case control study (intervention)	Children receiving supplementary food in a two-week take-home programme had similar weight gain to those enrolled in a supervised daily rehabilitative feeding programme.
(Bush, 1995)	Kenya	1,000 households in drought-affected Turkana district	To evaluate the role of food assistance in the context of long-term drought	Cross sectional surveys and qualitative case studies (intervention)	There was a decline in rates of childhood malnutrition as a result of food assistance.
<b>Other literature</b>					
(CDC, 2002)	Mongolia	937 children 6-59 months	To assess the nutritional effects of severe winters on pastoralist children	Cross-sectional survey (descriptive)	There was no difference in nutritional status (wasting, stunting underweight) between affected and unaffected areas. Wasting was approx. 2% and stunting 30%
(Sadler and Catley, 2010)	Ethiopia	40 men and women sampled from two areas of the Somali region	To examine pastoralists' views on the causes of child malnutrition, links between child nutritional status and milk supply and interventions for addressing malnutrition	Qualitative participatory focus groups (descriptive)	Milk contributes the majority of children's diets when it is available. During the dry season and during periods of drought, milk is not available and this is perceived to be directly associated with child weight loss.
(Mayer et al, 2009)	Mali	Representative sample of whole population of 30,000 people	To field test a novel survey method, better designed to assess prevalence of malnutrition among pastoralist children	Novel prevalence survey (descriptive)	The method is practical for use in pastoral populations it is valid and is simple to apply. The method used local knowledge to sample whole 'troupes' (groups of pastoralists who move together). There are significant differences in wasting prevalence when using MUAC vs WLZ in this community.
(Reese-Masterson et al, 2016)	Kenya	227 children aged 6-23 months	To investigate the socio-economic and health-related risk factors associated with stunting, wasting and both combined	Secondary data analysis of survey data (descriptive)	Stunting prevalence was 28%, wasting by WLZ 8.8% and MUAC<11.5cm 1.3%. Hand-washing, fever and older age were associated with stunting. Not owning livestock was associated with concurrent wasting and stunting.
(Buchanan-Smith and Barton, 1999)	Kenya	All households in the affected district malnutrition assessed in children < 5 years	To evaluate the Oxfam Wajir Relief Programme 1996-98	Project evaluation report	Rates of malnutrition decreased during the provision of food aid and supplementary feeding.
(Sadler and Mitchard, 2012)	Ethiopia	940 children 6-59 months	To evaluate the impact of livestock support on child nutritional status during the dry season	Case control study (intervention)	Targeted livestock support to milking animals that stay close to women and children during the dry season increases milk production and consumption among children and improves nutritional status.

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Author and year	Country	Population	Objectives	Study design	Findings
<b>Other literature</b>					
(Sesay et al, 2018)	Somalia	Community members from three livelihood groups: pastoralists, agro-pastoralists and urban populations	To determine the viability of a livestock intervention and identify areas to improve the nutritional status of children 6-23 months	Feasibility study (cross-sectional survey and qualitative methods) (intervention)	Interventions should aim to enhance milk production and processing during the wet season and should focus on improving milk handling, production and preservation. Behaviour change related to IYCF should also be implemented.

\*Abbreviations: IYCF=infant and young child feeding; RCT= randomised controlled trial. WLZ=weight for length z-score; WAZ= weight for age z-score; HAZ= height for age z-score; MUAC= mid-upper arm circumference

agency reports (i.e., the International Organization for Migration (IOM), the United Nations High Commission for Refugees (UNHCR) and Medecins Sans Frontieres (MSF)).

Additionally, we searched the Field Exchange database to identify any further studies not already captured. We used similar search terms to those used in the above review, including ‘pastoralis\*’ OR ‘nomad\*’ AND ‘malnutrition’ or ‘nutrition’. Inclusion criteria was any descriptive or interventional child nutrition research targeted at nomadic or semi-nomadic pastoralist populations.

