

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# Plant-Based Foods: Opportunities and Challenges

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# Roadmap



Introduction



Food consumption pattern scenario



Opportunities with plant-based foods



Challenges with plant-based foods



Conclusion



Reference

# Introduction

- ▶ **Plant-based diet** used to refer full spectrum of nutritionally preferred foods include
  - ▶ Vegans
  - ▶ Vegetarians
  - ▶ Flexitarian
- ▶ **Flexitarians** focus their diets on plant-based foods but occasionally eat meat and dairy



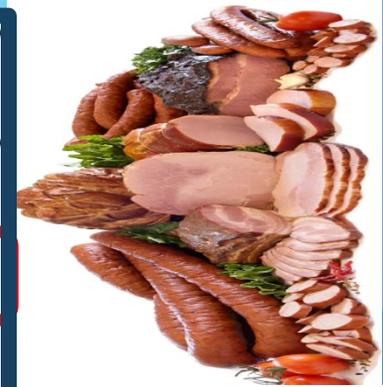
# Food Consumption Pattern Scenario

- ▶ Plant-based diets is main source of energy globally
- ▶ Per capita food consumption has increased dramatically since last few decades
- ▶ In affluent societies, a tremendous increased in energy intake from animal-based foods has also been observed



## Global and Regional Pattern (kcal per capita per day)

Region	1964–1966	1974–1976	1984–1986	1997–1999	2015	2030
World	2358	2435	2655	2803	2940	3050
Developing countries	2054	2152	2450	2681	2850	2980
Near East and North Africa	2290	2591	2953	3006	3090	3170
Sub-Saharan Africa <sup>a</sup>	2058	2079	2057	2195	2360	2540
Latin America and the Caribbean	2393	2546	2689	2824	2980	3140
East Asia	1957	2105	2559	2921	3060	3190
South Asia	2017	1986	2205	2403	2700	2900
Industrialized countries	2947	3065	3206	3380	3440	3500
Transition countries	3222	3385	3379	2906	3060	3180



# Vegetable and Animal Sources of Energy in the Diet (kcal per capita per day)

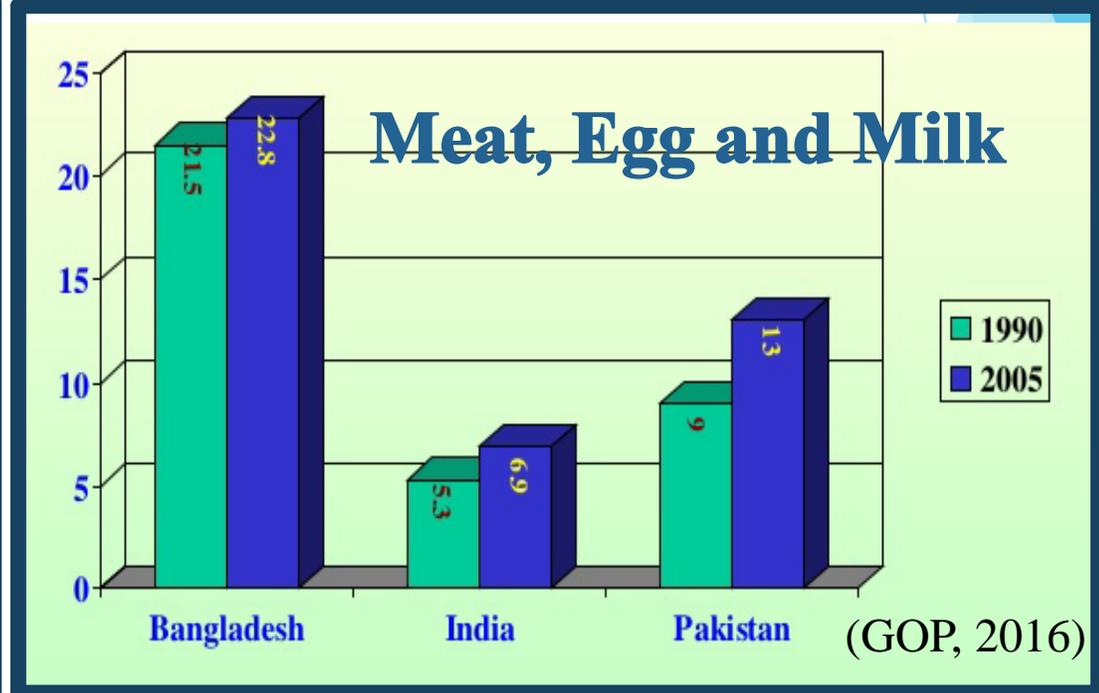
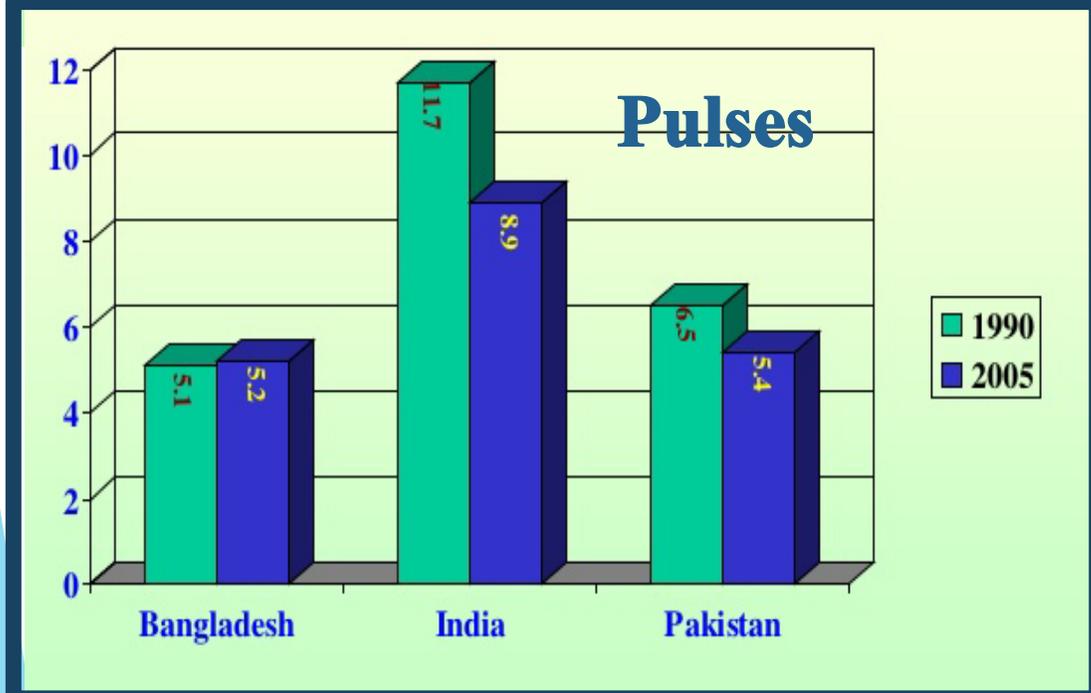
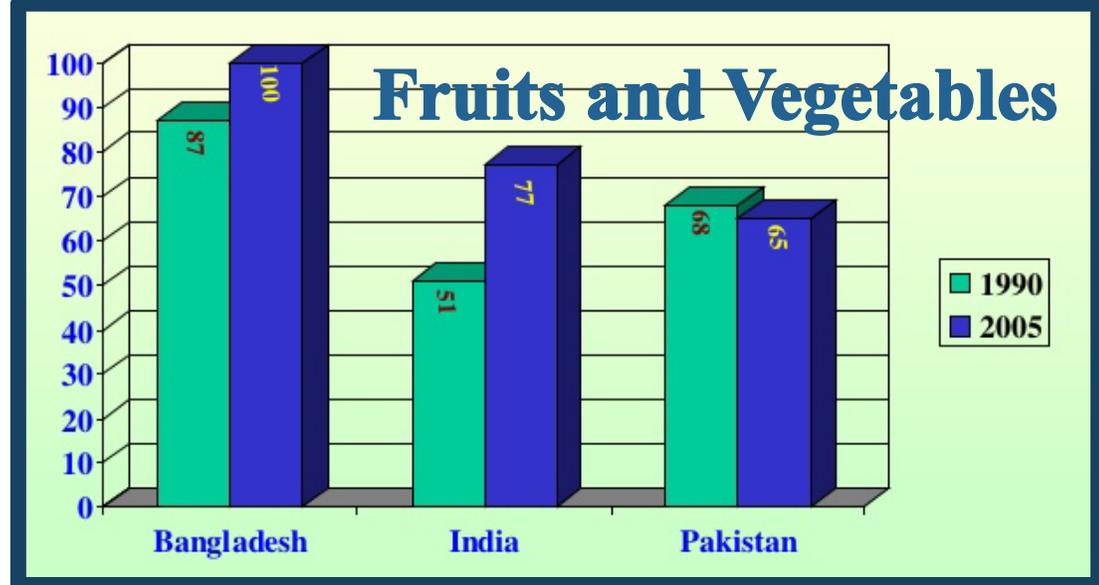
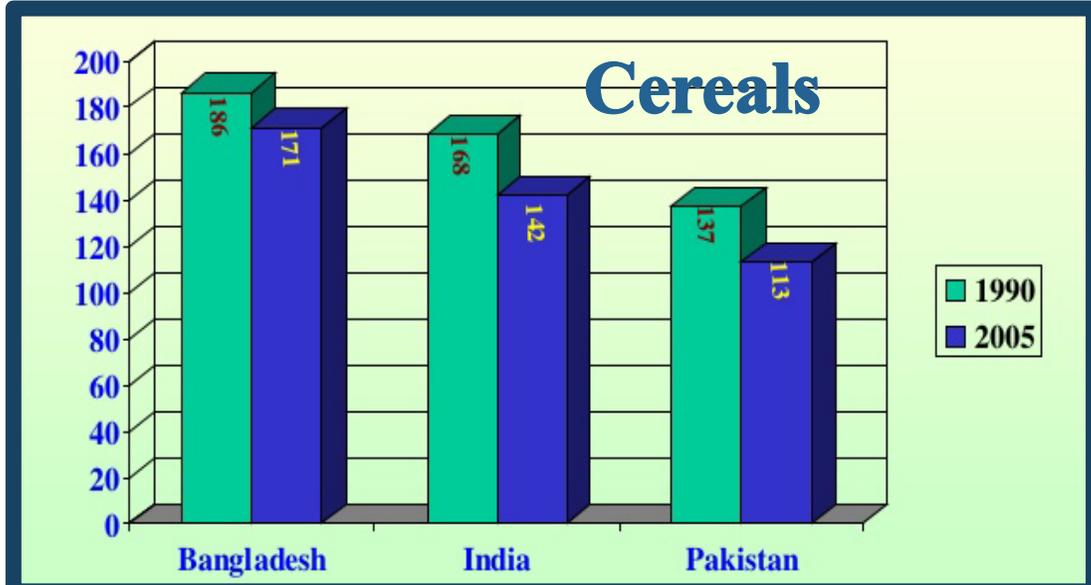
Region	1967-1969			1977-1979			1987-1989			1997-1999		
	T	V	A	T	V	A	T	V	A	T	V	A
Developing countries	2059	1898	161	2254	2070	184	2490	2248	242	2681	2344	337
Transition countries	3287	2507	780	3400	2507	893	3396	2455	941	2906	2235	671
Industrialized countries	3003	2132	871	3112	2206	906	3283	2333	950	3380	2437	943

