Complementarity of value chain analysis, consumption patterns and nutrition in the design of sustainable, effective and efficient food-system-based interventions

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Sharing passions, shaping futures

Source: ING

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Sharing passions, shaping futures

Key micronutrients supplied by animal-source foods (ASFs)

Nutrient	ASF source	Consequences of deficits	Comments
Vitamin A	Dairy, liver, eggs	Growth faltering, impaired development, blindness, impaired immune system, increased mortality.	Preformed vitamin A (retinol and retinol esters) - almost exclusive of ASFs. Plants contain pro-vitamin A carotenoids, less bioavailable.
Iron	Meat, fish (Heme iron-15-35% absorption) Dairy, eggs (Non-heme iron -2-20% absorption)	Anaemia; Impaired growth, immune function, cognitive development and school performance in children; lowered work capacity and maternal mortality in adults.	Absorption of non-heme iron is inhibited by phytic acid and fiber of cereal diets. Heme-iron promotes absorption of non-heme iron (meat addition to a legume/cereal diet can double the iron absorbed, contributing to anaemia prevention).
Calcium	Dairy is the major source Fish (with bones)	Nutritional rickets.	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.
Vitamin B2	Dairy, meat and organs, eggs, fish	Stunted growth, skin lesions, corneal vascularisation, cheilosis, angular stomatitis, glossitis, photophobia, anemia, neuropathy.	Vitamins A and B2 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 (22).
Zinc	Meat and organs, fish. Eggs, dairy to a lesser extent	Pregnancy complications, low birth weight, impaired immune function, mortality, growth faltering.	ASFs have higher bioavailability than plant sources. Protein increases zinc absorption, calcium and phytates and fiber may inhibit.
Vitamin B12	All ASFs -only in ASF with the exception of some algae	Megaloblastic anemia, demyelinating disorder of the central nervous system.	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.

Modified from: Randolph 2007

Objectives

Hypothesis: There is an association between consumers' **access to and use** of different food sources, in particular livestock value chains, and their nutritional status

Evaluate nutritional status & dietary adequacy

Investigate determinants of LVC associated with poor nutrition & LVC potential/barriers

MEAT

Assess consumer patterns, preferences & demand factors
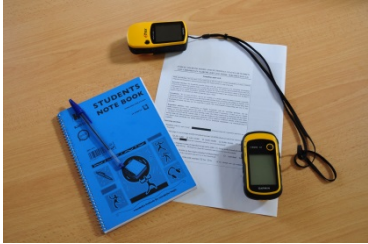
Assess potential of ASF in ensuring dietary adequacy
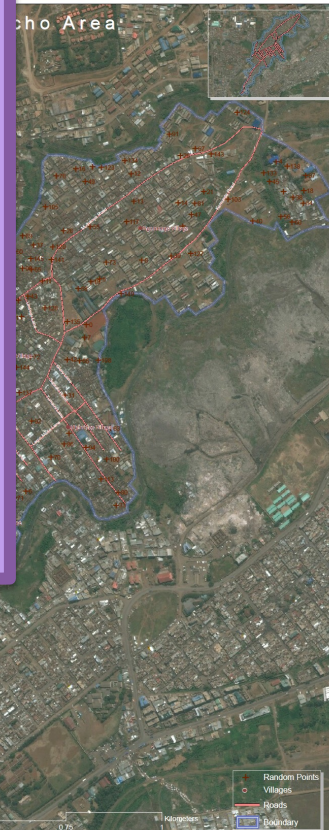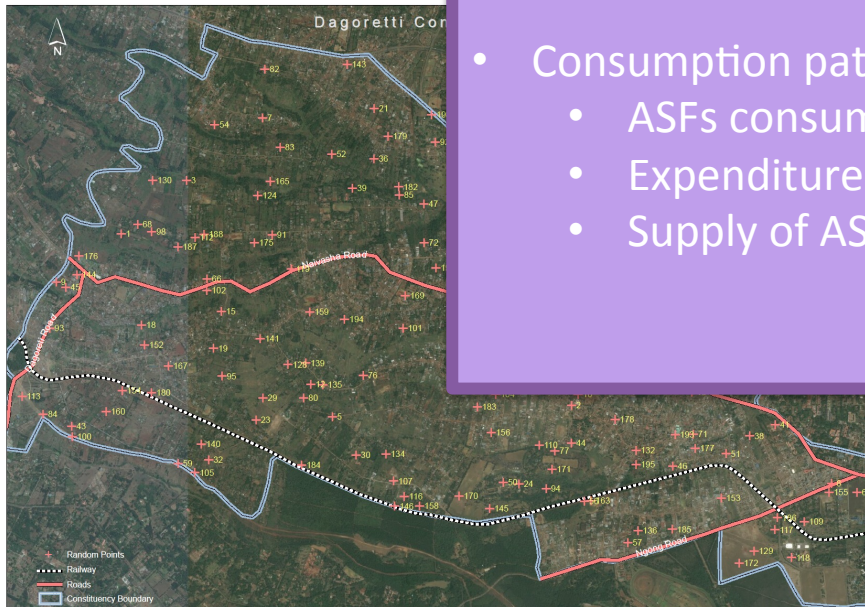
Scale –up research & Intervention design

