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SYDNEY

# Animal-source foods & Maternal and Child Nutrition

*in resource-limiting settings*

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# Nutritional contributions of animal-source foods

## Protein of high biological value

- Essential amino acid profile is well matched to body's requirements
- Contrast to cereals, typically largest contribution to protein intake (eg. maize – limiting in lysine and tryptophan)

## Variety of micronutrients in bioavailable forms

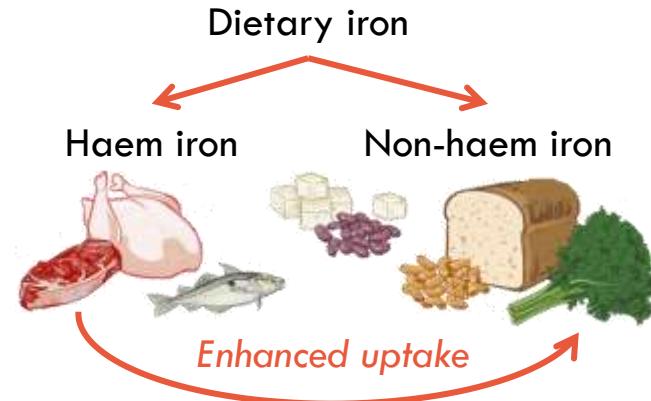
- Efficient for addressing multiple micronutrient deficiencies
- Haem iron, pre-formed vitamin A

## Enhanced uptake of less bioavailable micronutrients

- Non-haem iron (plant-source foods)
- Significant given inhibitory effect of oxalates and phytates in diet

## High nutrient density

- Benefits for young children and those with reduced dietary intake
- Small amounts can significantly increase nutritional adequacy of diets based on staple crops



Nutrient	Red meat	Liver	Milk	Poultry meat	Eggs	Consequences of deficiency	Prevalence of deficiency
Ca	0	0	+++	0	0	Nutritional rickets and inhibited bone growth and density; maternal increased risk of preeclampsia	Global estimates not available. WHO estimates that low intakes are common and nutritional rickets is reappearing.(FAO)
Fe (heme)	++	+++	0	++	0	Anaemia; impaired growth, immune function, child cognitive development/school performance; lowered work capacity; mortality	Estimated 1 in 4 people worldwide has iron deficiency (WHO global database on iron deficiency)
Fe (total)	++	+++	+	++	+		
Zn	+++	+++	+	+++	+	Pregnancy complications; low birth weight; impaired immune function, mortality, growth faltering; diarrhea.	Estimated 1 in 5 world's population is at risk of inadequate intake.
Vit A (retinol)	+	+++	++	++	+++	Growth faltering; impaired development; xerophthalmia and blindness; impaired immune system; increased mortality; skin infections	Low serum retinol concentration affects 33% of the preschool age children and 15% of pregnant women in populations at risk of VAD worldwide (WHO Global Database on Vita.A)
Vit B2	++	+++	+++	++	++	Stunted growth, skin lesions, corneal vascularisation, cheilosis, angular stomatitis, glossitis, photophobia, anemia, and neuropathy.	Good estimates of deficiency unavailable but incidence believed to be up to 40% in developing countries
Vit B12	+++	+++	++	+++	++	Megaloblastic anemia; gastrointestinal symptoms neurological symptoms; demyelinating disorder of the central nervous system.	High prevalences reported worldwide, particularly deficient in vegetarian diets with no supplementation
Choline	++	+++	+	++	+++	Fatty liver, increased risk of neural tube defects in pregnancy. Choline is critical during fetal development, particularly lifelong memory and learning functions.	Unknown



# Functional outcomes related to ASFs

- First randomised, controlled feeding study to compare effect of meat-, milk- and plant-based foods on functional outcomes in children
- Two-year project
- Schools of rural Kenya
- Children 6-14 y
- Mid-morning “snacks” given each day – *githeri* (maize, beans, greens)
- Cognitive assessments
- School-yard behaviours observed
- Height, weight, mid-upper arm circumference, triceps and subscapular skinfold thickness