## Results

Seven studies already identified by Wild et al (2020) were included. Our search of the Field Exchange database identified 213 titles and abstracts of which 10 full texts were reviewed with six reports ultimately included. Two of these studies were interventions and four were descriptive. We excluded three studies targeting sedentarised pastoralist populations only. We identified one study that was a systematic literature review of food assistance for pastoralist populations and we used the reference list of that review to identify a further three studies with child nutrition outcomes (Czuba et al, 2017). In total, we included 16 papers in this review, details of which are summarised in Table 1.

## Descriptive studies

Descriptive studies of pastoralist communities have found child malnutrition rates to be high, especially in the lowest income families and those with illiterate parents (Reese-Masterson et al, 2016; Seid et al, 2017). The difference in 7natural body proportions of many pastoralist populations means that estimates of wasting prevalence differ significantly when using weight-for-length/height z-score (WLZ/WHZ) versus mid-upper arm circumference (MUAC); which method to use and how to address this is an ongoing challenge.

Poor infant and young child feeding (IYCF), health-seeking and hygiene practices are common among pastoralists with high rates of child undernutrition (Sesay et al, 2018). The nomadic lifestyle and the temporary nature of many settlements mean that many families do not have access to health, education and sanitation services. This is likely to contribute to high rates of diarrhoeal disease which leads to and exacerbates undernutrition (Gizaw et al, 2016). A study of water hygiene practices in communities with large concentrations of cattle also found that child malnutrition rates were lower in families that cleaned their water containers or did not share their water source with livestock (Marshak

et al, 2017). Misinformation and cultural beliefs detrimental to nutrition are common among pastoralist communities, such as the early introduction of herbal teas before the age of six months and the consumption of raw meat and blood which has infection risks (Chege et al, 2015).

Positive nutritional cultural beliefs in this population include the perceived benefit of animal milk for young children; when fresh milk is available, it is frequently given to children and added to complementary foods (Sadler & Catley, 2010). While milk from animals is a major part of children’s diets when the animals are accessible and productive, the animals are often not accessible to women and children as they are away with the men seeking pasture (Chege et al, 2015). In a normal year, the dry season can result in a 70% reduction in children’s consumption of milk and, in a drought year, children’s milk consumption can drop to negligible amounts (Sadler & Catley, 2010). One study suggests that, during a normal year, pastoralist communities have access to adequate diets that could be optimised for adequate complementary feeding with improved diet knowledge by caregivers (Vossenaar et al, 2017). However, agro-pastoralists (pastoralists who have largely settled and practice crop production) had more limited access to diverse diets and sedentarisation can lead to further impoverishment and malnutrition as the context is often too unpredictable for crop production and the families are inexperienced in this way of life (Vossenaar et al, 2017). The decreased mobility of pastoralists globally has been caused by climate change, political instability and programmes that encourage settled status (Bush, 1995).

## Interventions

Education interventions, food assistance, the provision of fortified yogurts as part of the milk value chain and livestock support have all been effective in improving children’s diets and nutritional status. These successful interventions were all highly tailored to their context, based on discussions with communities and aimed to support the communities’ semi-nomadic way of life and optimise child survival in these arid contexts. For example, in Iran, a successful education and behaviour change intervention aimed at tackling harmful cultural beliefs such as the discarding of colostrum and the delayed introduction of complementary feeding was implemented by building on positive cultural beliefs and utilising known community influencers (Salehi et al, 2004). The intervention was embedded within existing mobile schools formed

by community elders that educated children during periods of migration. This resulted in greater uptake of messages compared to when messages were conveyed by ‘outsiders’ and led to greater consumption of eggs, legumes and vegetables in children in the intervention group.

