REGIONAL WORKSHOP WEST AFRICA/SAHEL

Nutritional background of the Sahel and Key notions of nutrition

Fulani boy in Niger herds his family's animals. Source: Stevie Mann, ILRI

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1. The state of malnutrition in the Sahel

West Africa countries face endemic problems of high morbidity and mortality, political instability and poor governance, and environmental degradation. According to the Harmonized Framework analysis, 58 zones out of 345 in West Africa were identified as food insecure last August 2014, with the situation reaching a crisis phase in Chad, Mali, Niger, Senegal, The Gambia, Burkina Faso, Guinea and Mauritania(1). The chronic vulnerability of this population, the erosion of livelihoods after recurrent crises (2008, 2010, and 2012), bad agro-pastoral productions in some areas, floods and other localized shocks explained the existence of 13 million people of food insecure people at the end of last year, despite average harvests (2).

Table 1 highlights some of the key characteristics and malnutrition rates of the Sahelian countries: all countries are sparsely populated (as low as 4 inhabitants/km^2 in Mauritania), with high proportions of this population living under the poverty line (up to 62% in Chad), mostly in rural areas (e.g. only 18% of the Niger population is urban). They also have very poor exclusive breastfeeding rates and experience remarkably high malnutrition indicators such as low birth weight (up to 35% in Mauritania), stunting (up to 44% in Niger) and wasting (18% in Niger). ***Wasting*** is a form of growth failure expressed as insufficient weight for a given height. It is usually called ***'acute malnutrition'*** and it is associated with high mortality. It is common in rapid onset emergencies and chronic emergencies, but also in non-emergency situations. ***Stunted growth*** refers to an inadequate height for a given age, and is the result of inadequate nutrition over a sustained period of time and/or recurrent infection (i.e. ***'chronic malnutrition'***). It is also affected by maternal malnutrition and low birth weight, and represents a severe social and economic burden. Stunted children have elevated risk of mortality, cognitive deficits, and increased risk of adult obesity and non-communicable diseases (NCDs). In addition, women who are stunted themselves have increased risk of foetal growth restriction and ultimately infant mortality and stunted growth and development, leading to a malnutrition cycle (3) which can compromise the overall development of any society. Underweight (i.e. inadequate weight for a given age) is a composite measurement that has traditionally been used in monitoring of child growth, but can be misleading in the interpretation of the nutritional problematic. Both stunting and wasting are undernutrition forms that can be moderate (between 2 and 3 Z-scores) or severe (<3 Z-scores). ***WHO emergency threshold indicates that when global (moderate and severe) acute malnutrition (GAM) of children under-five is greater than 10% the nutrition situation of children is considered 'serious' and when it is greater than 15% the nutrition situation of children is considered 'critical'.*** HIV prevalence in these countries is low (<1.0%) and only in Chad it reaches 2.7% (4). The Global hunger Index, which combines in one index indicators on undernourishment, child underweight and child mortality shows serious situation (index 10.0-19.9) for all countries, with Chad and Niger reaching alarming levels (index 20.0-29.9) in 2014, although all countries have experienced a substantial decrease from 1990. Finally, the maternal mortality indicators are amongst the worse in the world, with up to 980 maternal deaths per 100,000 live births.

Table 1: Poverty and nutrition indicators for the Sahel countries 2011

Indicators	Burkina Faso	Chad	Mali	Mauritania	Niger	Senegal
Total population ($x10^3$)	16,460	12,448	14,854	3,796	17,517	13,728
Population density (people/km^2)	58	10	12	4	13	69
GNI per capita (US$)	670	740	660	1,110	370	1,040
% below poverty line (US$1.25/d)	45	62	50	23	44	30
% Urbanized population	27	22	36	42	18	43
% Low birth weight	14	20	18	35	27	19
% Exclusive breastfeeding (<6m)	42	3	20	46	23	39
% Global Stunting (<5y)	33	39	28	23	44	27
% Global Wasting (<5y)	11	16	9	12	18	10
% Anaemia (<5y)	92	71	83	68	81	70
% Vitamin A coverage	99	0	93	99	98	-
% Iodized salt consumption	96y	54	79x	23	32	47
Global Hunger Index	19.9	24.9	13.0	11.9	21.1	14.4
HIV prevalence (%)	1.0	2.7	0.9	0.4	0.5	0.5
Under 5 mortality rate / (rank)	102 (14^{th})	160 (3^{rd})	128 (8^{th})	84 (27^{th})	114 (10^{th})	60 (43%)
Maternal mortality ratio (deaths per 100,000 live births)	400	980	550	320	630	320
Life expectancy at birth (years)	56	51	55	61	58	63