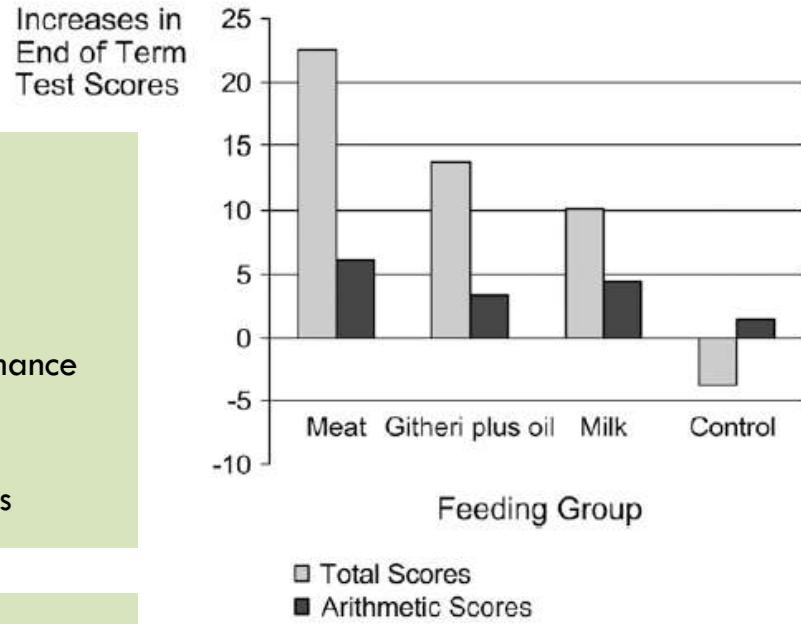
Neumann, et al. 2007. *Journal of Nutrition*.



# Functional outcomes related to ASFs



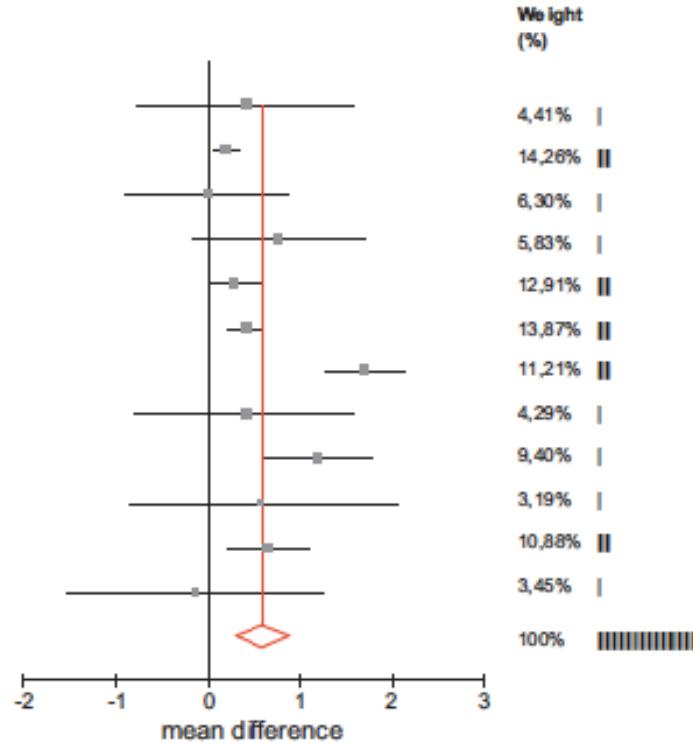
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- Two light green rectangular boxes contain lists of outcomes that have improved across all groups.
- Improved:**
- Physical activity
  - Initiative
  - Leadership
  - Cognitive performance
  - School test scores
  - Arm muscle mass
  - Vitamin B12 status
- Improved:**
- Linear growth (if stunted)
  - Vitamin B12 status



Neumann, et al. 2007. *Journal of Nutrition*.

