

Developing Sweetpotato-based Weaning(Complementary) Food: Technical and Cost Consideration

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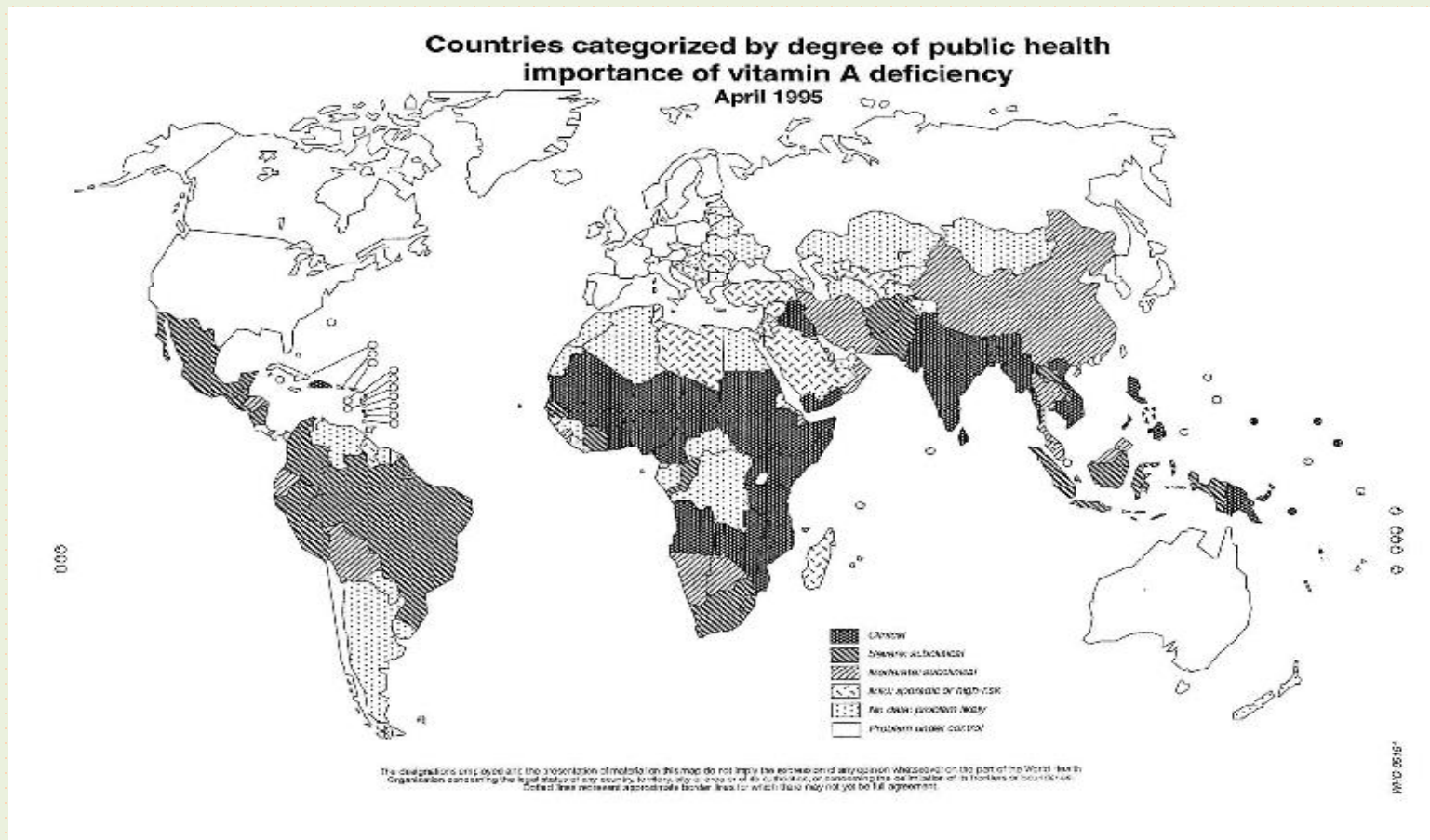


Weaning (complementary) Food

- Foods and liquids other than breastmilk given to infants and young children when breastmilk alone is not sufficient to meet their nutrient demands for growth.
 - Exclusive breastfeeding (first 6 mo)
- The attainment of one's full potential in life is largely influenced by adequate nutrition during infancy
 - Hence the need to feed infants with nutritionally adequate complementary food



Background, the gloomy picture



Source:

http://www.who.int/vmnis/vitamina/prevalence/mn_vitamina_map_1995.pdf



The gloomy picture still persists!

