

The challenge of assessing  
malnutrition and its health  
implications – the added  
value of nuclear technology

Anura Kurpad

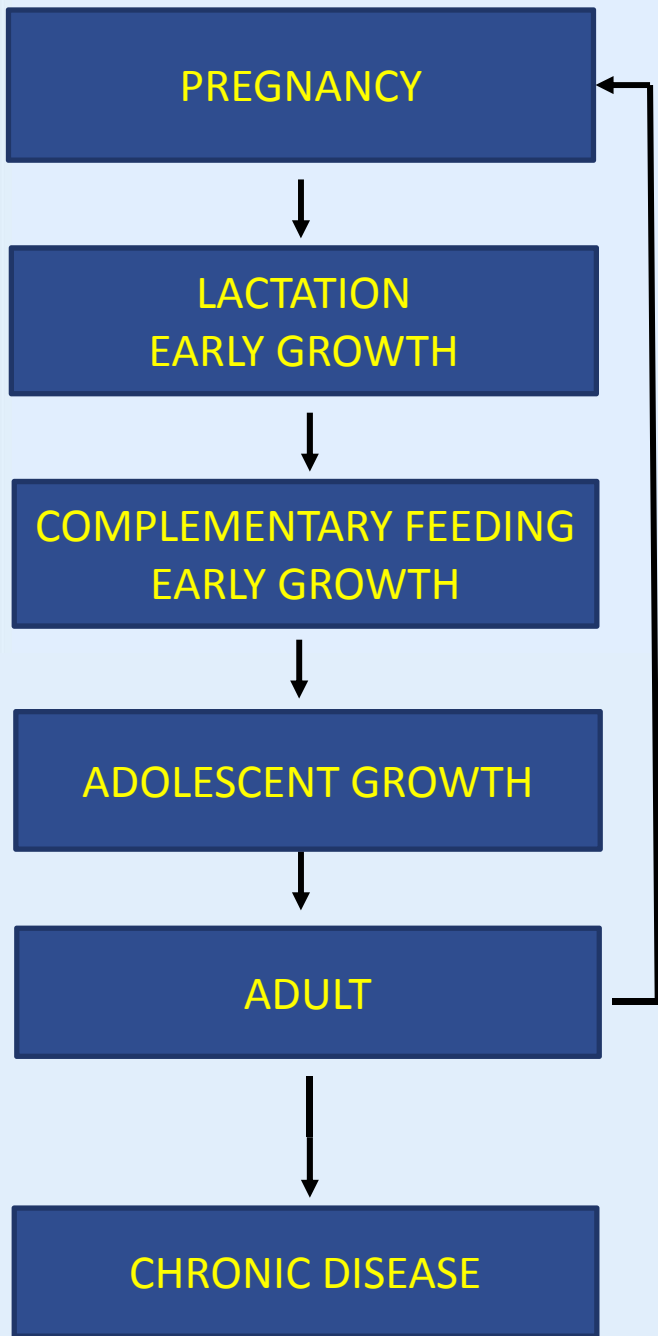
St John's Medical College,  
India

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**Nuclear Techniques  
in Human Health**

*Prevention, Diagnosis, Treatment*



Addressing malnutrition through:

- Feeding and supplementation Programs
- Addressing Sanitation and Parasites
- Infectious Disease Programs