# Dairy products and physical stature?

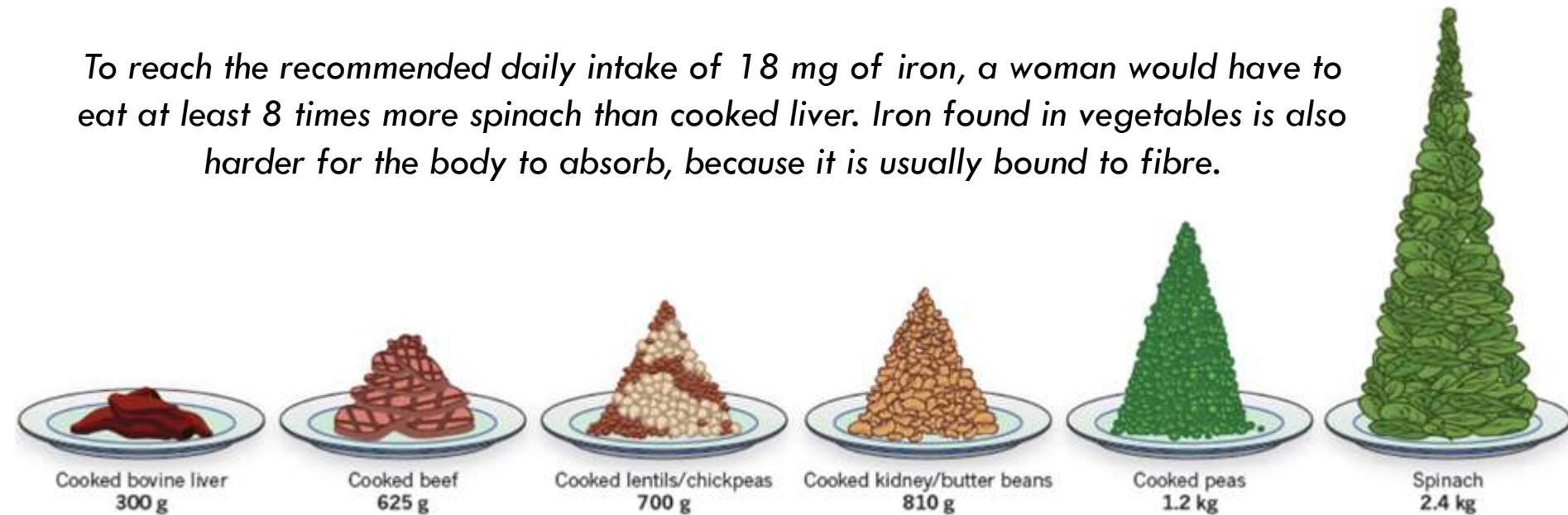
- Systematic review and meta-analysis of studies supplementing usual diet with dairy products on physical growth
- 12 studies, up to 3500 children
- Europe (3), USA (2), China (2), Vietnam (1), Kenya (1), Indonesia (2) and India (1)
- Male and female children, 3-13 years
- Most likely effects: +0.4cm per annum additional growth with 245mL milk/day
- Moderate quality evidence of supplementation with dairy products stimulating linear growth



de Beer, 2012.

# Nutritional contributions of animal-source foods

To reach the recommended daily intake of 18 mg of iron, a woman would have to eat at least 8 times more spinach than cooked liver. Iron found in vegetables is also harder for the body to absorb, because it is usually bound to fibre.



# Micronutrient content

Recommended Nutrient Intake  
(RNI) for Vitamin A for a  
breastfeeding mother:  
**950 µg/d**



●  
**Chicken liver,  
fried**  
9g

**Spinach,  
cooked**  
148 g

**Orange  
sweet  
potato,  
cooked**  
220 g

**Fresh papaya**  
704 g



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# Village poultry, gender and maternal and child nutrition

*Findings and lessons from Tanzania*

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# Acknowledgements



**Australian Government**  

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**Australian Centre for  
International Agricultural Research**

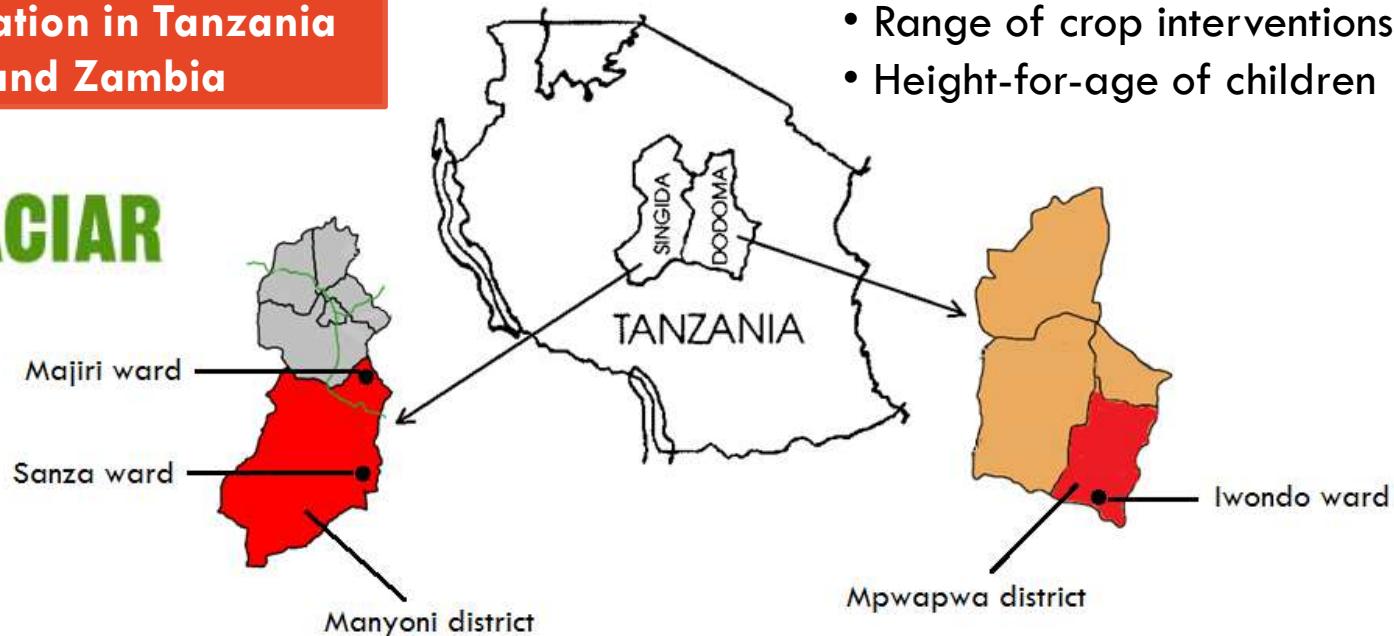


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# Chickens, children and crops...