x data older than 2011; y data refer from the standard definition or refer to only part of a country
Source: UNICEF data from 2008-12 (The State of the world's children, UNICEF 2014) (4) (5)

2. What is the animal-source foods contribution to diets and nutrition?

In lower-income countries where undernutrition remains a large and persistent problem, animal-source foods (ASFs) and livestock can play a key role in improving micronutrient deficiencies. ***ASFs are particularly good quality sources of vitamin A, iron, calcium, vitamin B2 (riboflavin), zinc, and practically the sole source of vitamin B12*** (see **Table 2**) (6). Consequences of deficiencies of these nutrients range from growth faltering, increased susceptibility to diseases and death and can have a profound impact in the capacity to learn and work of children and adults. Protein-energy malnutrition, iron-deficiency anaemia, and vitamin A deficiency are three key causes of reduction in disability-adjusted life years (DALY), which could be prevented with sufficient ASFs in the diet (7). Iron and calcium deficiency in pregnancy are risks factors for

mortality, via haemorrhage or increased risk of pre-eclampsia respectively, which are the leading causes of maternal deaths (23% and 19% of total maternal deaths). Also, appropriate complementary feeding practices (i.e. rich in nutrient-dense foods) (3) and zinc supplementation (8) have shown protective effect against stunting.

Table 2: Key micronutrients provided by animal-source foods (ASFs)

Nutrient	**ASFs**	**Consequences of deficiency** **Extent of deficiency**	**Additional comments** (9)
Vitamin A	Dairy, liver, eggs	Growth faltering, impaired development, blindness, impaired immune system, increased mortality. 14 million preschool children; 7 million pregnant women worldwide	Preformed vitamin A (retinol and retinol esters) is almost exclusive of ASFs, while plants contain pro-vitamin A carotenoids, significantly less bioavailable.
Iron	Meat, fish (Heme iron, more readily absorbable than non-ASF iron -15-35%) Dairy (low intake), eggs (non-heme iron, as in plants -2-20% absorption)	Anaemia; Impaired growth, immune function, cognitive development and school performance in children; lowered work capacity and maternal mortality in adults. Estimated 4-5 billion people worldwide.	Absorption of non-heme iron is inhibited by phytic acid and fiber of cereal diets. Heme-iron promotes absorption of non-heme iron present in non-ASFs (meat addition to a legume/cereal diet can double the iron absorbed, contributing to anaemia prevention).
Calcium	Dairy is the major source Fish (if consumed with bones)	Nutritional rickets. Rickets (caused by calcium deficiency, Vitamin D deficiency or both) is reappearing, but estimates not available	Absorption of calcium is inhibited by oxalates, phytates and fiber of cereal diets. The high calcium (and casein) content in milk inhibits absorption non-heme iron only.
Vitamin B2 (Riboflavin)	Dairy, meat and organs, eggs, fish	Stunted growth, skin lesions, corneal vascularisation, cheilosis, angular stomatitis, glossitis, photophobia, anemia, neuropathy. Good estimates of deficiency unavailable but incidence might be large.	Vitamin A and riboflavin are both needed for iron mobilization and hemoglobin synthesis; thus supplementation with iron alone can be unsuccessful to treat anemia if these other nutrients are deficient (7).
Zinc	Meat and organs, fish. Eggs, dairy to a lesser extent	Pregnancy complications, low birth weight, impaired immune function, mortality, growth faltering. Estimated half of the world's population has inadequate intake.	ASFs have higher bioavailability than plant sources. Protein increases zinc absorption, calcium (dairy) and phytates and fiber (cereal-based diets) may inhibit.
Vitamin B12 (Cobalamin)	All ASFs -only in ASF with the exception of some algae	Megaloblastic anemia, demyelinating disorder of the central nervous system. High prevalence reported in many countries. Deficient in vegetarian diets without supplementation.	B12 is bound to ASF proteins and is released for absorption in the stomach with the intervention of gastric acid, which production may be impaired in elderly, leading to B12 deficiency.