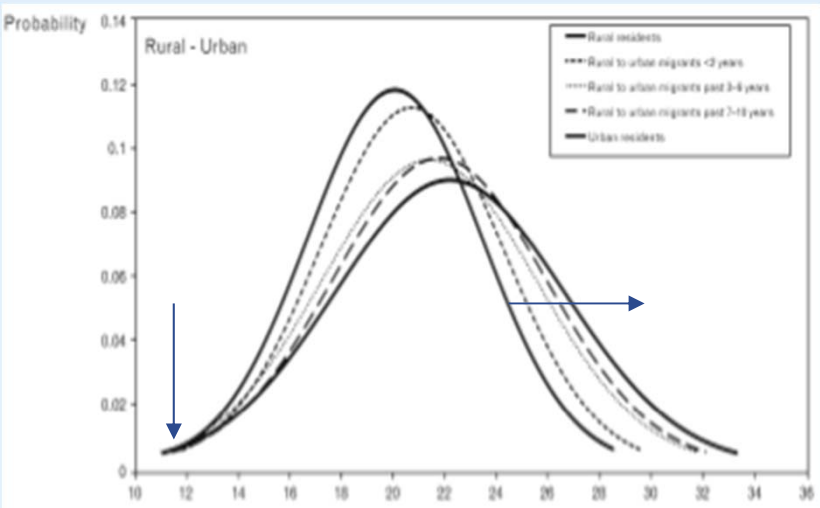
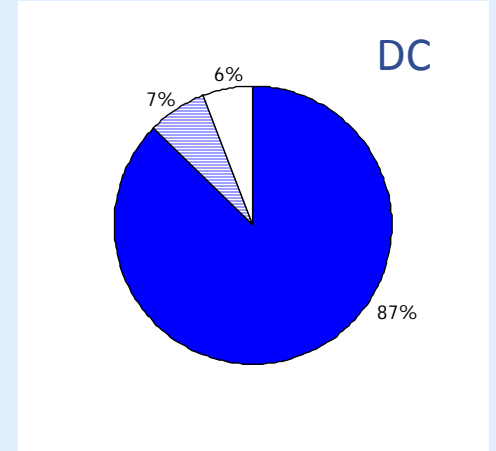
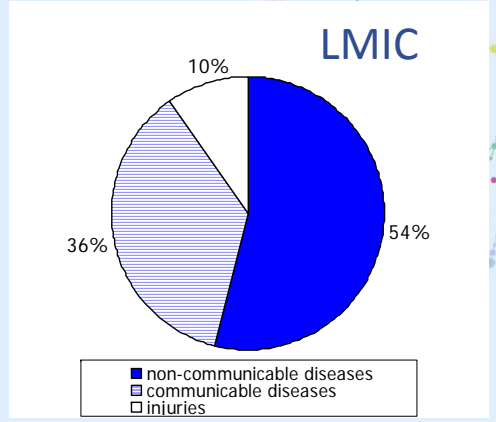
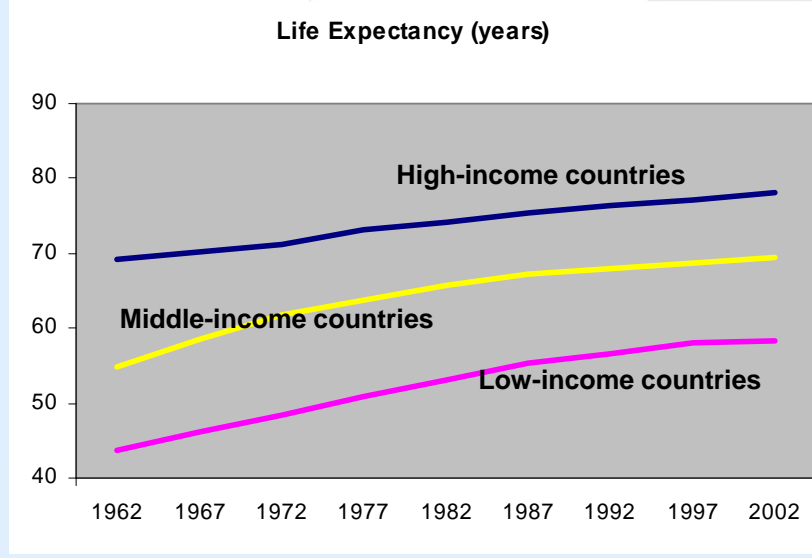
What to do?

How much to do?

What was the impact?

# A double burden

Increases in life expectancy are associated with a double burden of disease



**BMI frequencies with migration of populations**  
**Rural to Urban migration**

- BMI distributions shift to the right over 10 years

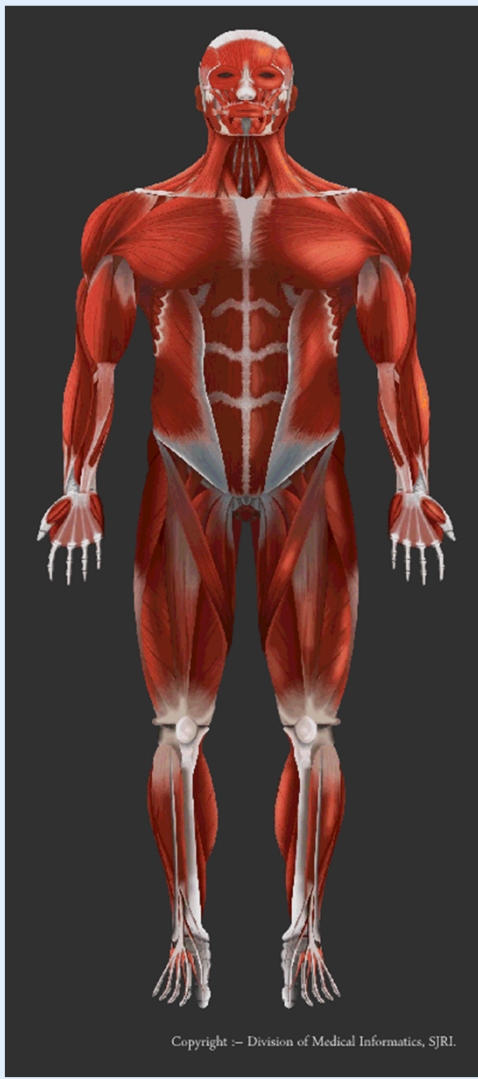
# Nuclear techniques are critical to all these problems