Methods: Household survey

HOUSEHOLD SURVEY

- Socioeconomic characteristics and gender aspects

- Maternal and child nutrition:
  - Anthropometry
  - 24-h recall
  - Care practices

- Consumption patterns of ASF
  - ASFs consumption (what, when, why, who)
  - Expenditure in ASFs
  - Supply of ASFs (from where and why)

Livestock
chain

LIVESTOCK VALUE CHAIN ANALYSIS

- Mapping
  - Profiles; movements; time stability

- Governance
  - rules and legislation; power groups; incentives and sanctions, consumers' needs

- Upgrading
  - access to service; expertise or technology; marketing; policy; infrastructures; barriers to entry

- Food safety risks

- Distribution of benefits
  - distribution of benefits; gender equality; losses
  - Supply of ASFs (where and why)

Results

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Assess potential of ASF in ensuring dietary adequacy

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Malnutrition in Nairobi slums

Target population

Children 1-3 years

Anaemia (gr/dL)	%	CI
Anaemia (<11)	74.1	68.1-80.2
Normal	25.9	19.8-31.9
Stunting (Z-scores)	**%**	
Severe (<-3)	14.2	9.3-19.0
Moderate (<-2, >-3)	27.3	21.2-33.5
Normal (>-2)	58.5	51.7-65.3
Wasting (Z-scores)	**%**	
Severe (<-3)	1.0	0.0-2.3
Moderate (<-2, >-3)	3.4	0.9-5.9
Normal (>-2, <+2)	90.7	86.7-94.7
Overweight (>+2)	4.9	1.9-7.9

Non pregnant women of reproductive age

Anaemia (gr/dL)	%	CI
Anaemia (<12)	25.9	19.9-31.9
Normal	74.1	68.1-80.2
BMI (kg/m^2)	**%**	**CI**
Severe (<16)	1.0	0.0-2.3
Moderate (16 -16.9)	1.0	0.0-2.3
Mild (17-18.4)	6.3	3.0-9.7
Normal (18.5-25)	62.9	56.3-69.6
Overweight (25.1-30)	18.5	13.2-23.9
Obese (>30)	10.2	6.1-14.4
	Mean	**CI**
MDDSW	4.0	3.9-4.3