**Strengthening food and nutrition security through family poultry and crop integration in Tanzania and Zambia**

- Five-year interdisciplinary project
- Cluster randomised controlled trial
- Newcastle disease (ND) vaccination
- Range of crop interventions
- Height-for-age of children



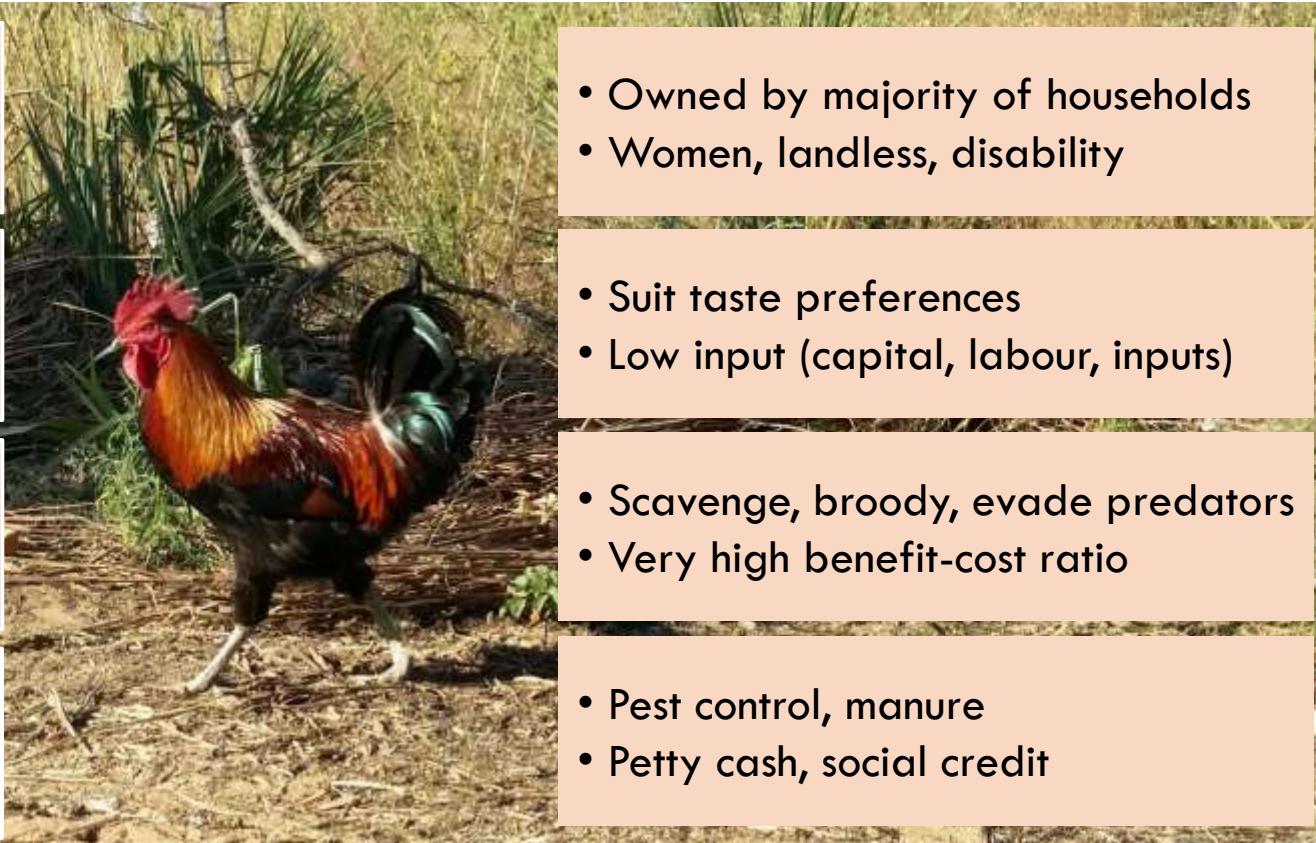
# Why village chickens?

