Food Fortification Initiative

Enhancing Grains for Healthier Lives

Maize flour fortification in Africa: markets, feasibility, coverage, and costs

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What is Mass food Fortification

- Is the **addition** of one or more micronutrients to foods consumed by a **large proportion** of the general population in order to **correct**, **improve** a demonstrated public health problem (inadequate micronutrient intakes and micronutrient deficiency).
- Started as early 1980s in USA, Great Britain, Switzerland
- Growth in number of countries and amount of fortified wheat/oil products increased (30-76 or 85) and (18%-31$)-2003-13
- But for Maize flour fortification growth has been very slow

Context

- Three case study countries: Zambia, Uganda and Kenya
- Both maize flour and maize meal used interchangeable
- According to FAO Balance sheet consumption;
    - Zambia 243g/person/day
    - Kenya 171g/person/day
    - Uganda 54g/person/day
- In World Zambia, Kenya and Uganda is 5th, 11th and 54th respectively
- In Africa Zambia , Kenya and Uganda is 3rd, 6th and 25th respectively

Context con't.

- All 3 countries have high levels of micronutrient deficiency and committed to prevent/controlling

Country	Anemia %	Zinc %	Vitamin A %
Kenya	46	30	24
Uganda	50	33	20
Zambia	61	47	54

- All the three have fortification program on-going voluntary or mandatory

Factors conditioning fortification of maize flour feasibility

- **Coverage:** Proportion of popn that consumes demands maize flour (Demand)
- **Supply:** The number, types and mix mills producing and incremental costs (production)
- **Interaction:** between supply and demand factors anticipated price increase or purchasing power of maize flour
- **Premix:** Viability of the premix market and physical accessibility to millers
- **Economies of scale:** Unit cost of production falls and quantity increases

Fundamental questions for effectiveness, coverage, sustainability?

- Do people purchase maize flour produced by large-scale roller mills or from hammer mills?
- Do people who eat hammer-milled grain bring their own maize grain to a hammer mill operator to have it milled, or do they mill it themselves, or do they purchase pre-milled maize flour?
- Do you need to include hammer mills or roller mills in your FF program for maize fortification?
- How much does it cost to fortify one MT ot maize flour produced by roller or hammer mill, how much will a consumer pay if the price is transferred to 100%?

Using HCES to estimate flour market and coverage in the three countries

- **Kenya:** Integrated household and budget survey 2006
- **Uganda:** National household survey 2006
- **Zambia:** Living Conditions Monitoring Survey 2006
- The data used to determine *potential fortifiable* maize flour/meal

Key characteristics of the household consumption and expenditures surveys

Characteristics	Kenya Integrated Household Budget Survey (KIHBS 2006)	Uganda National Household Survey (UNHS 2006)	Zambia Living Conditions Monitoring Survey (LCMS 2006)
1. Sample size			
a. Households	13,212	7421	18,662
b. Persons	66,725	38,543	97,750
2. Statistically representative	Province, $n = 8$	Region, $n = 4$	Province, $n = 9$
3. Recall period	7 days	7 days	14 days
4. Number of foods	161	61	39
5. Sources of food/acquisition method			
a. Purchases	Yes, and consumption from purchases	Yes, and consumption from purchases	Only purchases
b. Consumption from own production	Yes	Yes	Yes
c. Received in-kind	Yes	Yes	Yes
6. Maize food items	4 items 1. Grain 2. Green (cob) 3. Sifted flour (roller) 4. Loose flour (hammer)	3 items 1. Grain 2. Cob 3. Flour	4 items 1. Grain 2. Breakfast (roller) 3. Roller meal (roller) 4. Premilled hammer

Estimating coverage and apparent consumption

- Three types of acquisition used: **purchases**, home consumption/**own production** and **In-kind** gift
- HCES data validated with FAO balance sheet for the same year 2013
- Total consumption calculated after **standisation** for maize grain and taking care of 17.7% post harvest loss
- HCES results **tracked** closely with FAO with differences of 9%, 3% and 4% respectively for Kenya, Uganda and Zambia
- ***Assumption is only purchased maize is fortifiable hence used for countries apparent consumption estimates***

Proportion of apparent maize consumption

Characteristics	Kenya	Uganda	Zambia
1. Sample size			
a. Households	13,212	7421	18,662
b. Persons	66,725	38,543	97,750
2. Recall period	7 days	7 days	14 days
3. Maize food items	4 items	3 items	4 items
4. Apparent consumption %	*94*	*71*	*79*
5. Types of maize consumption %			
1. Grain	65	5	NA
2. Green (cob)	16	13	NA
3. Sifted flour (roller)	33	NA	86
4. Loose/pre-milled	59	NA	94
5. Breakfast (roller)	NA	NA	94
6.Loose+shifted	NA	NA	92
7.Hammer or Roller	NA	62	NA

What is the coverage estimates from HCES apparent consumption?

- All three countries have defined fortifiable maize flour;
  - Kenya-all packaged maize flour
  - Uganda- All maize mills producing above 20MT/day
  - Zambia-All flour produced from 33 roller millers but program halted
- It's possible for some hammer millers to fortify provided technical and political issues like below were addressed
  - Number of hammers millers
  - Training requirements of operators
  - Adequate access to premix
  - Monitoring for quality
  - Logisitcs and cost of fortification to millers
- ***From HCES coverage, only 23% Zn, 28%Ke and 39%Ug can be reached with fortification***

Estimating cost of fortifiable maize fortification-key questions:

- How many mills are producing fortifiable maize flour?
- How much meal or flour are they producing?
- What are the additional costs they incur due to fortification?
- How much will a consumers pay if fortification cost is transferred 100%?.