T= Total, V= Vegetable, A= Animal

(Popkin, 2001)



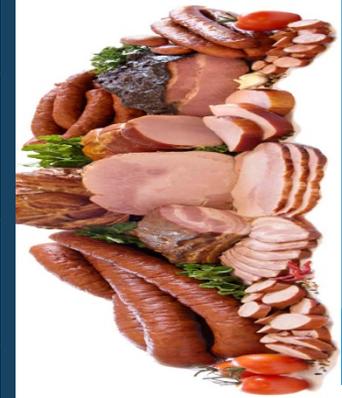
# Change in Consumption in Pakistan (kg/capita/annum)



(GOP, 2016)

# FAO Desirable Dietary Pattern and Pakistan

Food Item	FAO (DDP)	2013-14 Dietary intake Pakistan
	% share	Actual intake
Cereals Roots and tubers Bananas & Plantains	30	25
Pulses, beans & soya beans	10	2.4
Animal products	40	30
Added fats and oils	10	15
Sugars	5	10
Vegetables, Fruits	10	15
Others	1	10



# Opportunities



Cheep source of energy



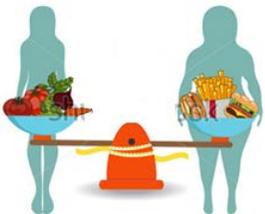
Diversity



Nutrient density



Economical and sustainability



Reduce overconsumption of calories



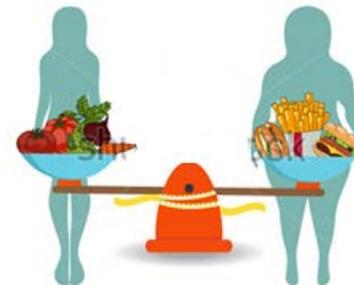
Alternative source of protein



Better shelf life



Life longevity



Protective factors against chronic diseases



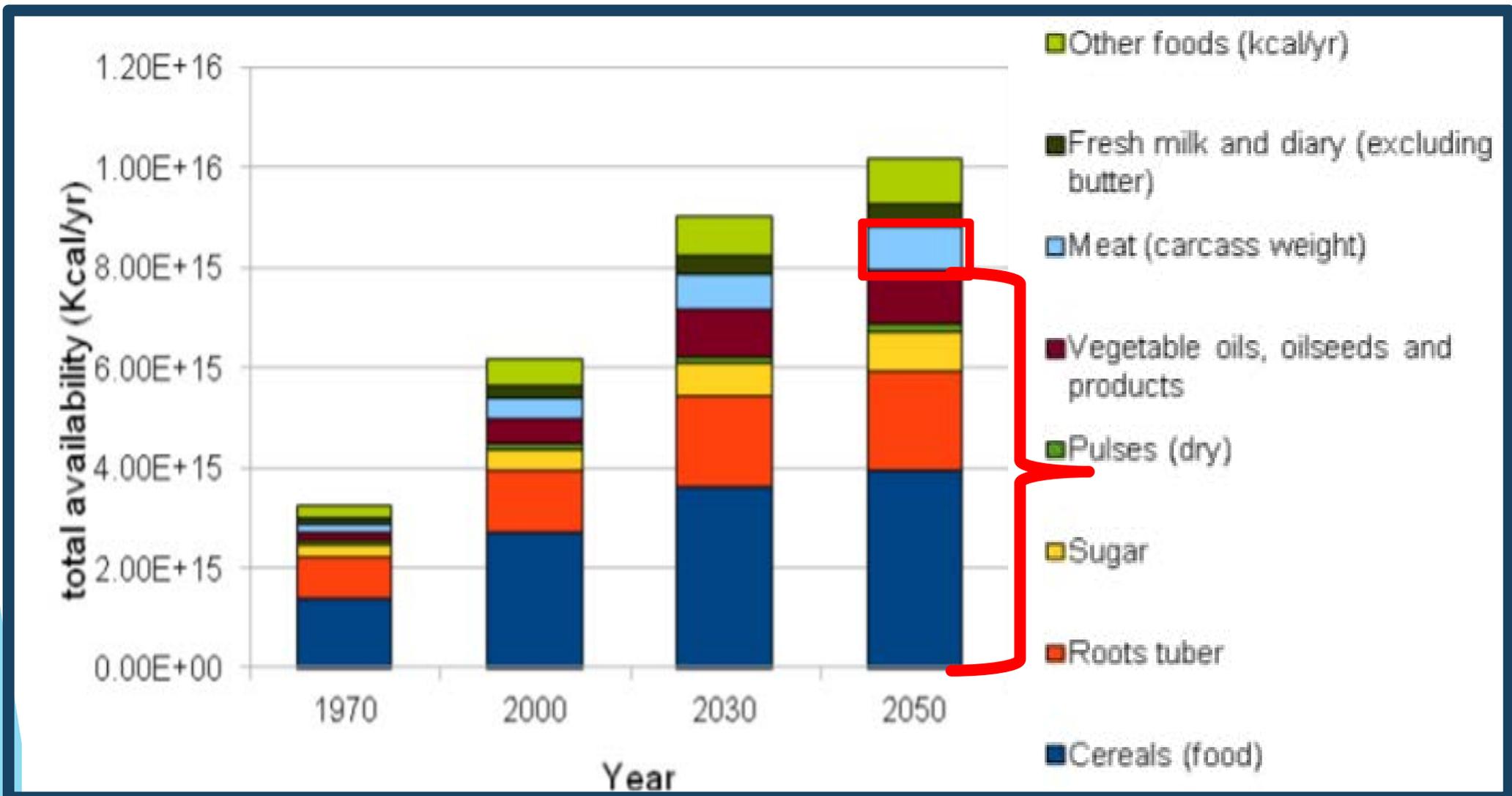
# Main Energy Source

## Conti....

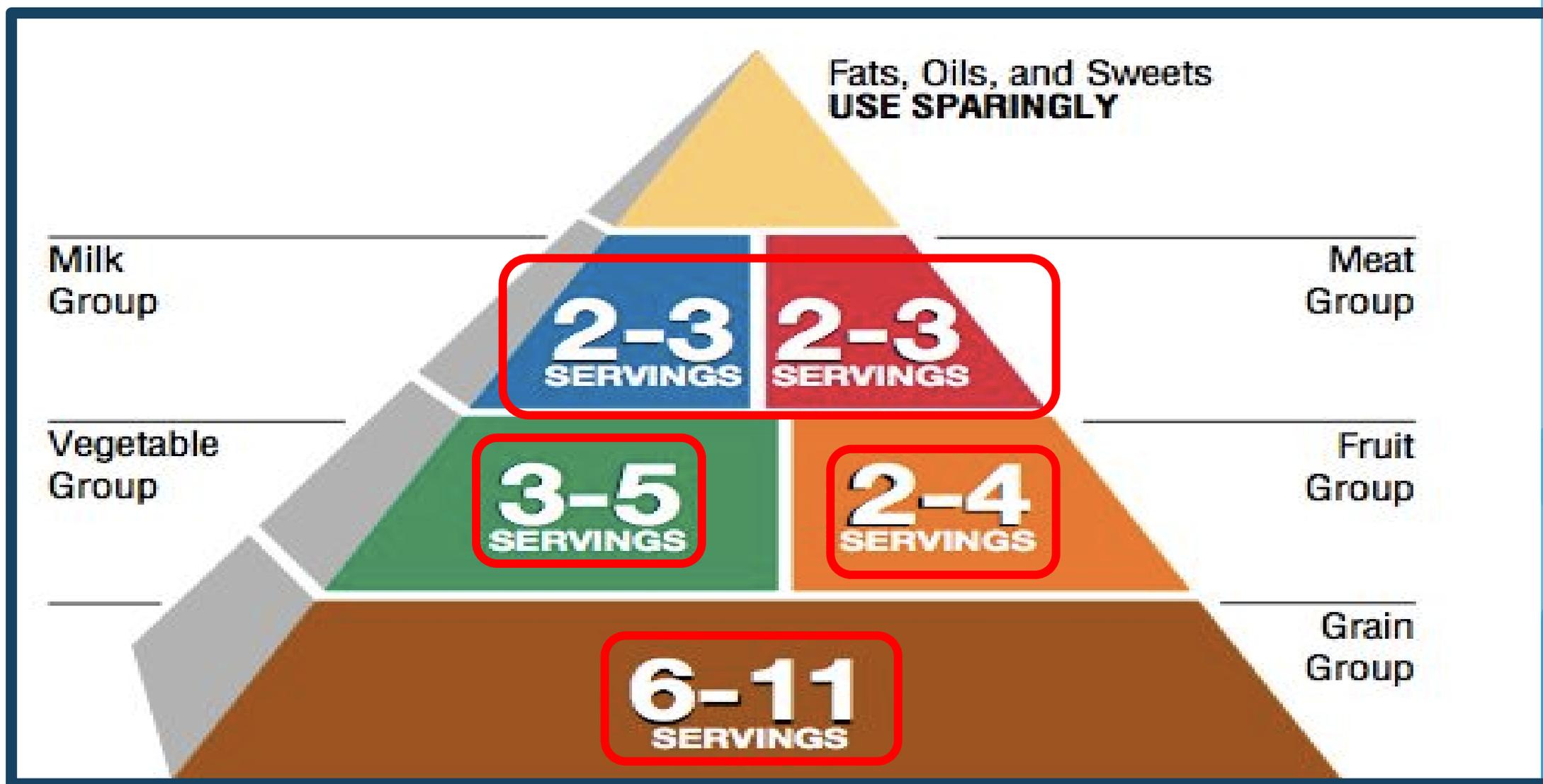
- An estimated **4 billion** live primarily on plant-based diets
- **2 billion** people live on meat-based diets