## Measuring Fat and Fat free mass

**BMI ≠ fatness!**

- Big and muscular
- Thin and fat



Fat

Mineral

Protein

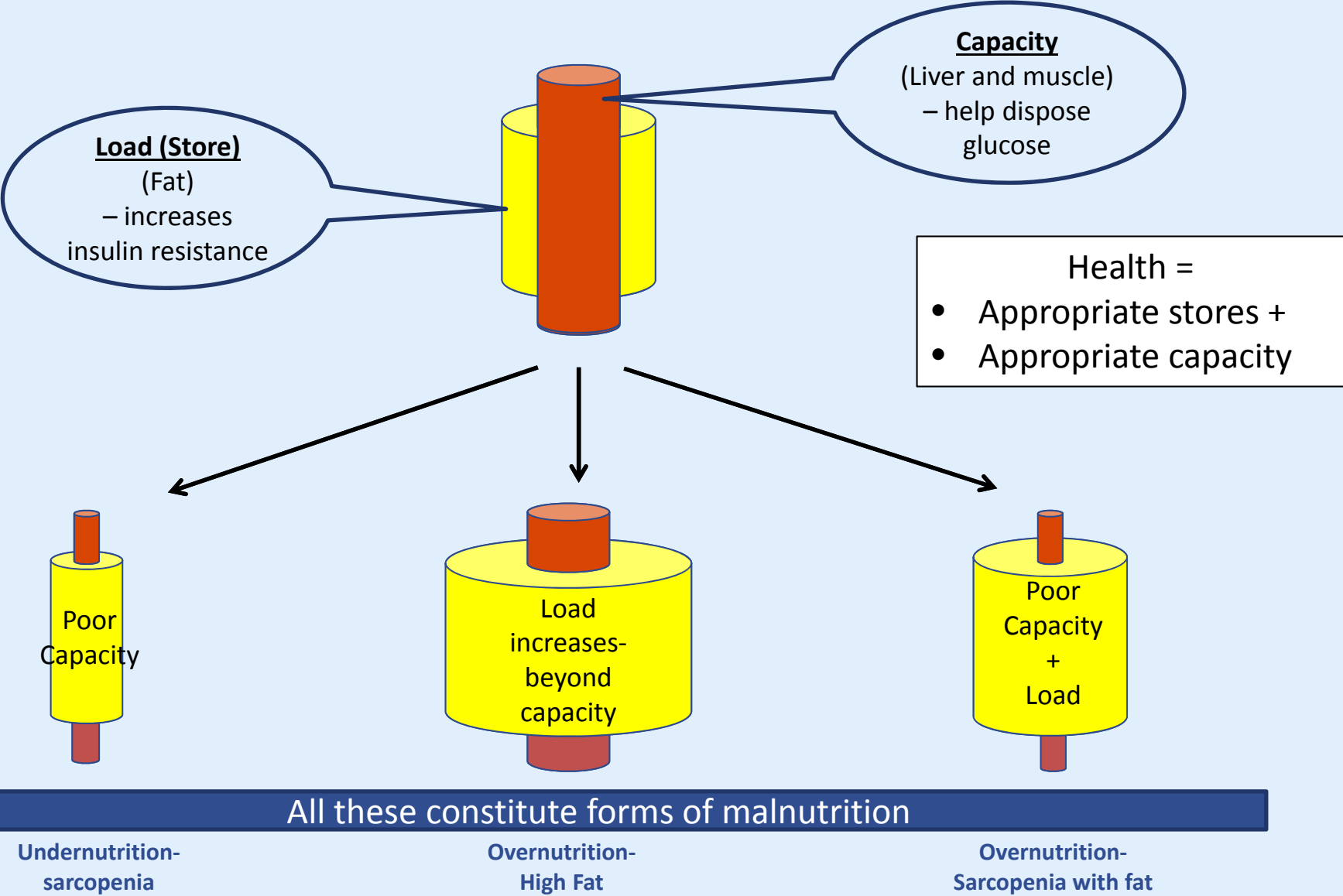
Fat Free Mass:

- Organs
- **Muscles**
- Bone
- Fluids

Water



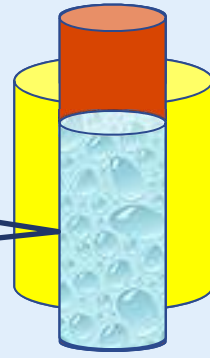
# Why is measuring fat and (fat free mass) important? Insulin resistance; diabetes



# What are the challenges in measuring fat stores? How do nuclear technologies help?



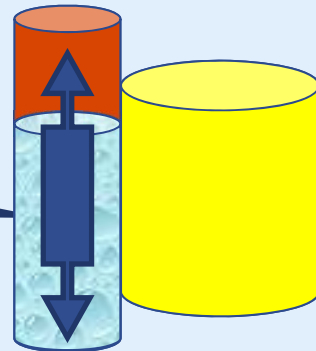
Water is only present in the fat free mass



No water in fat

Sum of Fat and FFM = Body weight

Deuterium dilution to measure water (TBW)



Impute the FFM

→ **Body Fat = Body weight - FFM**

Translates into a very simple field method, which can be deployed with minimal capacity building

# Nutrition in pregnancy and foetal growth

## Fat stores and FFM (capacity)



Shadow Shield-Whole body potassium counter  
Counting natural  $^{40}\text{K}$  in the body as an index of body cell mass

- Early undernutrition and later NCD are linked



Measuring body fat of infants in field situations by the use of deuterium dilution

- Starting with pregnancy – what food does a pregnant woman need for the best outcome and healthy babies?

– Some concern that undernourished babies are born already ‘fat’

Infant receiving an oral dose of deuterium oxide using a syringe (courtesy: Photo; M. Thame, Jamaica)