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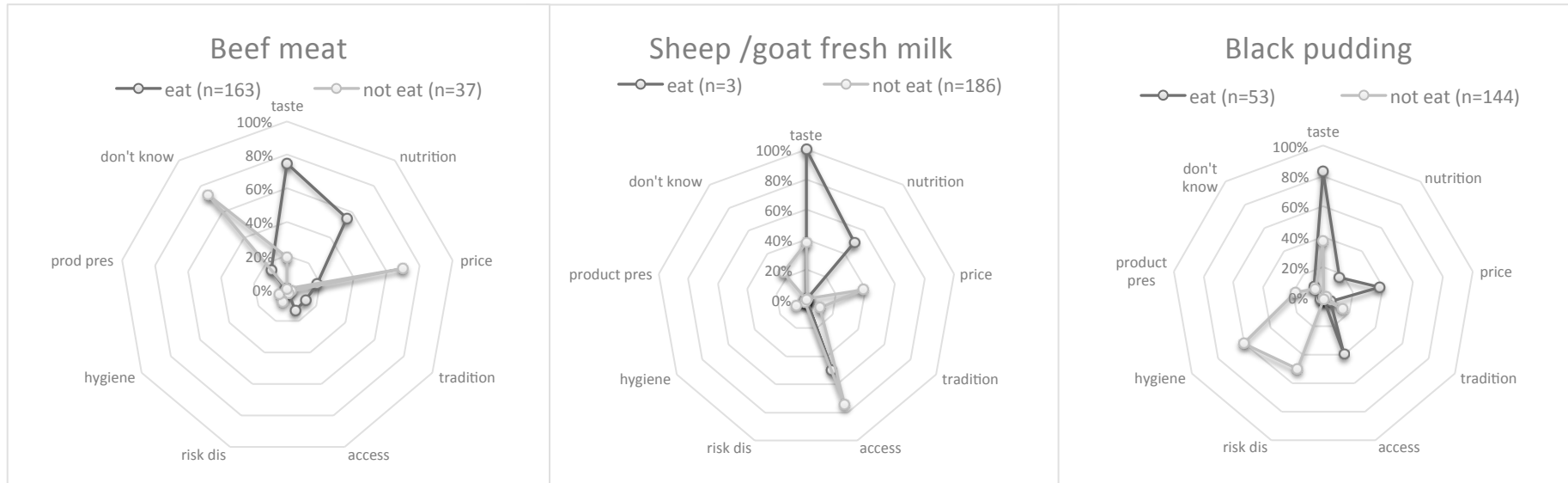
Assess potential of ASF in ensuring dietary adequacy

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Assessment of consumer patterns, preferences and demand factors

Beef meat — eat (n=163), not eat (n=37)

Sheep /goat fresh milk — eat (n=3), not eat (n=186)

Black pudding — eat (n=53), not eat (n=144)

ASF own- and cross-price elasticities

ASF own-/ cross- price elasticities	Beef meat	Offal	Processed meat	Fresh milk	Fermented milk	Eggs	Fish	Other meat	Broiler chicken
Beef meat	**-0.95**	-0.38**	0.22	-0.19*	0.18	-0.15	-0.30**	0.27	-0.01
Offal	-0.56**	**-1.62**	0.09	0.07	0.43	0.52**	-0.03	0.17	-0.24
Processed meat	0.5	0.16	**-1.34***	0.06	0.01	0.93**	-0.09	0.82*	-0.24
Fresh milk	0.009	0.11*	-0.003	**-1.08**	0.15	0.03	0.1**	-0.09	0.15*
Fermented milk	0.47	0.65	0.03	0.85**	**-2.4**	-0.19	0.09	0.44	-0.06
Eggs	-0.26	0.76**	0.88**	-0.04	-0.25	**0.22**	-0.14	0.82*	0.20
Fish	-0.20*	0.03	-0.04	0.38**	0.03	-0.02	**-1.09**	-0.44**	0.21
Other meat	0.29	0.14	0.41*	-0.19	0.21	0.44*	-0.49*	**-0.81***	0.22
Broiler chicken	-0.05	-0.19	-0.15	0.07	-0.06	-0.14	0.16	0.19	**-1.90**
Expenditure elasticities	**1.35**	**1.38**	**0.81**	**0.82**	**0.28**	**1.17**	**0.52**	**0.98**	**1.47**

HHs allocated on average 42% of their food expenditure to ASFs, of which 52% were allocated to dairy products and 13% to beef.