Production based estimates methodology

- Activity based and an ingredient based approach
- Identify specific types and levels of activities
- Identified ingredients-inputs required
- Two categories
    - *Capital costs:* feeders mixes annualized
    - *Recurrent cost:* Premix, Internal QA/QC, External monitoring and Incremental production costs-maintenance, supervisor etc
- All three countries had standards for maize flour or meal fortification
- Government was running some social marketing and capacity training

Data sources

- Primary data obtained from Industries, CSO, public sector, partners, premix producers and experts
- Three categories of plants size visited in each country 2 times:
    - Small
    - Medium
    - Large
- Half of the estimates were ex-ante in nature

Incremental fortification costs of a large maize miller in Kenya

	In US$	% of costs
A. Capital Costs		
Feeder and Installation costs for two dossiers	16,000	
Annualized Capital Costs (over 10years)	1,600	0.3
B. Annual recurrent costs		
1. Premix Costs		
Annual premix at target addition rate of 171 g/MT (KS 168) flour (kg)	23,731	
Annual amount of maize flour produced expressed in MT	138,778	
Premix cost/kg (Seaboard—inclusive of freight clearance and license fees and	23.56	
Total annual premix costs	559,102	95.3
2. Internal QA/QC testing costs and lab personnel		
On spot tests iron at 100 Ksh/test	6240	
One quality controller 10% on fortification-specific activities: 40,000 Ksh/month	600	
Two laboratory technicians with monthly pay of 35,000 KSh (fortification 25%	2625	
Total annual in-plant QA costs	9,465	1.6
3. ***External quality control*** monthly sent to UK/US every 2 months, two samples		
Vitamin and iron with other micronutrient @ 80,000 Ksh per sample	12,000	
Average total cost per plant	12,000	2.0
4. ***Incremental production costs***		
Average annual operating costs	600	
Average annual maintenance costs at 7% estimates	1120	
Production supervisors 1 per shift for two shifts @ 60,000 Ksh 10% on FF	1800	
Mixing persons 2 per shift for two shifts @ 7800 Ksh 25% on FF	1170	
Total annual production-related costs	4690	0.8
Total costs	***586,857***	***100***

National maize meal fortification costs

Cost item	Small plant output (MT/year) 10,000–30,000	Medium plant output (MT/year) 30,000–70,000	Large plant output (MT/year) >70,000	Kenya Nationwide, all plants	Zambia National wide 33 large mills	Uganda Nationwide, 4 large mills
1. Average cost per plant	98,716	127,213	453,465	173,673	NA	54,993
2. Number of plants	5	10	3	18	33	4
3. Total output of the plant size	116,617	320,168	325,528	762,313	963,648	35,000
4. Premix cost/kg	18.75	27.00	23.56	24.14	13.038	11.80
5. Total annual cost	493,580	1,272,132	1,360,395	3,126,106	3,070,779	219,971
6. Premix cost percentage of total fortif. cost	89	97	96	95	95	77
7. Average cost per MT	4.23	3.97	4.18	4.10	3,19	4.41

Note: Premix costs difference was coming from: incorporations rates 171g/Mt to 400g/MT, premix formulation differences and levels of fortificants in the premix.

Comparing annual incremental costs of fortification in the three countries

	Kenya		Uganda		Zambia	
Cost item	US$	% of costs	US$	% of costs	US$	% of costs
1. Premix	2,979,287	95	169,596	77	2,741,579	89
2. QA/in-plant lab testing	26,841	1	19,714	9	39,600	1
3. QC/external lab testing	52,724	2	2,786	1	0	0
4. Production-related costs	54,386	2	24,454	11	205,054	7
5. Annualized capital costs	12,868	0	3420	2	84,546	3
Total costs	3,126,106	100	219,971	100	3,070,779	100

- *Premix costs in Zambia and Uganda are lower than Kenya premix prices due to lower addition rates and lower level of fortificant in the requirement.*
- *Kenyan plants are 50% large than Zambia and five time large than Uganda*

Incremental private sector fortification costs: the consumer's perspective

	Kenya	Uganda	Zambia
1. Maize meal consumer price/kg (Prefortification)	$0.44	$0.69	R: $0.30; B: $0.44
2. Maximum increase in price due to fortification–assuming the full cost is passed onto consumer	0.09	0.07	0.09
3. Conditional average apparent consumption: Includes only maize meal purchasers (grams/person/day)	82	67	242
Assuming consumption levels remain constant, fortification will result in at most an increased expenditure as a percentage of household income of:			
4. All households apparently consuming fortified maize meal	0.03	0.002	0.2
5. Households among poorest 40% of households that purchased fortified maize meal	0.07	0.005	0.8

Conclusion

- Data is needed to determine the need for fortification
- Countries considering fortification can use HCES data, improve on them to provide more information. e.g roller milled flour from harmer millers
- Premix comprises the highest costs hence formulation and levels are impact factors for quality, sustainability and impact of the program
- Even if incremental costs of fortification is passed to consumers, the poorest poor consuming maize meal can afford to pay, there is no large impact on price and consumer behavior.
- Maize fortification may be feasible but a mix of interventions should be used to address micronutrient deficiencies

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