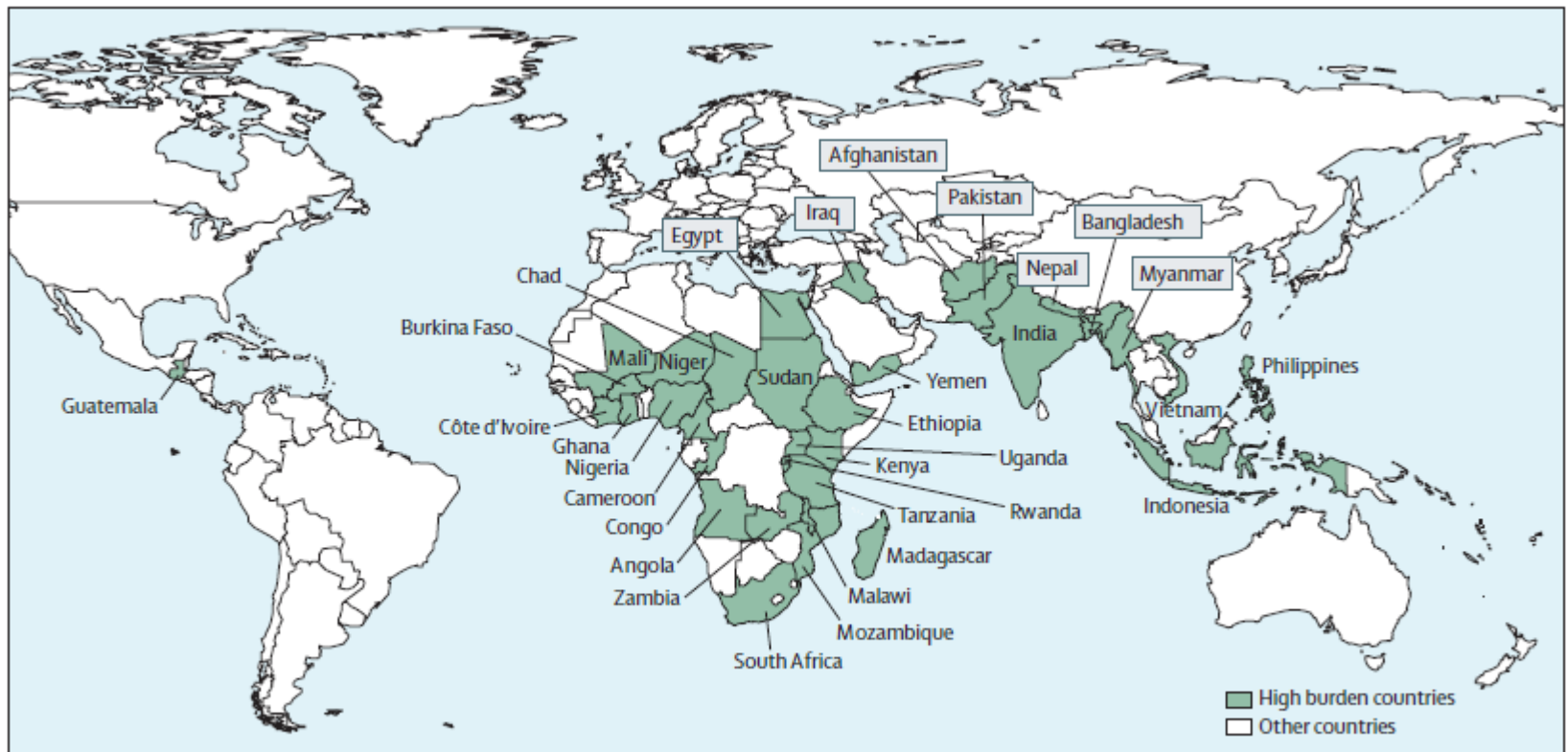


Figure 3: Countries with the highest burden of malnutrition
These 34 countries account for 90% of the global burden of malnutrition.

Bhutta Z A *et al.* Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *The Lancet*, 2013, Epub ahead of print



The Problem & the Cause

- Vitamin A deficiency among children <5 years in sub-Saharan Africa remains high (44%), second to South-East Asia (50%), compared with the worldwide occurrence of 33% [World Health Organization, 2009]
- The reason could be the widely used cereal-based complementary foods in low-income countries, which are naturally low in β -carotene



And good news

- “However, evidence on the nutritional effect of agricultural programmes is inconclusive—**except for vitamin A from biofortification of orange sweetpotatoes**—largely because of poor quality evaluations.”

