

# Why nutrition matters: pathology and pathophysiology

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# Conflicts of Interests Declaration

- Chair of the British Society of Gastroenterology Small Bowel & Nutrition Committee
- Member of BAPEN Medical Committee
- No other conflicts of interests relevant to this talk

# Overview

Why malnutrition and obesity are important to patients and the NHS

Overview of nutritional management

Estimating requirements

Micronutrients and their importance

Why nutrition matters in clinical practice and for your training/careers

# Malnutrition

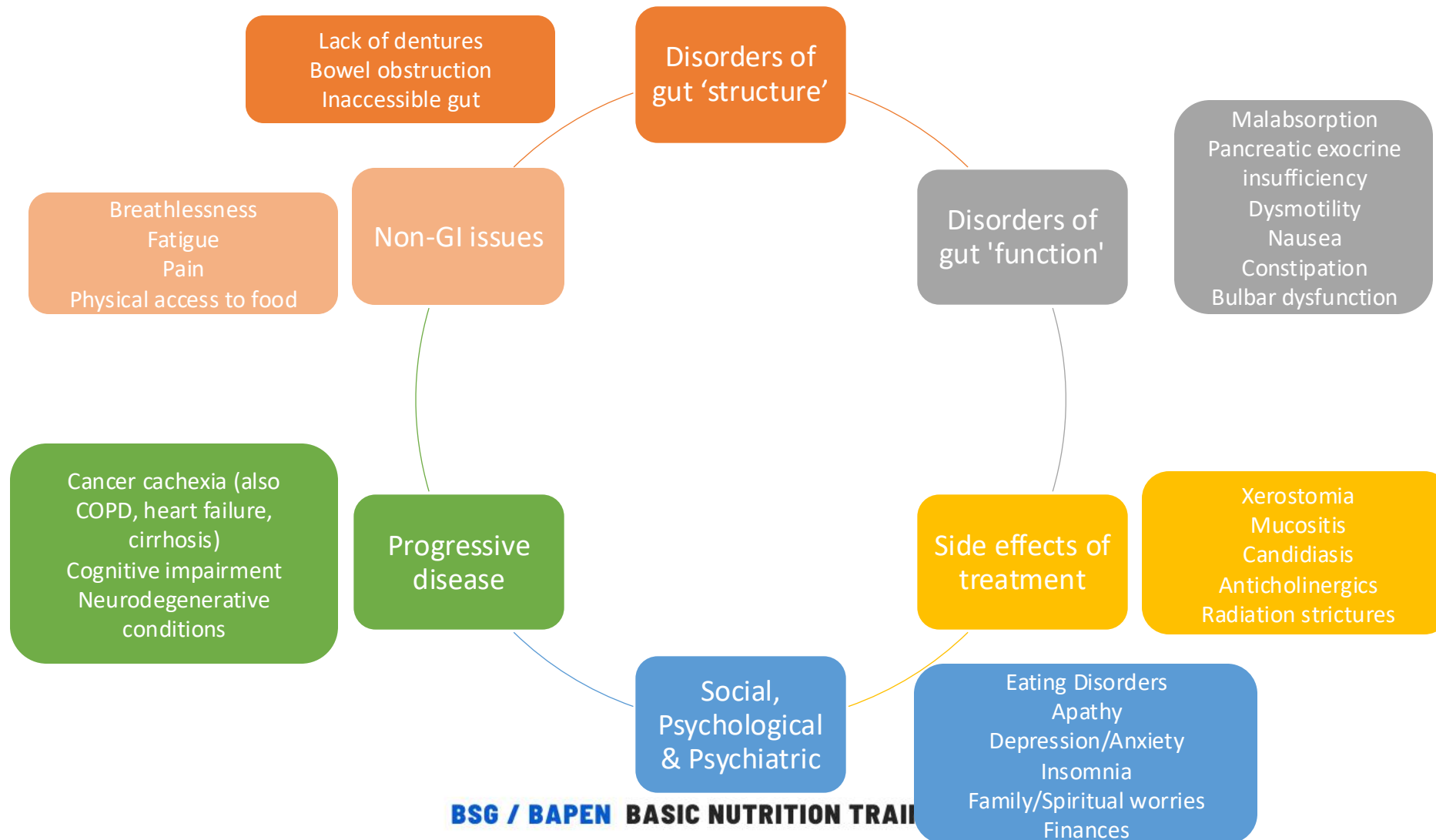
*A state of nutrition in which a deficiency or excess of energy, protein and other nutrients causes measurable adverse effects on tissue/body form, function and clinical outcome*