Animal milk is a nutrient dense food and has long been recognised as an important component of pastoralist diets across the world. Interventions that can increase milk production, sustain milk production through the dry season and include milk consumption alongside the promotion of optimal IYCF practices are likely to positively impact child nutrition. While many livestock interventions have taken place in these communities, we only found four examples that demonstrated a positive impact on child nutrition (Sadler, 2012; Sesay, 2018; Le Port, 2017; Bernard, 2019). A feasibility study found that the timing of these interventions is important. To maximise impact, interventions should focus on enhancing milk production, processing and consumption during the season when milk is most scarce (Sesay et al, 2018). There is also a need to build the capacity of communities in milk handling and preservation. An intervention that gave milking animals a daily ration of supplementary feed plus a package of vaccinations and deworming medications during the four months of the dry season resulted in significantly increased milk consumption among young children and had positive implications for nutritional status (Sadler & Mitchard, 2012). While a study in this review found that biweekly outpatient visits were effective at treating children with severe wasting (Stefanak & Jarjoura, 1989), a preventative intervention such as livestock support is likely to be more cost-effective and reduce the risk of severe wasting happening in the first place.

Besides livestock support, two other studies improved children’s milk product consumption and nutritional status through a milk value chain incentive intervention (Le Port et al, 2017; Bernard et al, 2019). Farmers were offered fortified yoghurt for their children when they came to sell their milk to a processing factory during both the wet and dry seasons despite the milk production level falling in the dry season. The yoghurt was fortified with iron due to high rates of anaemia in the region. Additionally, the practice of milk fermentation improves the bioavailability of micronutrients in milk and improves food safety. This public-private partnership also had the benefit of improving the regularity of milk deliveries to the factory,

making the business viable which, in turn, could improve investment and employment in the area (Le Port et al, 2017; Bernard et al, 2019).

Contexts with nomadic pastoralist communities are vulnerable to shocks as well as the impact of seasonality, often as a result of warming climates, irregular rainfalls and political insecurity. During crises, food aid interventions have frequently been used to protect children from severe wasting. The effectiveness of food aid interventions has been evaluated by a number of studies including a systematic review in 2017 (Czuba et al, 2017) which included three studies that focused on child nutrition outcomes (Buchanan-Smith & Barton, 1999; Bush, 1995; CDC, 2002). These studies all argue that the rates of malnutrition in children decreased because of access to food assistance. For example, following the loss of many livestock due to drought in Wajir district in Kenya, a food relief programme was set up that provided 80% of households' calorific requirements. This saw acute malnutrition rates fall from 25% to 9% in just four months (Buchanan-Smith & Barton, 1999). There was also a tangible drop in child mortality and other secondary benefits including a reduction in household debt and a reduction in the price of maize which allowed more families to purchase it. These economic benefits of food aid are often not assessed but are important for the sustainability of the intervention. For example, a generous ration of food relief following a drought in Turkana district in Kenya helped prevent further livestock depletion and enabled cash generation through the selling of surplus food (Bush, 1995). This evidence suggests that, despite the notion that food aid is an unsustainable intervention, it can have longer term benefits for child nutrition when used during periods of drought.



## Conclusion

In conclusion, there is evidence from descriptive studies that low levels of education, poverty, poor IYCF practices and poor health-seeking and hygiene practices are important determinants of child malnutrition in mobile pastoralist communities. While studies show that food insecurity is a significant contributing factor to child malnutrition, especially during times of drought and conflict, there is evidence from one study that, during stable periods, children of nomadic pastoralists can access quality diets. Pastoralists who have settled, often in regions that are unsuitable for an agronomist lifestyle, have greater food insecurity than nomadic pastoralists. While few interventions for improving child nutrition in pastoralist communities have

been assessed, those that have, have been successful. Interventions that target livestock health and add nutritive value and stability to the milk supply chain or that provide sufficient food aid during periods of shock have seen reductions in the levels of child wasting and anaemia. Given the identified risk factors, nutrition education interventions are also important for this community and those that provide culturally tailored and community-directed interventions show promise for improving child nutrition. More research into these interventions across a range of pastoralist contexts is needed, given the high rates of child malnutrition in these vulnerable communities.

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