Ruel M T *et al.* Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *The Lancet*, 2013, Epub ahead of print





Guidelines *contd.*

- Starch is efficiently digested by infants when it is present in complementary food in small quantities

– Nestlé uses cereals that are hydrolysed enzymatically (CHE on package) in the production of dry infant cereals to hydrolyse starch to maltose and maltodextrin

- Lentze MJ. Gastrointestinal development, nutrient digestion and absorption. In: Koletzko B, editor. Pediatric nutrition in practice. Basel: Karger; 2008. p. 76-9.
- Weaver LT. Complex carbohydrates and sugars. Pediatrics. 2000; 106(Suppl. 5): 1291.
- Nestlé. Baby nutrition: Product-Dry infant cereals. Nestlé; 2006 [cited 2011 October 10]; Available from: http://www.nestlebaby.com/au/baby_nutrition/products/Infant_cereals/LittleTummies.htm.



The ComFa Formulations

Ingredient (g/100 g) *	Household-level	Industrial-level
Sweetpotato	66	72
Full fat soyabean flour	10	15
Soyabean oil	6	6
Iodised salt	0.5	0.5
Sugar	0.5	0.5
Skim milk powder	-	6
Fish powder(anchovies)	17	-

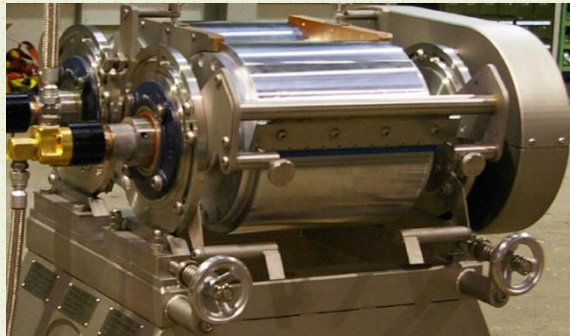
*Nutrient composition of the ingredients was available in the GAIN Nutrition Calculator except for sweetpotato and fishmeal. Nutrient composition of sweetpotato FoodWorks version 6 (FoodWorks, 2009). Data on fish (*Engraulis hepsetus*) to be used was not available; therefore the data on *Engraulis encrasicolus* from USDA (<http://www.nal.usda.gov/fnic/foodcomp/search/>) was used.



Sweetpotato-based CF from flour



Industrial-based (SP, soybean flour, oil, skimmed milk powder and sugar)



Roller-dried ComFa



Extrusion-cooked ComFa



Homestead (SP, anchovy powder, soybean flour, oil and sugar)



Oven-toasted ComFa



Sweetpotato-based CF from roots



<http://www.radionz.co.nz/national/programmes/ourchangingworld/audio/2533859/weaning-food-for-african-children>



Compositional data: ComFa vs. Weanimix

- Both the sweetpotato- and maize-based CFs met the energy (1670 kJ/100 g) and fat (10-25 g/100 g) stipulated levels in the Codex Standard
- Porridge prepared from the ComFa formulation is less viscous, thus, reduction of excessive dilution with water, a practice that invariably leads to “*energy and nutrient thinning*”, that is, the reduction of energy and nutrient densities

Amagloh F K *et al.* Sweet potato-based complementary food for infants in low-income countries. *Food Nutr. Bull.*, 2012, 33: 3-10

Amagloh F K *et al.* Carbohydrate composition, viscosity, solubility, and sensory acceptance of sweetpotato- and maize-based complementary foods. *FNR*, 2013, 57: 18717



Compositional data *Contd.*

Energy and macronutrient densities and levels of other carbohydrate fractions of sweet potato-based and cereal-based CFs

Complementary food	Energy (kcal/g)	Protein	Simple sugars	Fructose	Fat	Soluble dietary fiber	Insoluble dietary fiber	Maltose	Lactose	Starch
		g/100 kcal					g/100 g			
OFSP CF	0.89 ^x	4.53 ± 0.06 ^{w,x}	4.39 ± 0.10 ^w	1.45 ± 0.04 ^w	2.36 ± 0.04 ^w	2.83 ± 0.45 ^w	9.45 ± 1.49 ^w	20.38 ± 0.41 ^x	ND	13.19 ± 0.20 ^z
CFSP CF	0.87 ^y	4.33 ± 0.10 ^x	3.02 ± 0.04 ^x	0.64 ± 0.01 ^x	2.35 ± 0.02 ^w	1.99 ± 0.35 ^w	8.06 ± 0.53 ^{w,x}	24.10 ± 0.54 ^w	ND	17.11 ± 0.22 ^y
Weanimix	0.88 ^y	4.73 ± 0.20 ^w	0.52 ± 0.00 ^z	ND	1.94 ± 0.01 ^y	0.03 ± 0.06 ^x	6.90 ± 0.64 ^x	2.72 ± 0.12 ^z	ND	48.38 ± 0.50 ^w
Cerelac	1.19 ^w	3.25 ± 0.04 ^y	1.69 ± 0.02 ^y	ND	2.23 ± 0.02 ^x	0.45 ± 0.31 ^x	1.03 ± 0.20 ^y	10.31 ± 0.12 ^y	14.67 ± 0.22	30.93 ± 0.34 ^x
Codex specification	≥ 0.8	2.0 – 5.5	≤ 5.0	≤ 2.5	≤ 4.5	—	—	—	—	—