# Calories From Major Commodities (Developing Countries)



# Conti....



# The Food Guide Pyramid

## A Guide to Daily Food Choices

These symbols show fats and added sugars in foods:

### KEY

- Fat (naturally occurring and added)
- ▼ Sugars (added)

Fats, Oils, & Sweets  
**USE SPARINGLY**

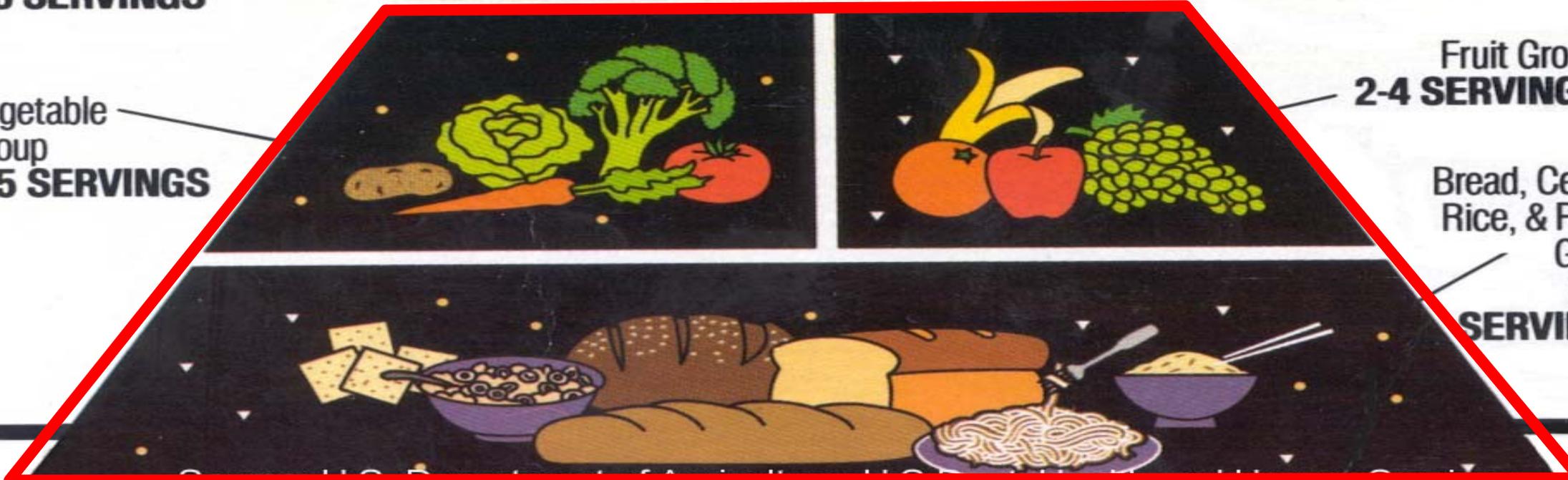
Milk, Yogurt,  
& Cheese Group  
**2-3 SERVINGS**

Vegetable  
Group  
**3-5 SERVINGS**

Meat, Poultry, Fish,  
Dry Beans, Eggs, &  
Nuts Group  
**2-3 SERVINGS**

Fruit Group  
**2-4 SERVINGS**

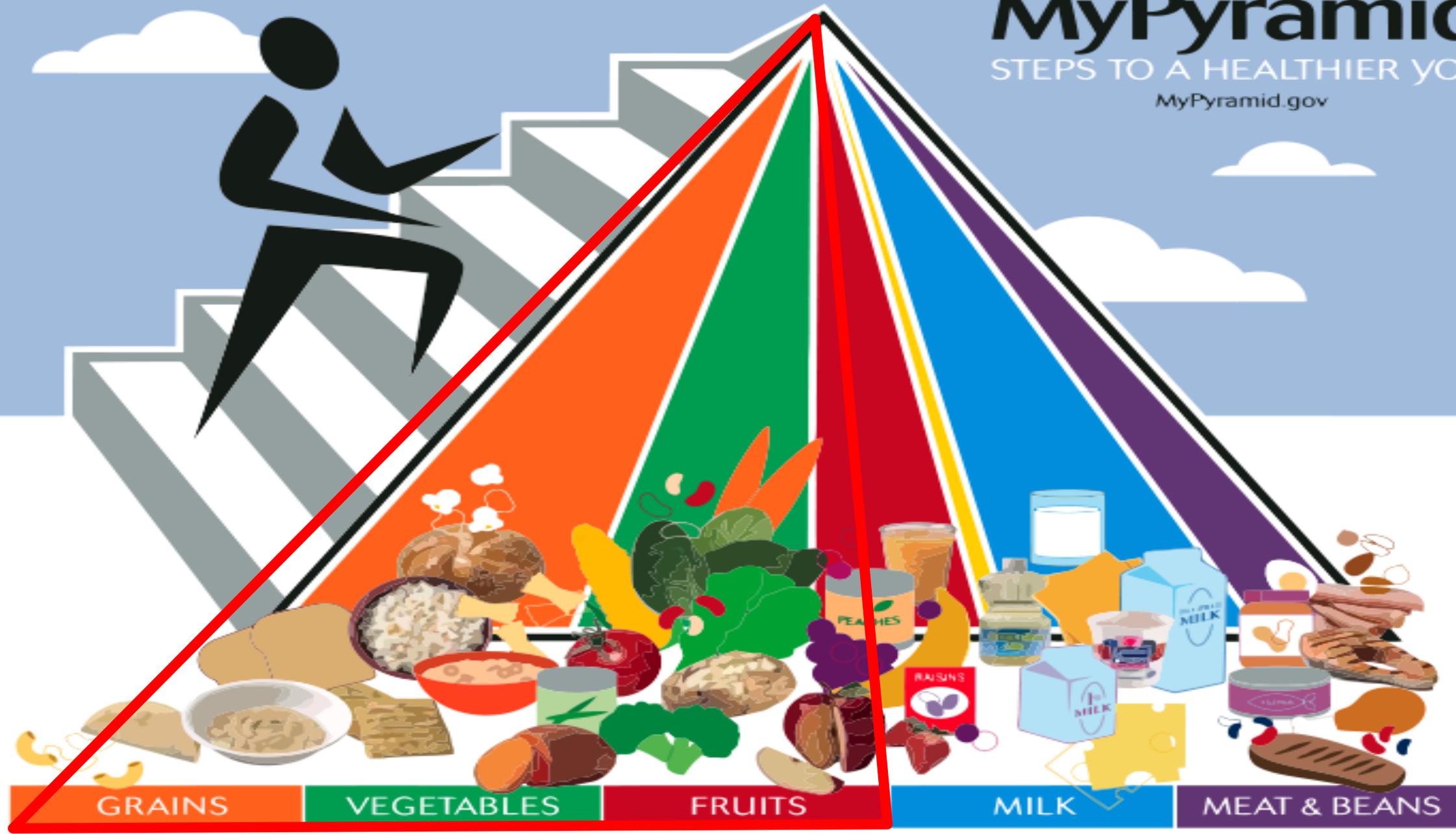
Bread, Cereal,  
Rice, & Pasta  
Group  
**6-11  
SERVINGS**



# MyPyramid

STEPS TO A HEALTHIER YOU

MyPyramid.gov



GRAINS

VEGETABLES

FRUITS

MILK

MEAT & BEANS

# The eatwell plate

Use the eatwell plate to help you get the balance right. It shows how much of what you eat should come from each food group.

Fruit and  
vegetables

Bread, rice,  
potatoes, pasta  
and other starchy foods



Meat, fish,  
eggs, beans  
and other non-dairy  
sources of protein

Milk and  
dairy foods

Food and drinks  
high in fat and/or sugar

# Canadian Food Guide

	Children			Teens		Adults			
	2-3	4-8	9-13	14-18 Years		19-50 Years		51+ Years	
	Girls and Boys			Female	Male	Female	Male	Female	Male
<b>Vegetables and Fruit</b>	4	5	6	7	8	7-8	8-10	7	7
<b>Grain Products</b>	3	4	6	6	7	6-7	8	6	7
<b>Milk and Alternatives</b>	2	2	3-4	3-4	3-4	2	2	3	3
<b>Meat and Alternatives</b>	1	1	1-2	2	3	2	3	2	3

Source: Eating Well with Canada's Food Guide. Health Canada, 2011. Reproduced with permission from the Minister of Health, 2013

# Australian Guide to Healthy Eating

Enjoy a wide variety of nutritious foods from these five food groups every day. Drink plenty of water.



Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties

Vegetables and legumes/beans



Lean meats and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans

Milk, yoghurt, cheese and/or alternatives, mostly reduced fat

Use small amounts



Only sometimes and in small amounts





# Diversity

# Conti....

- ▶ **250-300 thousand** known edible plant species
  - ✓ Humans use only **150-200**
- ▶ 75 % of the world's food → **12** plants and **5** animal species





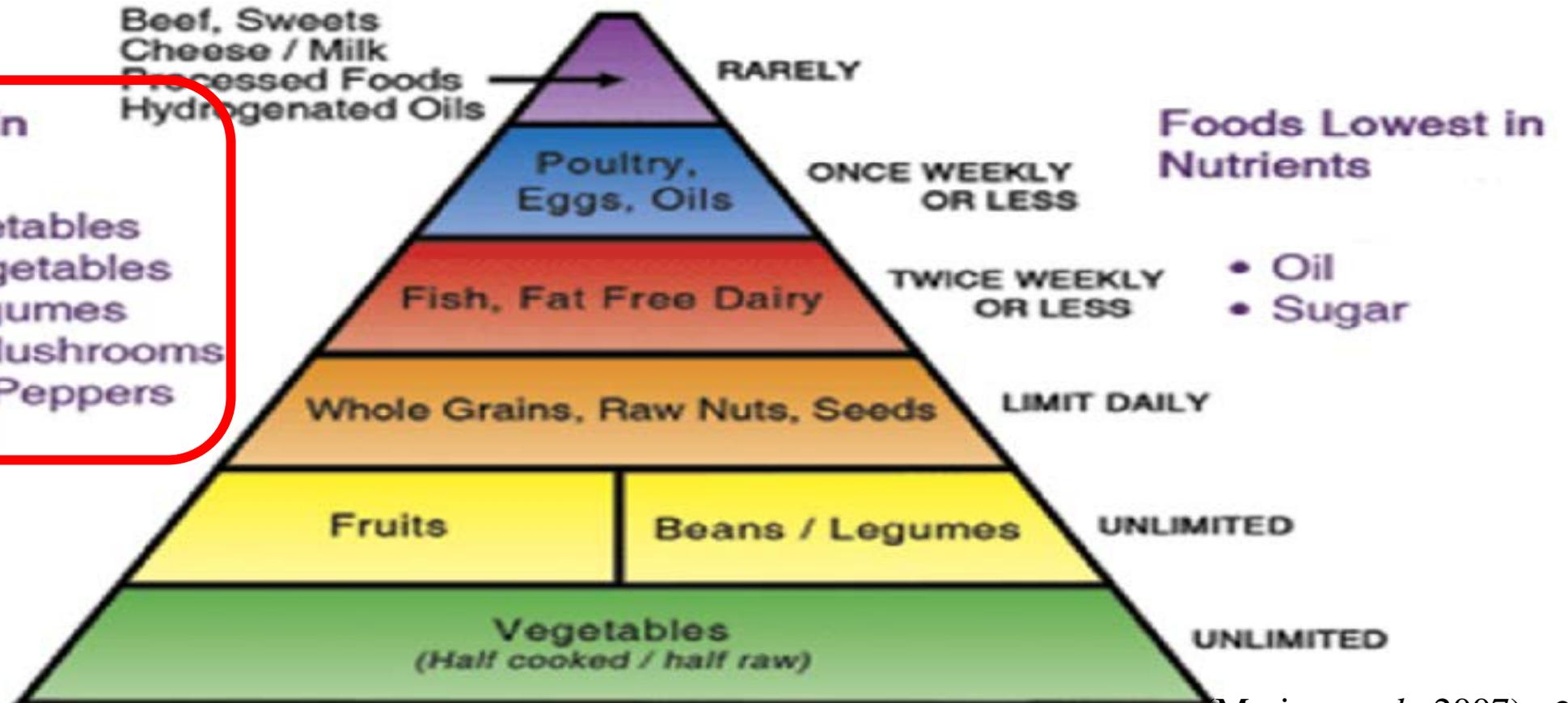
# Nutrient Density

Conti....

## Eating The Nutrient Dense Way

### Foods Highest in Nutrients

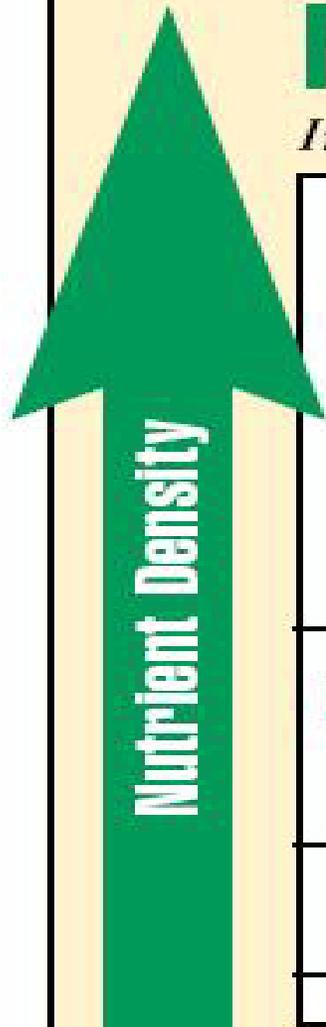
- Green Vegetables
- All Raw Vegetables
- Beans / Legumes
- Eggplant, Mushrooms
- Tomatoes, Peppers
- Fresh Fruit



Conti....

## Nutrient Density of Foods

*Indicating the frequency with which various foods should be eaten*



<b>Unlimited Quantities</b>	<i>Green vegetables All-raw vegetables Non-starchy cooked vegetables Beans and legumes Fresh fruit</i>
<b>Limited Quantities Daily</b>	<i>Cooked starchy vegetables Whole grains Raw nuts, seeds, and avocado</i>
<b>Limited Quantities Weekly</b>	<i>Fish<sup>1</sup> • Fat-free dairy Wild meats and fowl • Eggs</i>
<b>Rarely</b>	<i>Red meat • Refined grains • Full-fat dairy/cheese • Refined oils/sweets</i>



## **Economical and Sustainable**

# Conti....

Items	Units	Islamabad
		27-04-2017
Wheat	Kg	35
Wheat Flour	Kg	39
Chicken farm	Kg	163
Petrol	Ltr	74
Diesel	Ltr	83
Rice Basmati	Kg	85
Vegetable ghee	Kg	151
Eggs	Doz	86
Sugar	Kg	66
Beef	Kg	352
Gram Pulse	Kg	154
Milk Fresh	Ltr	99
Masoor Pulse	Kg	153
Moong Pulse	Kg	152
Mash Pulse	Kg	203
Red Chilies	Kg	300
Onion	Kg	54
Mutton	Kg	806
Tomatoes	Kg	49
Potatoes	Kg	44
DAP	50 Kg	2588 *
Tea	Kg	1025
Urea	50 Kg	1368 *

\*10

\*23

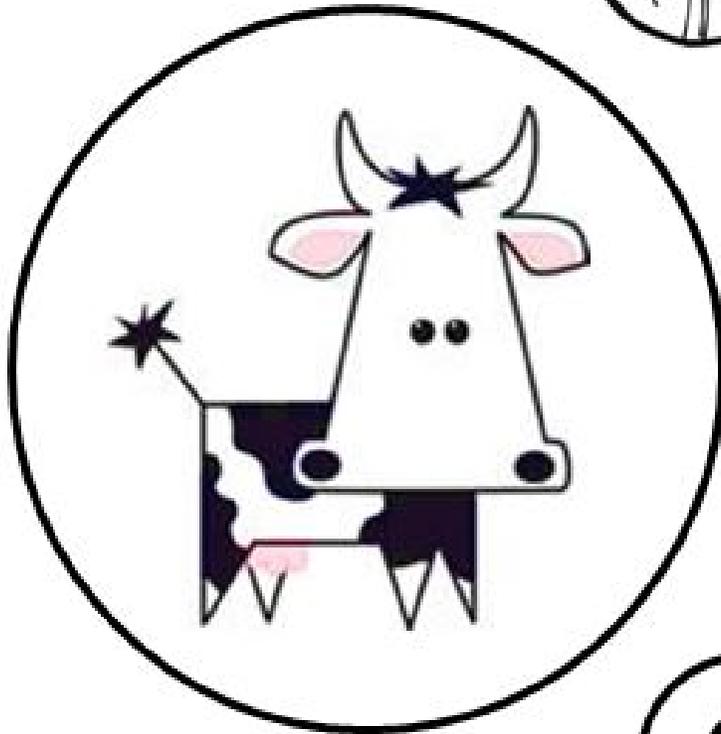


## Conti....

- Compared to plant-based foods, meat production requires:
  - ✓ More energy
  - ✓ More land
  - ✓ More water resources
- The American's livestock consumes **7 times** more grain than consumed by entire US people

## It Take A Lot Then We Think:

The production  
of **1 kilogram**  
beef costs:



**15 455** liter of water



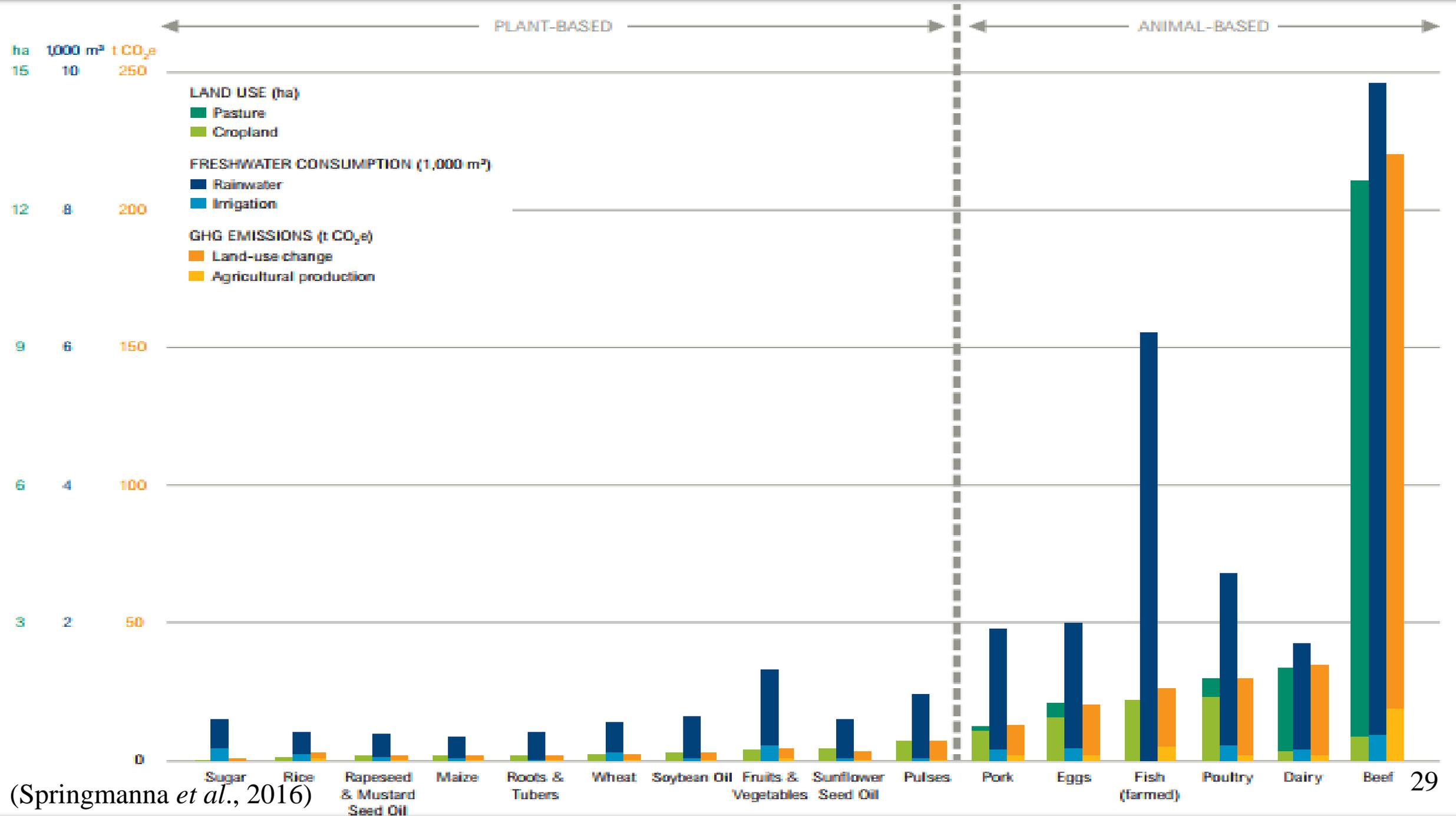
**6,5** kilogram of crop



**330** square meter of ground



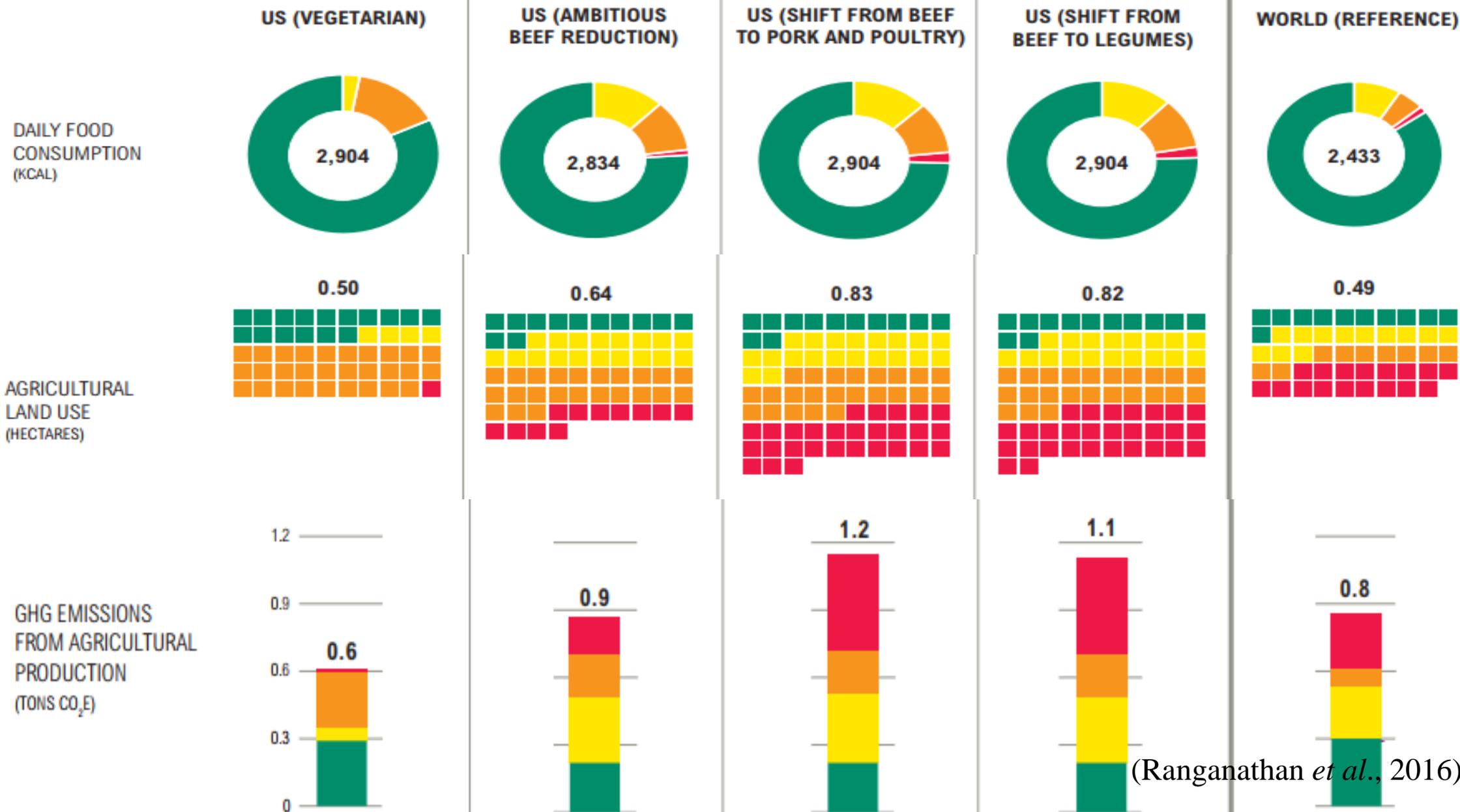
**16,4** kilograms of carbon dioxide

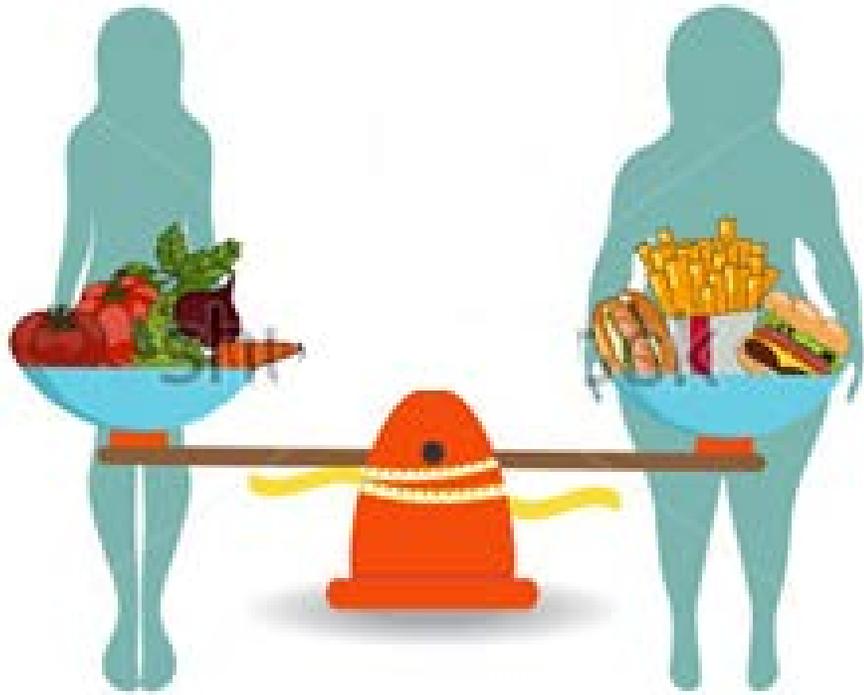


(Springmanna *et al.*, 2016)

REDUCE OVERCONSUMPTION OF PROTEIN BY REDUCING CONSUMPTION OF ANIMAL-BASED FOODS

REDUCE CONSUMPTION OF BEEF SPECIFICALLY





# Reduce Overconsumption of Calories



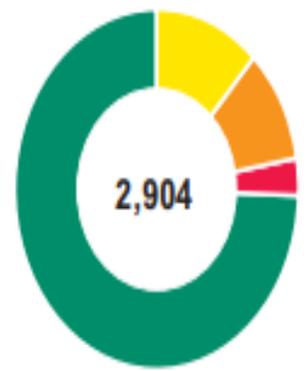
# Conti....