Accessible form  
of livestock

Work well in  
local settings

Efficient  
production system

Multiple roles  
and benefits



- Owned by majority of households
- Women, landless, disability

- Suit taste preferences
- Low input (capital, labour, inputs)

- Scavenge, broody, evade predators
- Very high benefit-cost ratio

- Pest control, manure
- Petty cash, social credit

# A focus on women

- Limited access to opportunities and resources
- **Resource-limited household members**
- Key players in family poultry production
- Primarily responsible for management of chickens
- Lose power in decision making re marketing and consumption



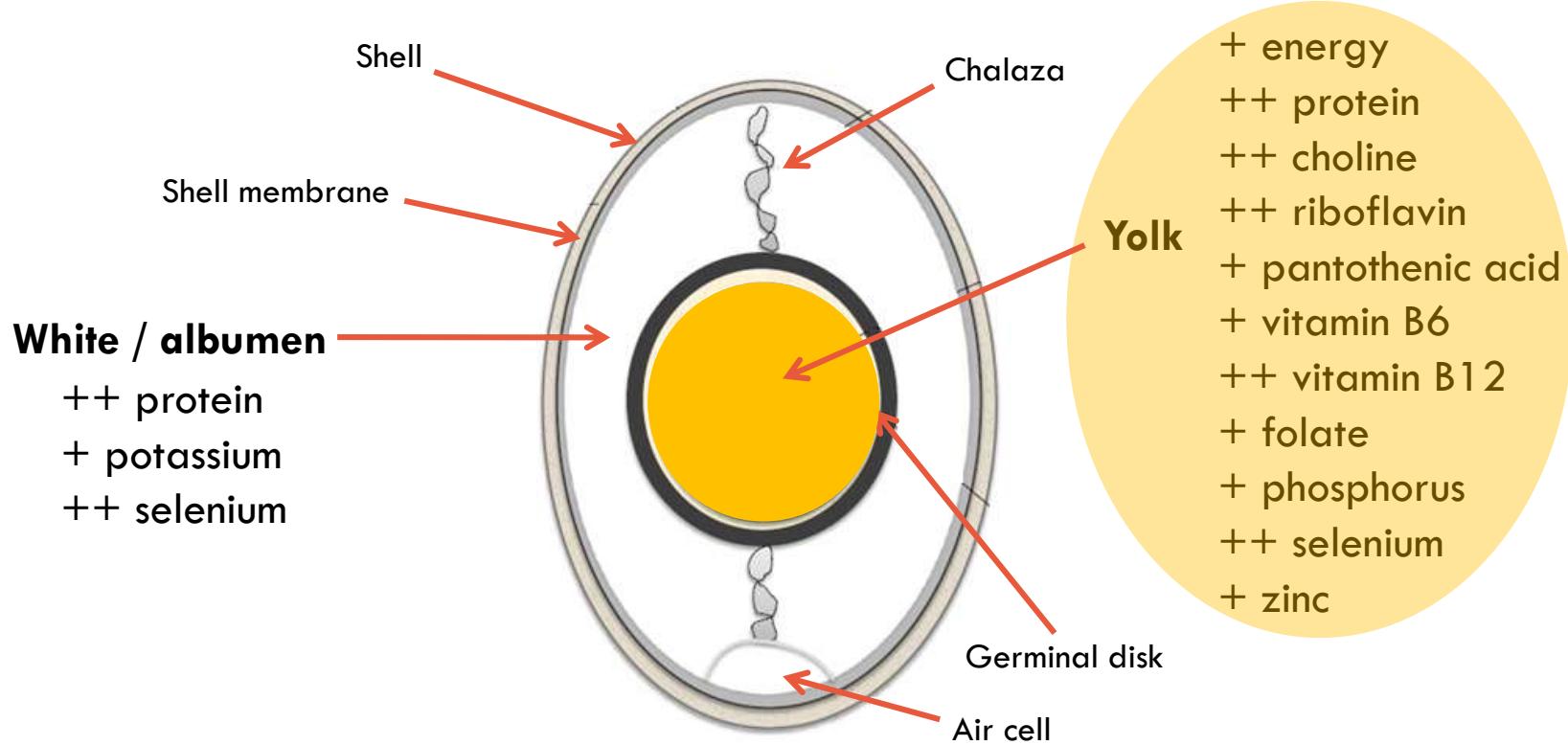
Boys eat more meat than their sisters from around 12 years of age, when they start working in the field.

Men are reported to receive “the best bits” and a larger share of meat than women of the same age, or any other household member.