*Elia 2000*

Survival without food: 10 weeks

Survival without water: 3-14 days

# Causes of malnutrition



# Causes of malnutrition

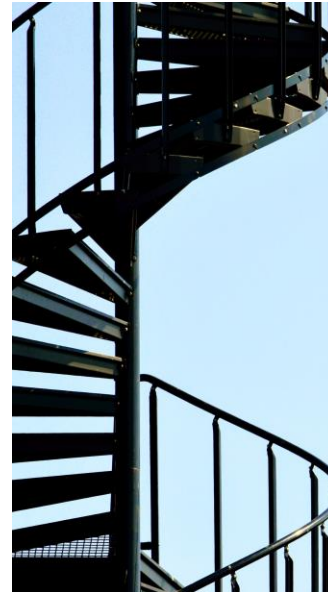


Management of malnutrition differs depending on the underlying cause and today's training day will touch on some of these

# Consequences of malnutrition

## Biological

- Infection risk
- Reduced respiratory function
- Thin skin and loss of protective skin barrier
- Impaired temperature regulation
- Venous thromboembolism
- Reduced bone health
- Pressure ulcers
- Poor wound healing
- Psychological effects
- Reduced response to chemotherapy
- Increased mortality

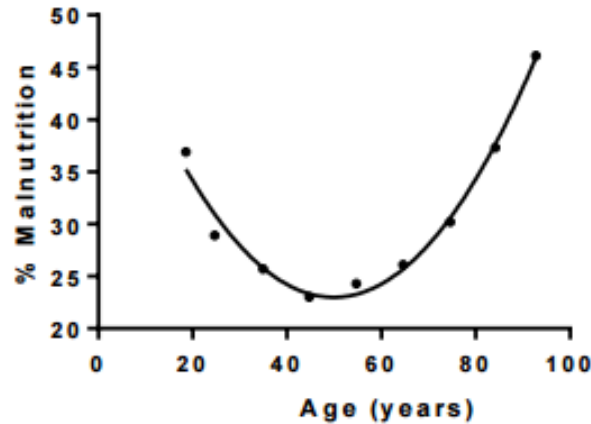


## Personal

- Falls and injuries (reduced muscle strength)
- Difficulty with ADLs and independence
- Reduced ability to work and socialize
- Self neglect
- Increased healthcare use  
-admissions and length of stay

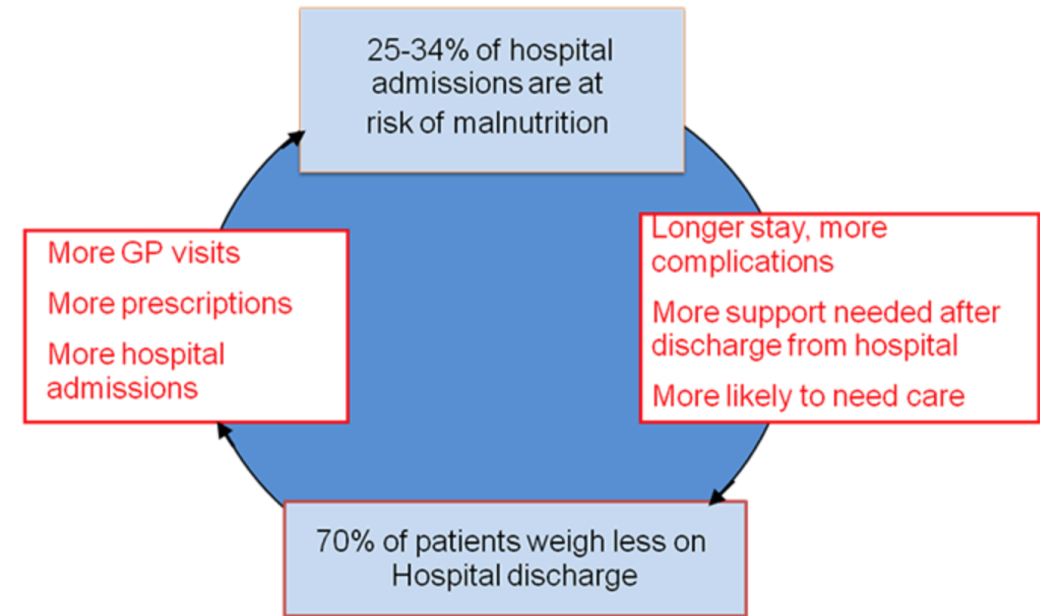
Without action, malnutrition begets malnutrition