*significant at least p<0.1; **p<0.05

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Population-based dietary recommendations for women based on ASFs

Nutrient % covered by the recommendations	Vit C	B1	B2	B3	B6	Fol	B12	Vit A	Ca	Fe	Zn	Cost/day [KES]	N
Best possible individual diet	273.4	166.8	238.5	145.5	192	220.7	869.9	847.7	100	81	427.6	229.2	11
No recommendations	9	69.3	79.3	54	62.1	33	336.1	30.2	12	21.7	150.6	80.1	3
1. 7p/wk Fruit	99.6	70.7	81.9	57	79.8	41.4	336.1	46	14.2	21.7	150.6	87.1	5
2. Rec 1 + 28p/wk Vegetables	186.2	81.9	91.9	64.4	98.8	50	336.1	130.9	18.9	24.3	154.2	91.9	7
3. Rec 1 +2 + 7 p/wk Pulses	193.9	114.5	94.8	64.4	109.5	130.5	336.1	130.9	24.8	30	163.5	91.9	8
4. Rec 1 + 2+ 3 + 28 p/wk Dairy	198.4	116	144.4	64.4	109.7	132.3	379.9	177.5	81.6	30	176.1	125.4	9
5. Rec 1 + 2+ 3 + 4+ 21 p/wk ASF	198.4	116	148.7	70.8	114.4	132.3	404.5	177.9	81.8	34.1	186.6	141.6	10
6. Rec 1 + 2+ 3 + 4+ 21 p/wk ASF (7 egg- 4 red meat- 4 poultry- 3 sausage)	198.4	126.8	172.3	89.8	140.7	146.4	1273.6	227.2	83.6	46.6	300	172.9	10

- Optifood modelling predicts which food-based recommendations can ensure dietary adequacy for most nutrients (>65% or 70% RNI=adequate)

- Times/week vs portion size considerations

- The cost relative to incomes to improve dietary adequacy is high

Specific objectives

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Assess potential of ASF in ensuring dietary adequacy

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Dairy

Consumption ➡ 98.5% of HHs
5.5 times/week/HH

Why YES

⬇

Nutrition: 68%
Taste: 65%

Why NOT

⬇

Access: 73%
Price: 40%

Elasticity

⬇

-1.08 own-price

Value chain issues

- Key retailers:
  - Milk bars (raw, informal traders),
  - Kiosks (mainly processed, large companies),
  - Slum producers (raw).
- In some slums, factories sell milk about to expire at a cheaper price.
- Mainly women-dominated chain.

- Processed milk is controlled by few large companies.
- Important wastage in large companies
- Informal sector: Food safety risks due to adulteration, lack of cold chain, inadequate transport, poor hygiene, antimicrobial use, lack of licensing, regulation and training.

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Steps forward

- Finalise LVC-nutrition analysis

- Scale up our primary data collection

  - Use the experience from this pilot to draft guide on methodology to detect inefficiencies & design studies

  - Develop further gender issues, food choice, confounders for malnutrition, matching of retailers, etc.

- Stablish the best indicators to inform the design of sustainable interventions to test in the field

- Potential of value chain analysis across animal and non-animal value chains

Key messages

DEMAND/SUPPLY for each ASF

The cost to improve dietary adequacy is likely to exceed average household food expenditure

ASFs contribute substantially to dietary adequacy

Consumer choice largely driven by price & accessibility

Double burden of malnutrition is highly prevalent in the Nairobi slums

Taste & nutrition also influence food choice -> nutrition education?

For certain MN (e.g.iron) additional strategies might be required

LVC: good potential for safe & sustainable nutrient supply in slums (↓ price, ↑ distribution, ↑ safety, product development, etc.).

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