## **Reasons nominated by women for allocating meat to male household members:**

- “The one who brings the food”
- Men spend more energy
- Men need more strength
- A sign of respect
- Head of the household

# Nutritional contributions of eggs



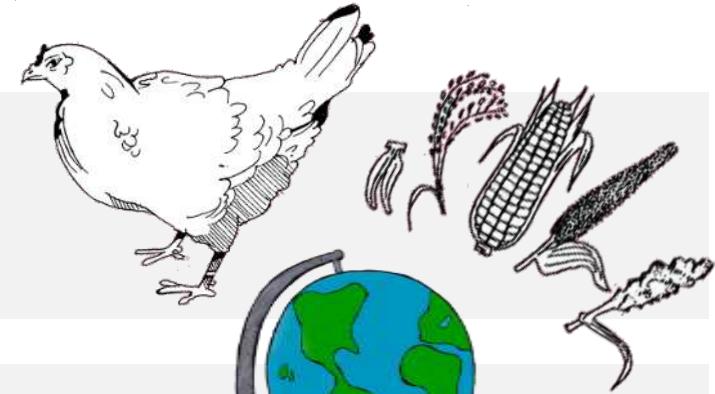
For infants 7-12 months old: + 20-50% recommended daily allowance (RDA), ++ >50% RDA (Source: Iannotti et al, 2014)

# Food Composition Data

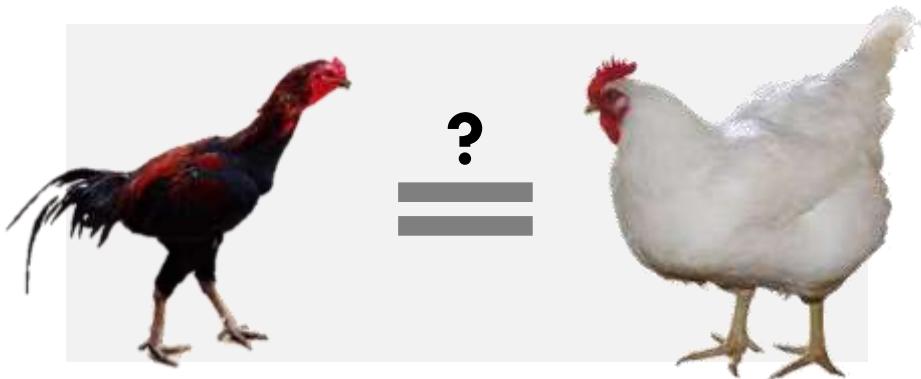
Food composition tables in sub-Saharan Africa don't always reflect the **range of foods** which might be consumed by food-insecure populations.

Most data presented in national or regional databases is derived from **sources outside the country or region**, often from analyses conducted decades previously.

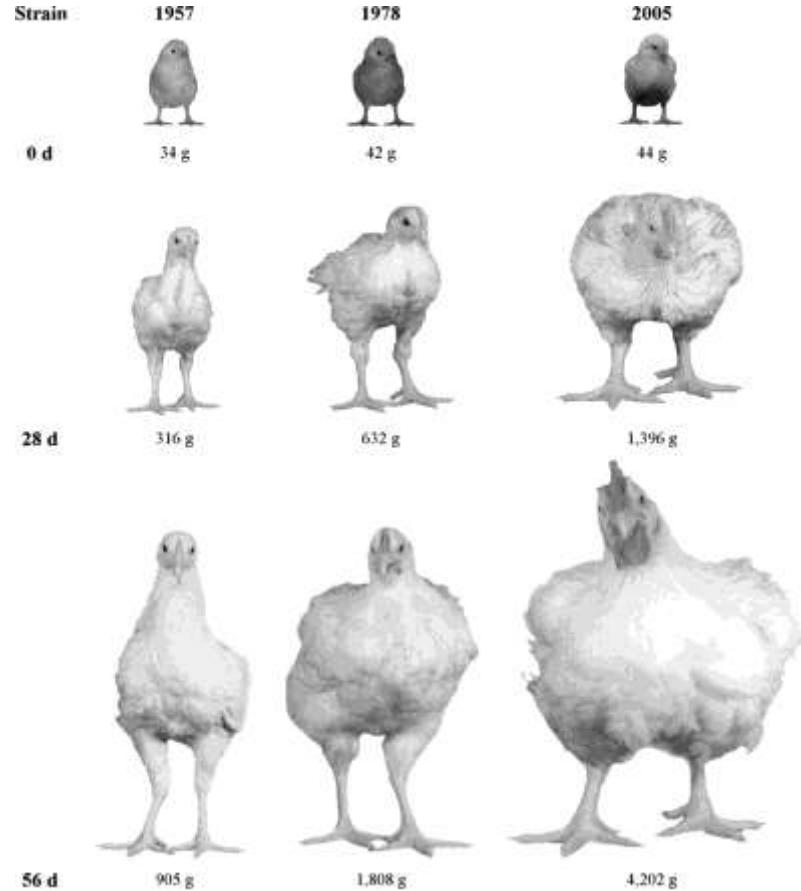
There is **significant variation** in the nutrient content of equivalent food items in databases from developed nations (including nutrients of public health significance).