- Globally, there are **2.5 times** more overweight than undernourished people
- **One in three** adults are overweight

■ Beef ■ Dairy ■ Other Animal-Based Foods ■ Plant-Based Foods

REDUCE OVERCONSUMPTION OF CALORIES | REDUCE OVERCONSUMPTION OF PROTEIN BY REDUCING CONSUMPTION OF ANIMAL-BASED FOODS

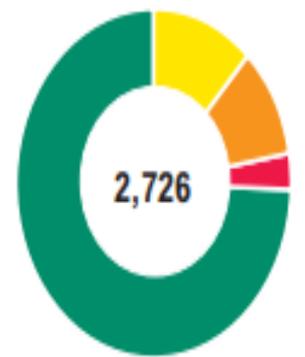
US (REFERENCE)



0.96



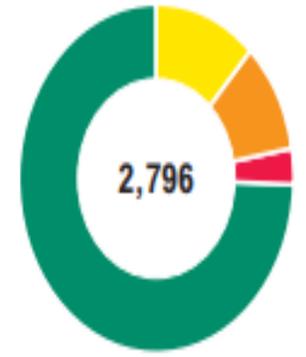
US (ELIMINATE OBESITY & HALVE OVERWEIGHT)



0.90



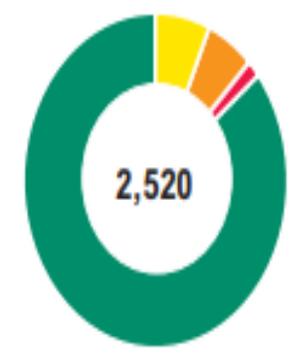
US (HALVE OBESITY & OVERWEIGHT)



0.93



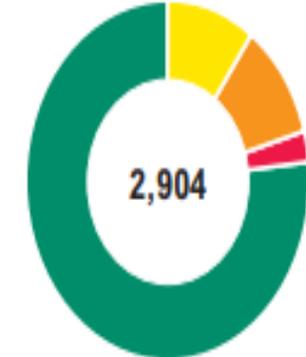
US (AMBITIOUS ANIMAL PROTEIN REDUCTION)



0.53



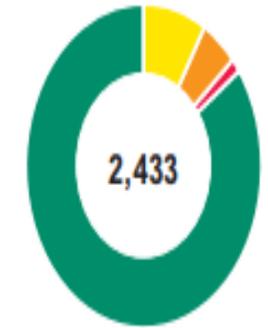
US (TRADITIONAL MEDITERRANEAN)



0.85



WORLD (REFERENCE)



0.49



DAILY FOOD CONSUMPTION (KCAL)

AGRICULTURAL LAND USE (HECTARES)

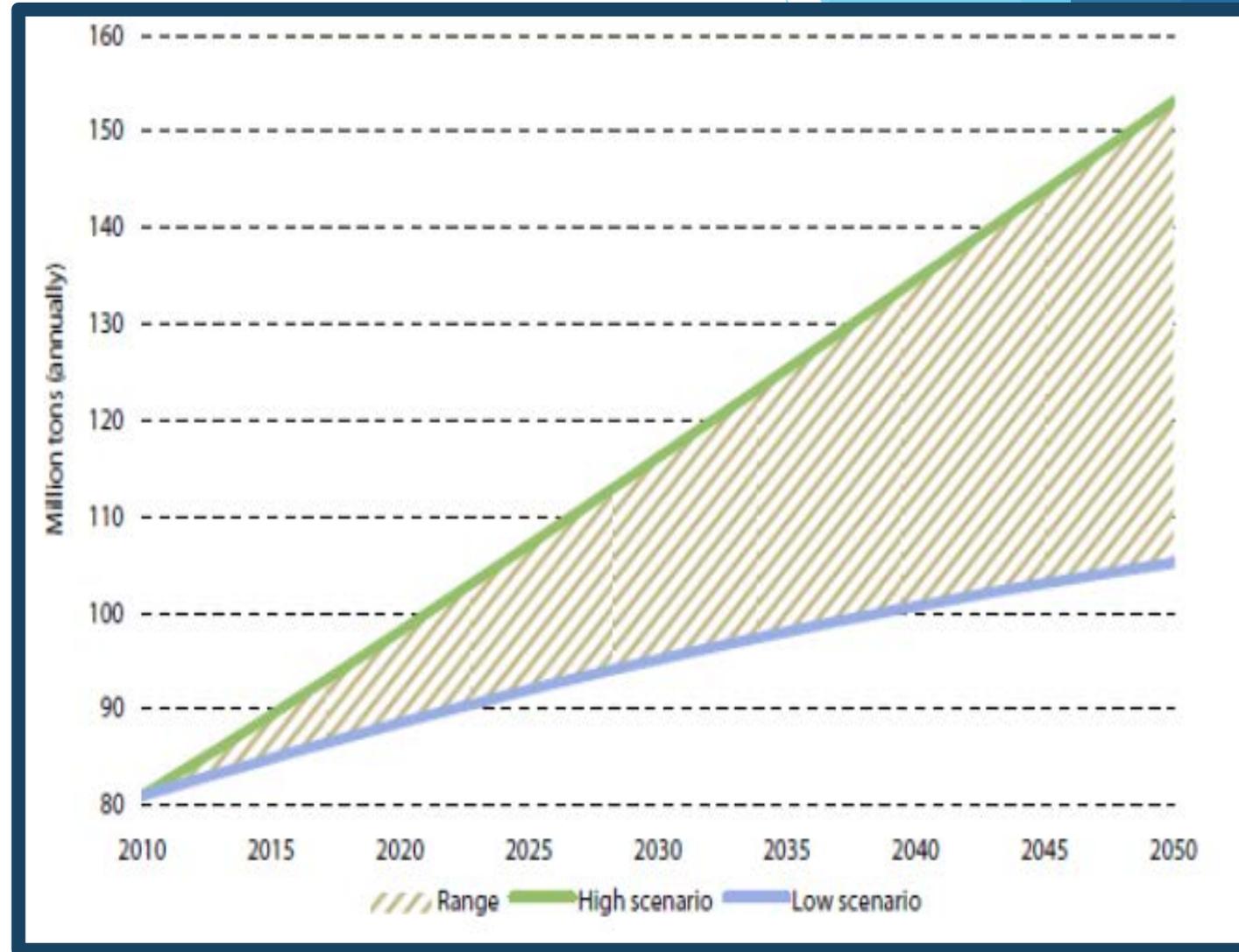


# Alternative Source of protein

# Conti....

- Global Population will increase from **7.2 billion** to **9.6 billion** by 2050
- Demand for protein will straiten the environment

Projected global protein demand, 2010 to 2050



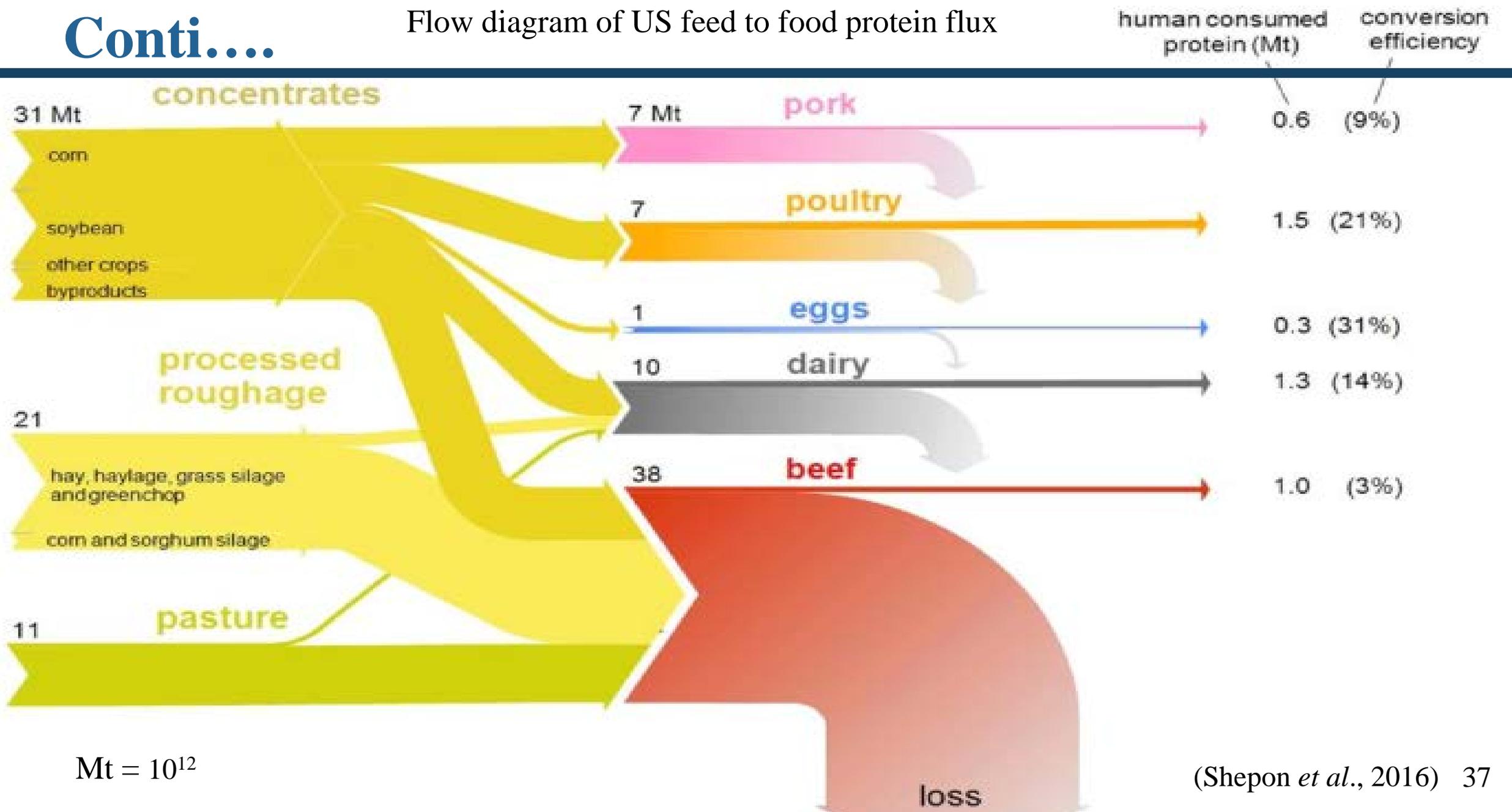
# Conti....