Source: modified from Randolph et al. (6)

3. Causal Framework of Malnutrition

Causal frameworks are theoretical models to organise ideas about the sequence of causes that lead to a particular outcome (positive or negative) in an easy-to-apply way. They typically contain several layers of causality supplemented with lateral relationships to help answer "What is happening/happened?" and "Why?" (10). They help to foresee how changes in the context might influence the outcomes and helps pinpoint where in the chain of events we could expect a change. In addition, they provide a clear map for the development and interpretation of indicators and proxy indicators (10). ***The understanding that 'food essential but not enough´ has led to an effort to conceptualise the pathways to malnutrition.*** This thinking has led to worldwide use of UNICEF framework (**Figure 2**), released in 1990 to conceptualise the determinants of malnutrition. This framework has great acceptance in the field and 25 years later it is still in use, probably due to its simplicity and clarity. It is however comprehensive, and has helped understand the complexity of the causes of malnutrition, foster the dialogue between disciplines and stakeholders and, ultimately, guide the programming of nutrition interventions. This framework also helps distinguishing between immediate and distal causes, and the design of actions necessary for a short-, middle- or long-term result. Conversely, one limitation of its simplicity is that it does not specify the rich net of pathways and interactions between each of the categories that would allow to generate testable hypothesis, leaving it at a high level of abstraction (e.g. maternal disease could affect negatively care practices, as could much time spent working in food production). This UNICEF framework summarises the evidence that dietary adequacy in combination with health is needed to achieve enhanced nutrition.

Please, think on this framework using a livestock lens. Where and how livestock has an influence or impact in this framework?

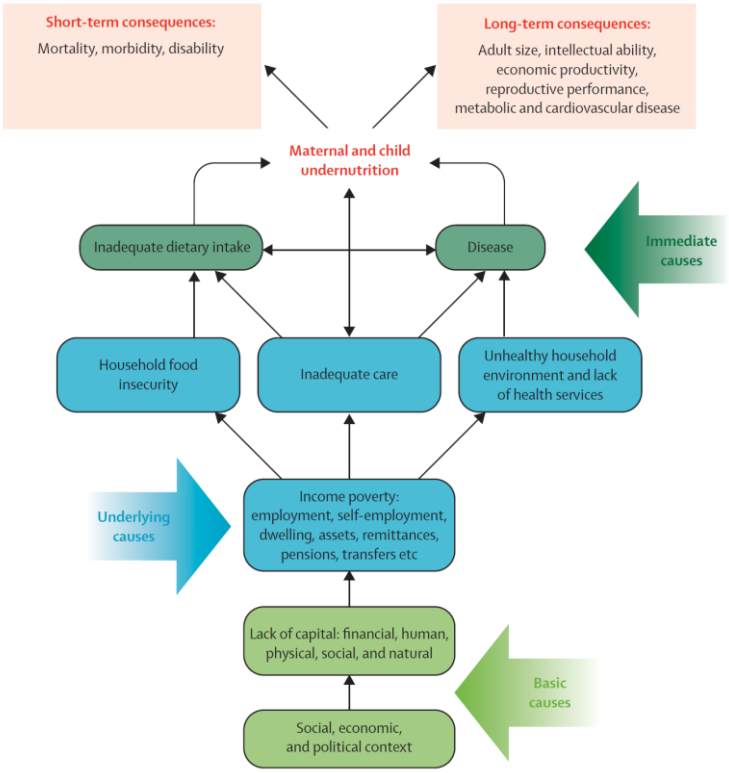

Figure 3: Adapted UNICEF conceptual framework (**Source:** *Black et al.*(3))

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