# Food Composition Data



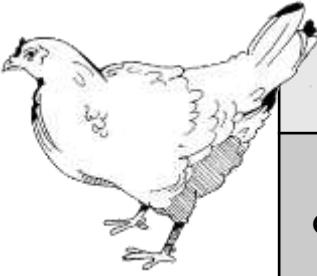
- Genotype?
- Diet?
- Season?
- Management systems?
- Differing fat content?



Zuidhof et al. 2014. Poultry Science.

# Baseline consumption patterns - Chicken

**Table 1:** Proportion of target household-members **consuming at least one meal containing chicken** in Sanza ward (Visual diary, August 2014)



	Breastfeeding women			Children under 2 years		
	Number consuming chicken	Total number (n)	Proportion consuming chicken	Number consuming chicken	Total number (n)	Proportion consuming chicken (%)
Sanza	7	53	13.2%	5	53	9.4%
Ntope	7	48	14.6%	5	51	9.8%
Chicheho	5	49	10.2%	7	49	14.2%
Ikasi	27	52	51.9%	27	52	51.9%

# Baseline consumption patterns - Eggs

**Table 2:** Proportion of target household-members **consuming at least one meal containing eggs** in Sanza ward (Visual diary, August 2015)



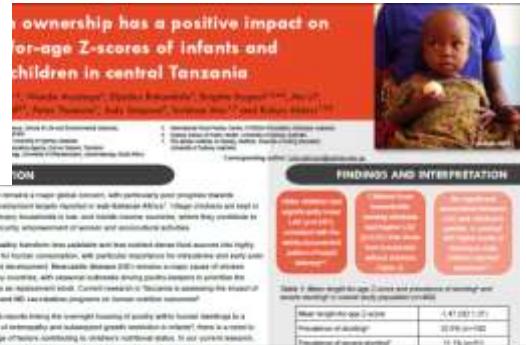
	Breastfeeding women			Children under 2 years		
	Number consuming eggs	Total number (n)	Proportion consuming eggs	Number consuming eggs	Total number (n)	Proportion consuming eggs
Sanza	4	53	7.5%	6	51	11.8%
Ntope	9	48	18.8%	9	51	17.6%
Chicheho	4	49	8.2%	6	49	12.2%
Ikasi	14	52	26.9%	16	51	31.4%

# Baseline analysis of LFA in Sanza and Majiri

- Baseline data
- Households with children <24 m
- 8 communities, 2 wards
- Interview-based data collection
  - MCHN questionnaire
  - Livelihood questionnaire
- Child anthropometry
  - Length-for-age (LAZ)

## SANZA WARD

Baseline data  
(n = 231)



2014

May Jun Jul Aug Sept Oct Nov



## MAJIRI WARD

Baseline data  
(n = 279)



# Methods

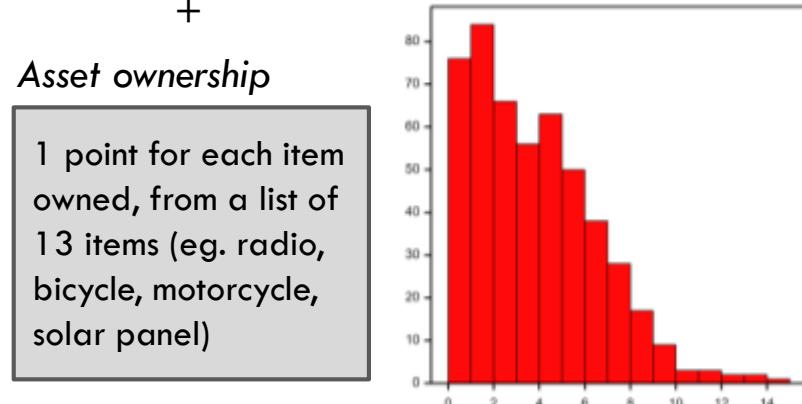
- Child gender
- Child age
- Household socioeconomic status
- Gender of household head
- Household size
- Level of maternal education
- Cattle ownership
- Small ruminant ownership
- Chicken ownership