- Factors that involve in selection alternative source of protein
  - ✓ Availability
  - ✓ Affordability
  - ✓ Quality, safety
  - ✓ Supply chain and sustainability



# Conti....

Flow diagram of US feed to food protein flux



Mt = 10<sup>12</sup>



# Life Longevity

# Life Longevity

- Life span shows linear correlation with plant-based diet



Dies 19 month earlier



Dies 19 month later



Per day

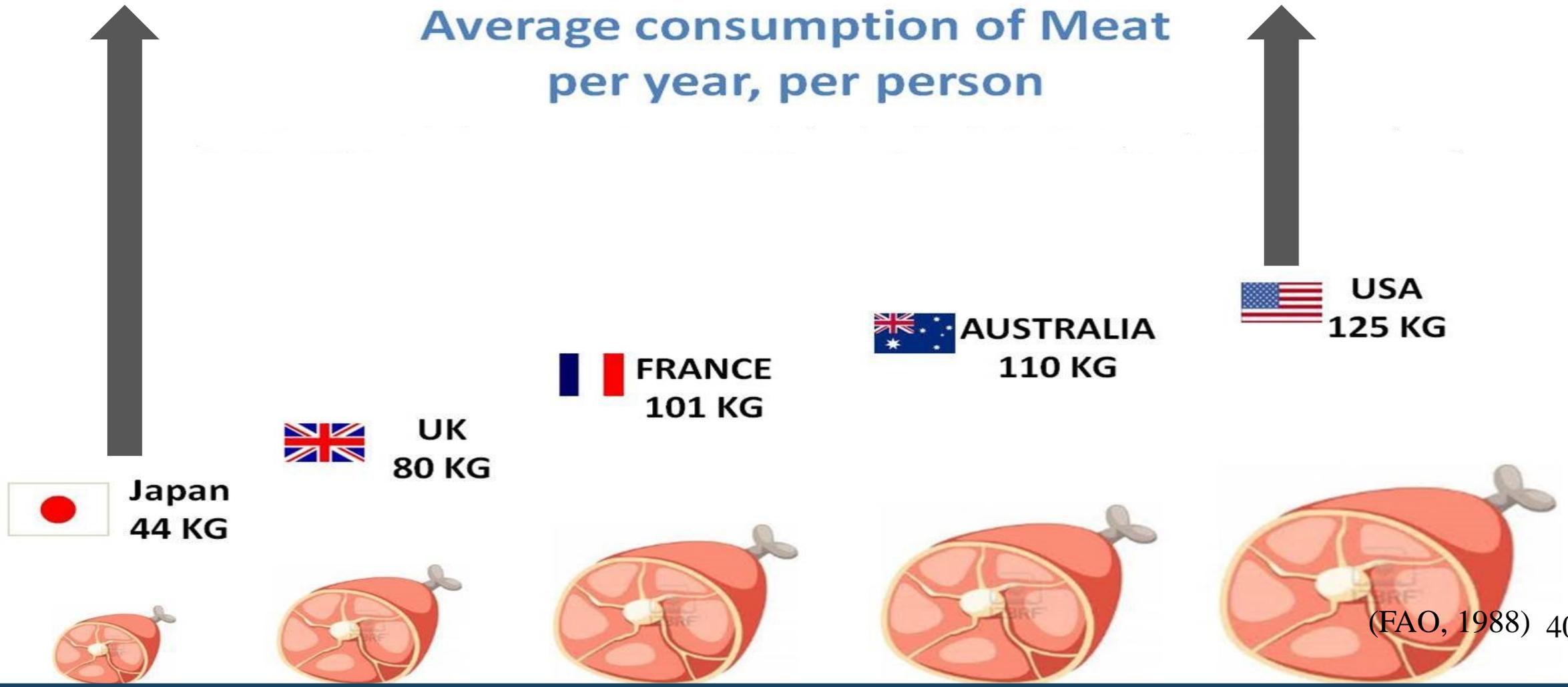


Extra year to a life span

*Lower Diseases Burden*  
*Highest life expectancy (1<sup>st</sup>)*

*Higher diseases burden*  
*Lower life expectancy (19<sup>th</sup>)*

Average consumption of Meat  
per year, per person

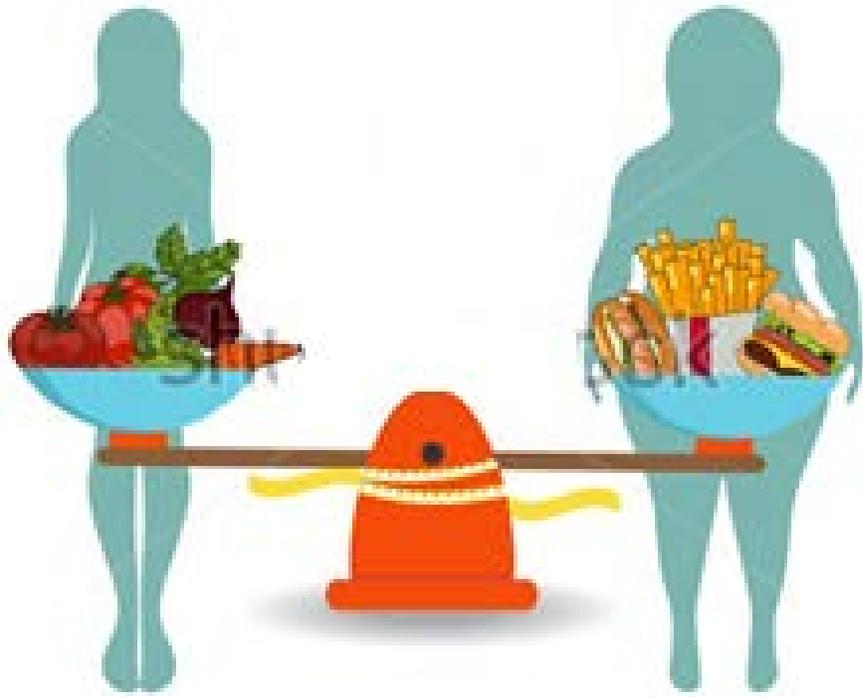




## **Better Shelf Life**

# Better Shelf Life



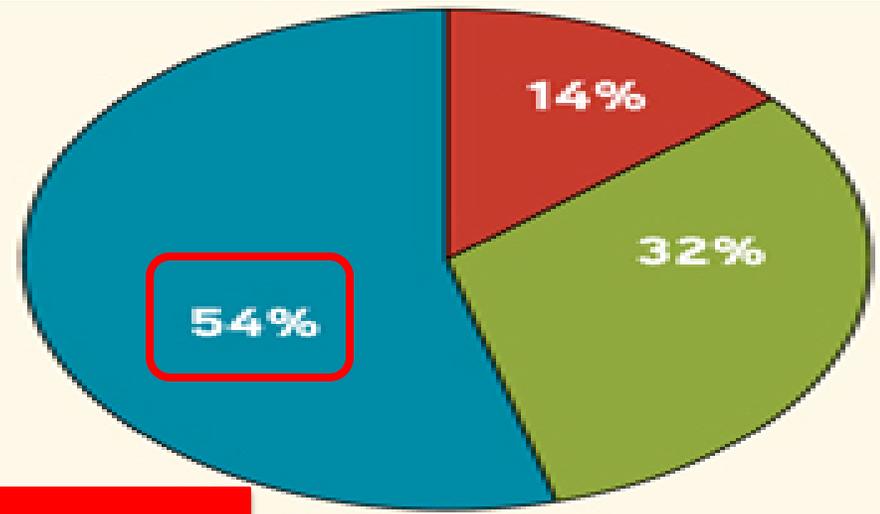
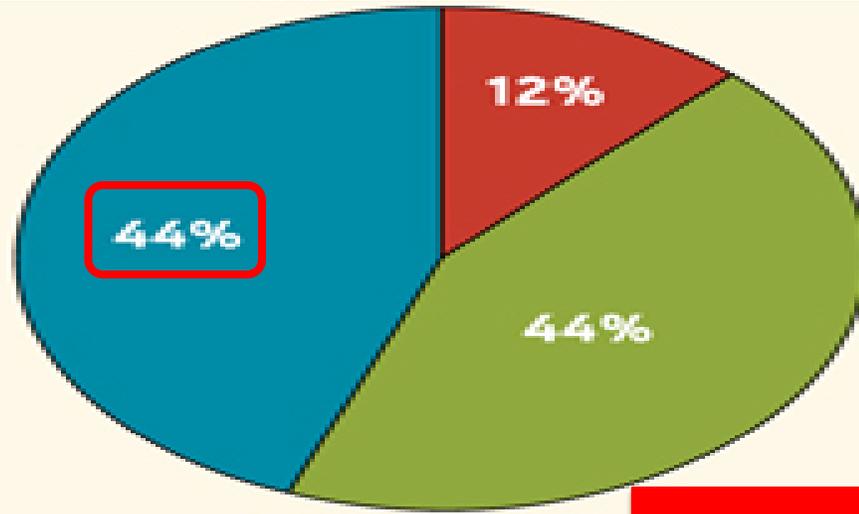


## **Less Number of Chronic Diseases**

# Conti....

- ▶ Several studies have shown that plant-based foods can be helpful in prevention and management of chronic diseases such as:
  - ✓ Heart diseases
  - ✓ Type II diabetes
  - ✓ High blood pressure
  - ✓ Obesity and overweight
  - ✓ Cancer

**Low- and Middle-Income Countries**

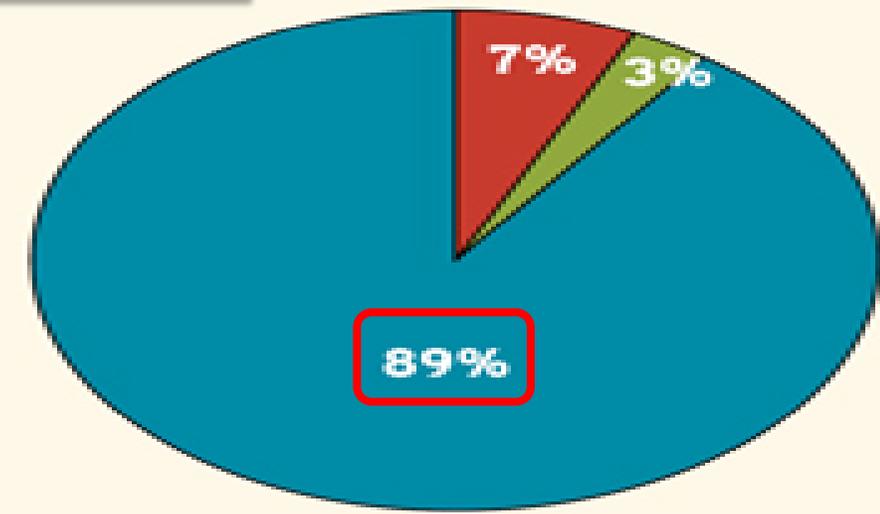
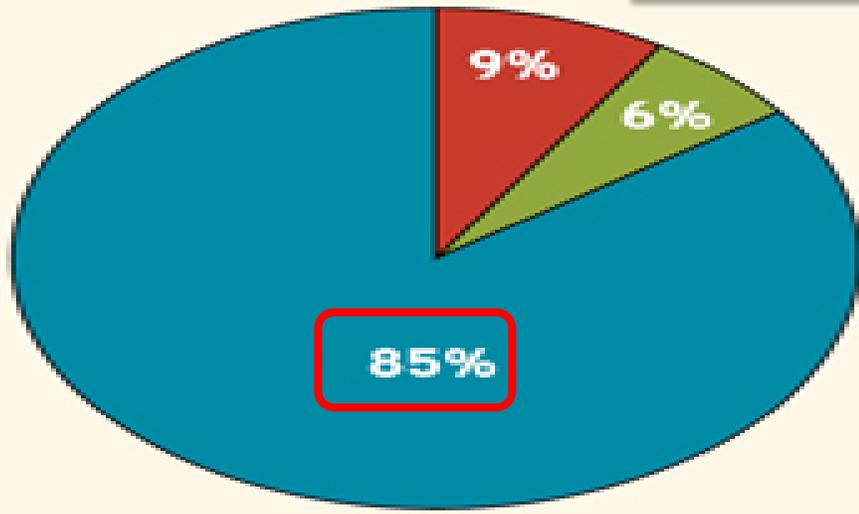