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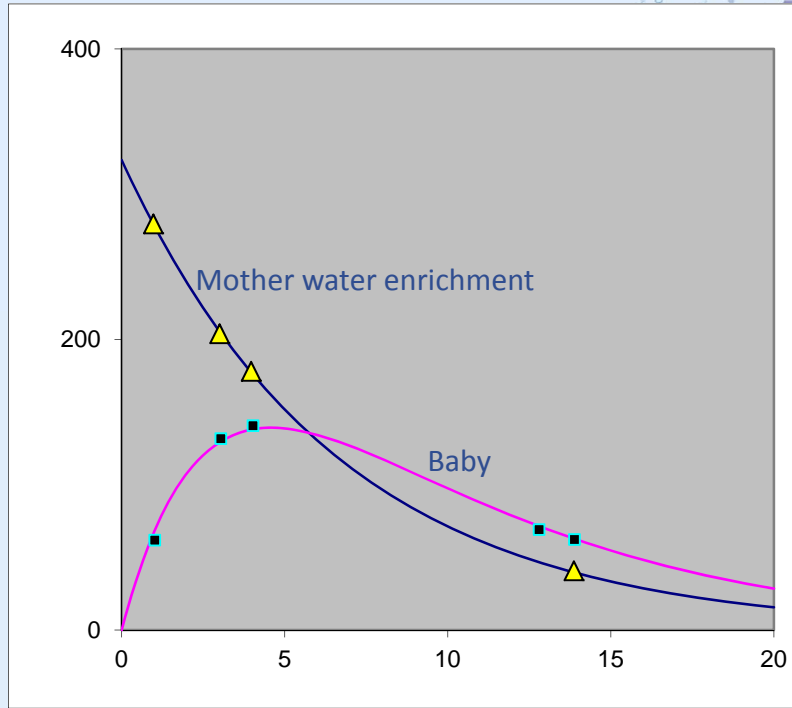
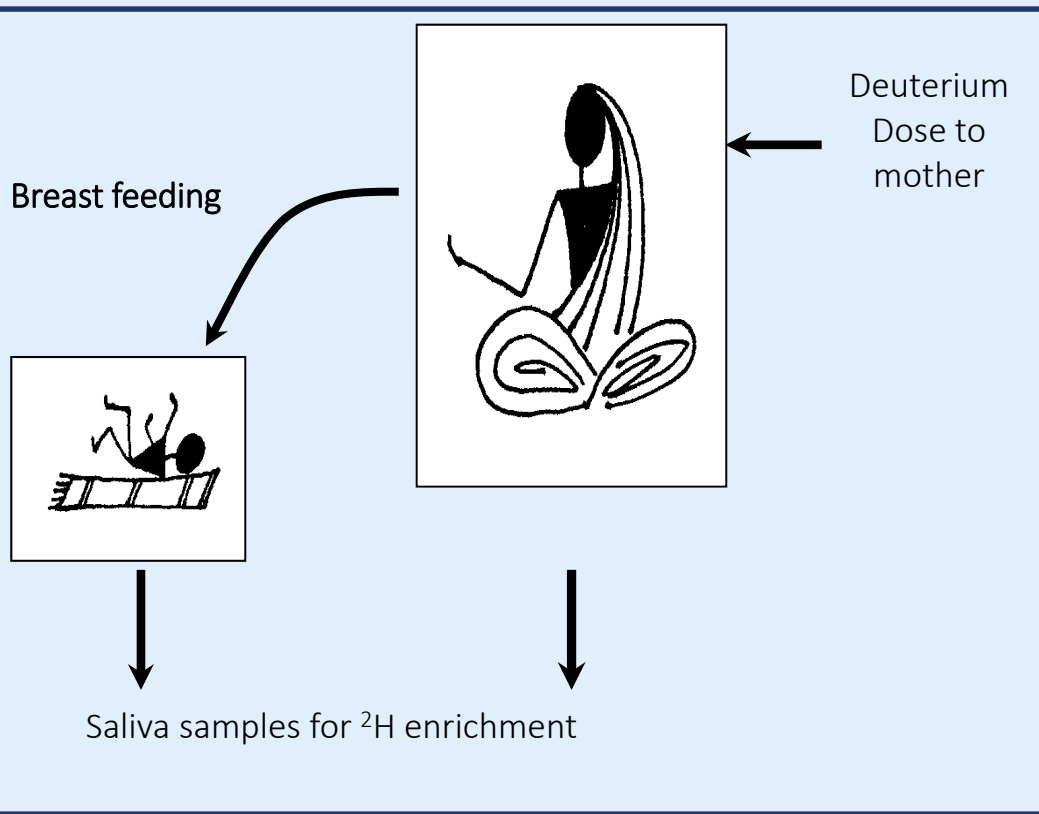
It is a challenge to measure body tissue or fat in pregnancy or in babies  
Variable amounts of water in the body, which confounds usual measurements

Picture Courtesy: Dr Rebecca Raj

# Nuclear techniques are also critical at other stages Breast feeding is difficult to measure, invasive...



## Measuring lactation



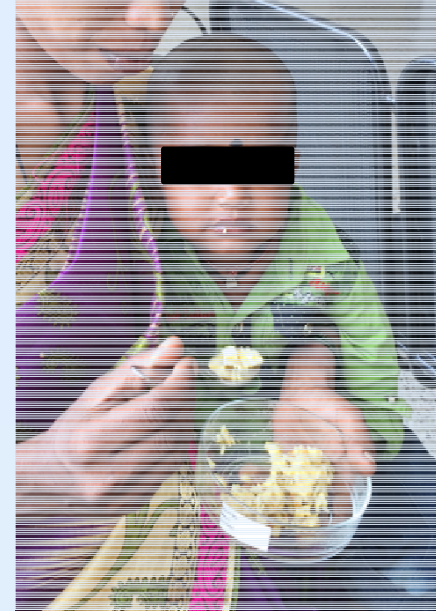
Translates into a very simple non-invasive, field method, which can be deployed with minimal capacity building



# Measuring protein quality for infant feeding through stable isotopes ( $^2\text{H}$ and $^{13}\text{C}$ )



Photo courtesy: Dr S Sreeman, India



Collecting breath sample

Photo courtesy: Dr N Shivakumar, India

Understanding how much protein should be fed – protein digestibility

# Added value of nuclear technology in the nutrition value chain...

What is the state of nutrition?  
Pregnant women, children, adolescents

Impact evaluations



Breastfeeding

Complementary feeding

Requirements for mother and baby  
Body comp at birth  
lactation measures

Diversified

Activity

Best Practices  
Complementary feeding  
WASH -Unsanitary environments



<http://www.thebetterindia.com/8580/>