*House construction materials*

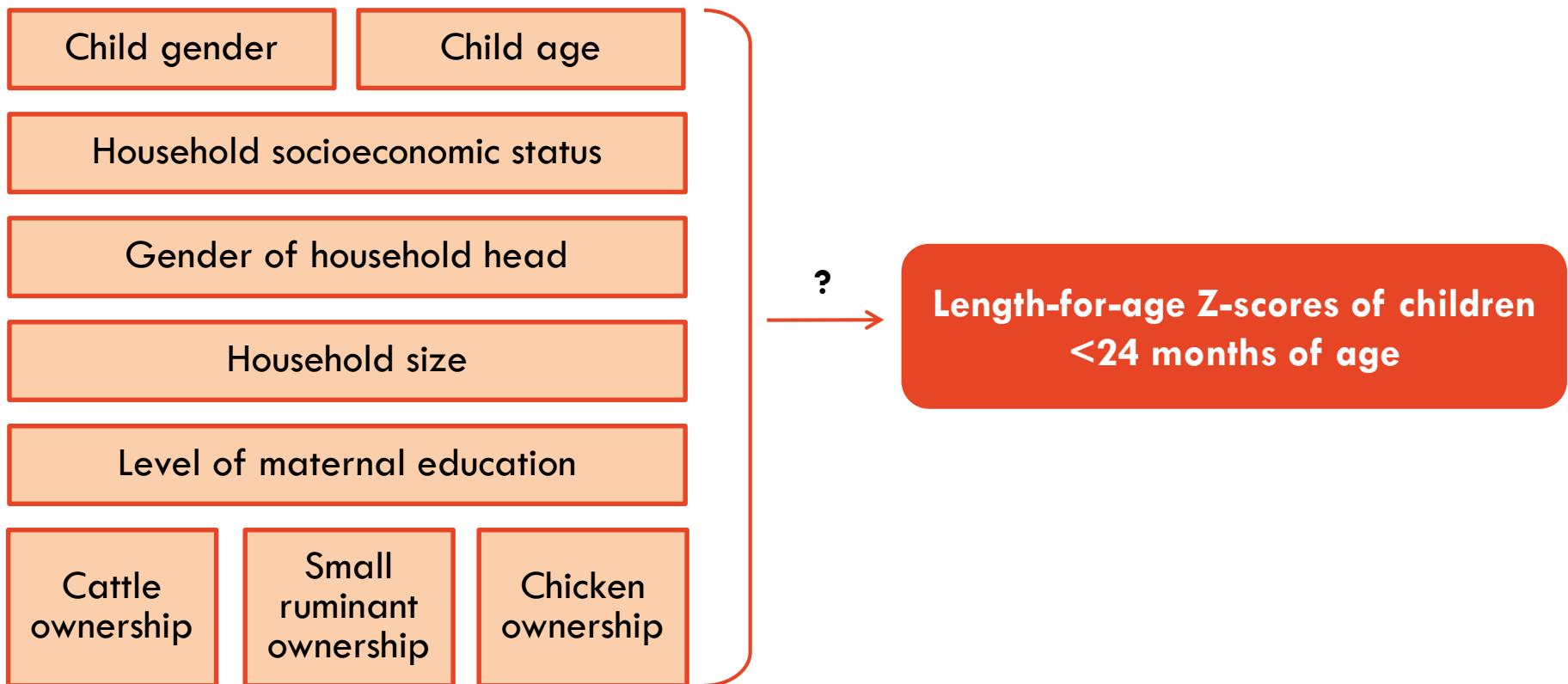
	0	1
Roof	Grass, thatch, mud	Iron sheets, tiles
Walls	Grass, thatch, poles & mud	Mud bricks, baked bricks, cement bricks
Floor	Earth	Wood, tiles, concrete

+  
*Asset ownership*

1 point for each item owned, from a list of 13 items (eg. radio, bicycle, motorcycle, solar panel)



# Methods



# Results

Child gender

Child age

Household socioeconomic status

Gender of household head

Household size

Level of maternal education

Cattle ownership

Small ruminant ownership

Chicken ownership

**Length-for-age Z-scores of children  
<24 months of age**

Mean LAZ -1.47 (SD 1.37)  
n = 460

# Results

## Child age

Older children have a significantly lower LAZ ( $p<0.001$ )

Consistent with documented pattern of height faltering beginning soon after birth and continuing until 24 months of age.

## Next steps...

- Impact of chicken flock size?
- Impact of chicken housing?
- Longitudinal findings?

## Chicken ownership

Chicken from households owning chickens have a higher LAZ than those from households without chickens (-1.32 cf. -1.56;  $p=0.06$ )

Scope for interventions such as Newcastle disease vaccination that promote poultry ownership and increased flock size to contribute to improved nutrition?



A photograph of a traditional African village under a blue sky with scattered white clouds. In the foreground, a white goat stands on a sandy ground, looking down. Behind it are several small, round huts with thick thatched roofs supported by wooden poles. One hut on the right is more prominent and appears to have a porch or entrance. Large pieces of weathered wood are scattered across the ground in front of the huts.

**Thank you  
Questions?**