OFSP and CFSP CF were processed directly from the roots

Amagloh & Coad. Orange-fleshed sweet potato-based infant food is a better source of dietary vitamin A than a maize–legume blend as complementary food. *Food Nutr. Bull.*, 2014, “In Press”



Compositional data *Contd.*

Micronutrient density and levels of ascorbic acid and phytate in sweet potato-based and cereal-based CFs

Complementary food	Sodium (mg/100 kcal)	Calcium (mg/100 kcal)	Vitamin A (μ g RAE/100 kcal)	Ascorbic acid (mg/100 g) ^c	Phytate (mg/100 g)	Total polyphenols (mg gallic acid equivalents/100 g)
OFSP CF	54.50 \pm 0.41 ^{x,y}	128.30 \pm 12.95 ^{w,x}	226.24 \pm 30.70 ^w	32.48 \pm 0.48 ^x	229.85 \pm 20.36 ^x	466.27 \pm 9.36 ^w
CFSP CF	59.05 \pm 1.27 ^x	135.08 \pm 14.23 ^w	21.79 \pm 0.35 ^{x,y}	37.40 \pm 0.61 ^{w,x}	78.62 \pm 3.50 ^y	466.42 \pm 34.97 ^w
Weanimix	36.19 \pm 0.66 ^y	100.90 \pm 12.84 ^x	0.58 \pm 0.20 ^y	ND	438.10 \pm 8.58 ^w	263.68 \pm 17.82 ^x
Cerelac	94.16 \pm 17.23 ^w	107.64 \pm 1.68 ^{w,x}	47.72 \pm 5.84 ^x	53.11 \pm 12.07 ^w	66.92 \pm 4.00 ^y	213.45 \pm 29.93 ^x
Codex	\leq 100	\geq 80	60 – 180	\leq 50	—	—

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Cost estimation based on ingredients

Complementary food and ingredient	Moisture (/100 g)	Amount (kg)	Cost (Gh¢) ^b	Preparation method
OFSP complementary food				
Beauregard (OFSP)	80.38	6.63	6.63	Peeling and dicing
Full-fat soybean flour	7.60	0.17	0.29	Roasting, dehulling, and milling
Soybean oil	—	0.14	0.96	—
Anchovy powder	10.06	0.44	5.50	Breaking off heads and milling
Total cost (Gh¢)			13.38	
CFSP complementary food				
“Toka Toka gold” (CFSP)	74.22	5.04	5.04	Peeling and dicing
Full-fat soybean flour	7.60	0.17	0.29	Roasting, dehulling, and milling
Soybean oil	—	0.14	0.96	—
Anchovy powder	10.06	0.44	5.50	Breaking off heads and milling
Total cost (Gh¢)			11.79	
Weanimix				
Refined maize flour	14.20	1.75	1.75	Dehulling, milling, and roasting
Full-fat soybean flour	7.60	0.32	0.55	Roasting, dehulling, and milling
Groundnut paste	1.20	0.20	1.05	Roasting, dehulling, and milling
Anchovy powder	10.06	0.44	5.50	Breaking off heads and milling
Total cost (Gh¢)			8.85	

Gh¢1.00 = US\$0.52
(January 2013)



Nutritional Concerns of sweetpotato-based CF

- High polyphenols
 - May limit iron absorption, and thus being low phytate may not be of an advantage
- High fibre
 - Negative or Positive

Answers in conducting randomised control trials



Bon Appétit



The Colours for Health

Thank you



Storage Photos from Ghana

Ventilated Pit



Storage Photos from Ghana

Evaporative Cooled Store



Storage Photos from Ghana



Sandpit
method



Storage Photos from Ghana

Farmer's
method



Puree for bread and biscuit