**2002**

**% Diseases Burden**

**2030**

**High-Income Countries**

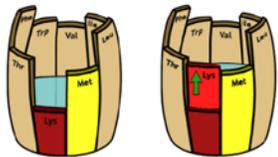


-  Communicable, maternal, perinatal, and nutritional conditions
-  Noncommunicable diseases
-  Injuries

# Challenges



Anti-nutritional factors



Limiting amino acids



Bioavailability

Biological value



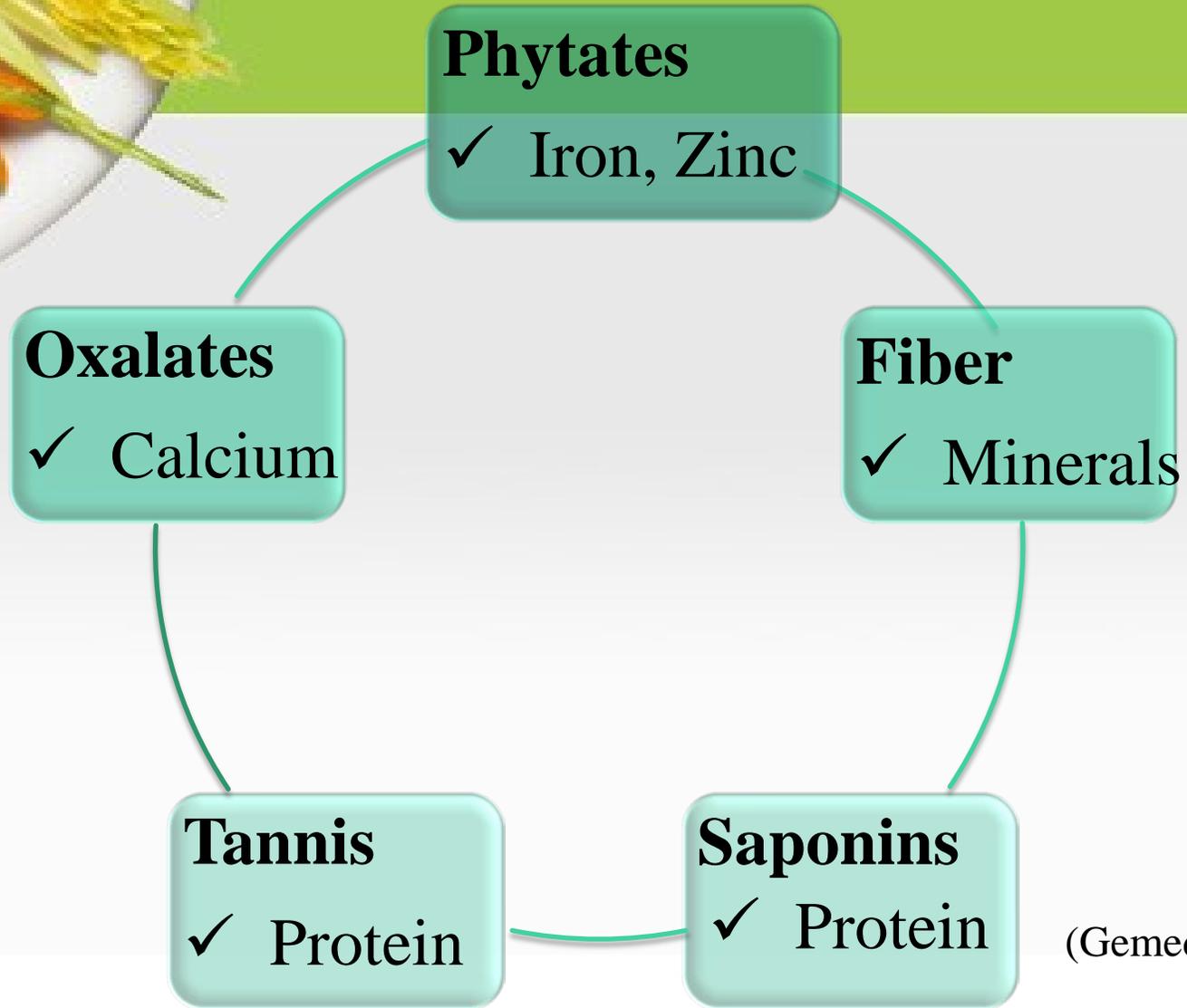
Deficient vitamins  
and minerals

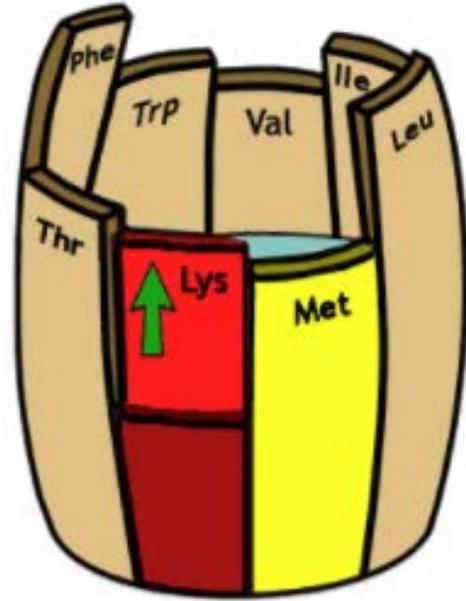
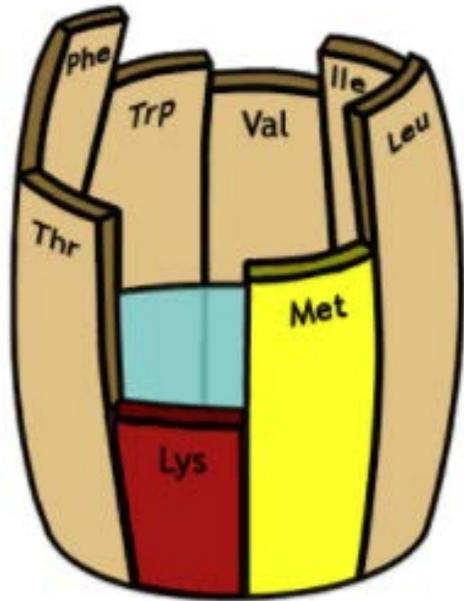


# Anti-Nutritional Factors



## Conti....





# Limiting Amino Acids

# Conti....

<b>Food</b>	<b>Limited Amino Acid</b>	<b>Complement</b>
Beans	Methionine	Grains, nuts, seeds
Grains	Lysine, threonine	Legumes
Nuts/seeds	Lysine	Legumes
Vegetables	Methionine	Grain, nuts, seeds
Corn	Tryptophan, lysine	Legumes



## Deficient Vitamins and Minerals



# Conti...

## Vitamins



- Vitamin B12
- Vitamin D

## Minerals



- Zinc
- Calcium



# Bioavailability

Conti....

Examples of diets with estimated overall iron bioavailability

Typical diet	Bioavailability of Fe
Cereal-based, roots or tubers and legumes (with negligible meat, fish or ascorbic acid-rich foods)	Low (5 % absorption)
Cereal-based, roots or tubers (with small quantities of food of animal origin, or containing ascorbic acid and large amounts of tea or coffee)	Intermediate (10% absorption)
Diverse diet containing generous quantities of meat, poultry and fish or foods containing high amounts of ascorbic acid	High (15% absorption)



# Biological value

## Conti....

Source of protein	PER	BV	NPU	Chemical score	Limiting amino acids
Egg	4.5	94	90	100	Nil
Milk	3	84	75	65	S-Containing amino acids
Fish	3	85	70	60	Tryptophan
Meat	2.7	75	76	70	S-Containing amino acids
Rice	2.2	68	60	60	Lysine, threonine
Wheat	1.5	58	47	42	Lysine, threonine
Bengal gram	1.7	58	47	45	S-Containing amino acids
Red gram	1.5	57	46	45	S-Containing amino acids
Groundnut	1.7	55	45	44	Lysine, threonine, S-Containing amino acids
Soyabean	2.1	65	55	55	S-Containing amino acids

PER=Protein Efficiency Ratio, BV=Biological Value, NPU=Net Protein Utilization  
S=Sulphur

# Strategies to shift consumption





# Conclusion

- Adopting plants based diets could be beneficial:
  - ✓ In alleviating food insecurity
  - ✓ In reducing gas emission and global warming
  - ✓ In imparting therapeutic benefits
- Strategies like shift consumption wheel are beneficial in reducing challenge regarding plants based diets



# Take Home Message

*Balanced diet with more focus on plant-based foods  
and less red meat foods.....*

*We can ensure quality life*



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A fountain pen with a gold nib, black barrel, and wooden grip, lying on a white card with the words "Thank You" written in cursive.

Thank You

ANY  
QUESTIONS?