# Consequences of malnutrition



**Figure A.3** The prevalence of malnutrition (medium + high risk) according to 'MUST' on admission to hospital according to 10-year age bands (based and Nutrition Screening Week survey in England, N = 23,631)<sup>25</sup>.

## The Malnutrition Carousel

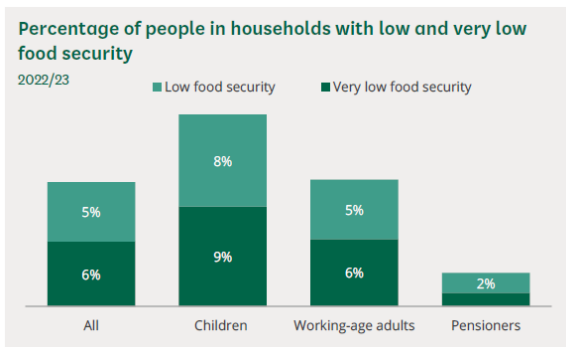


£23.5 billion per annum in 2015  
(equates to 15% of the health & social care budget in 2020)

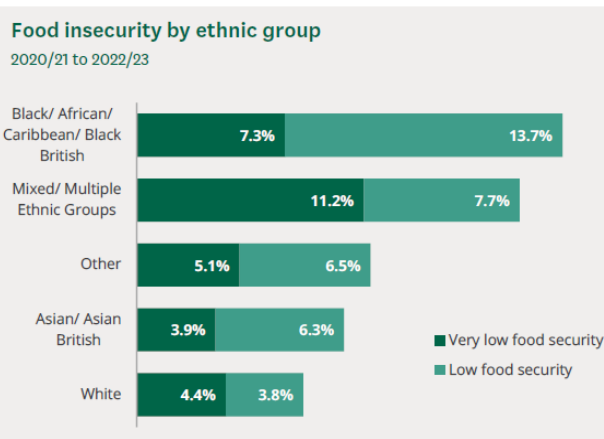


# Food insecurity in the community

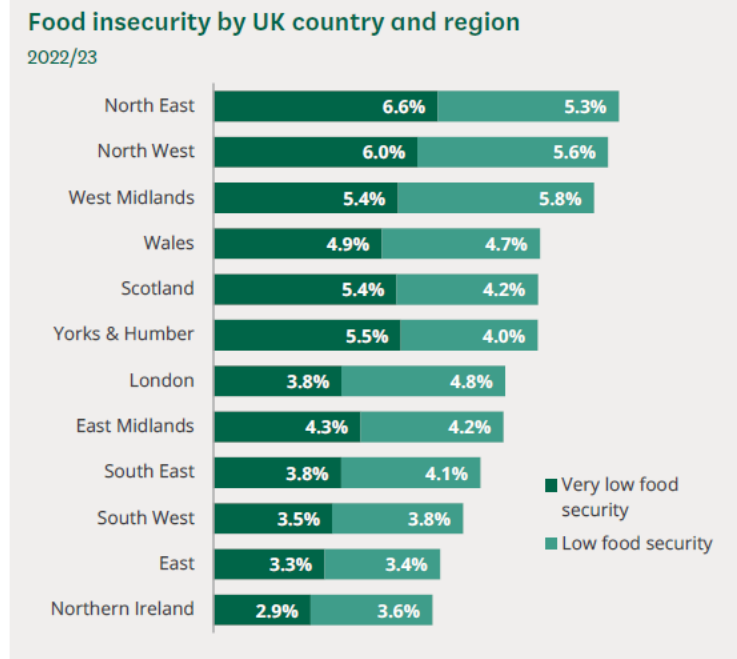
“Inability to acquire adequate or sufficient quantity of food in socially acceptable ways”



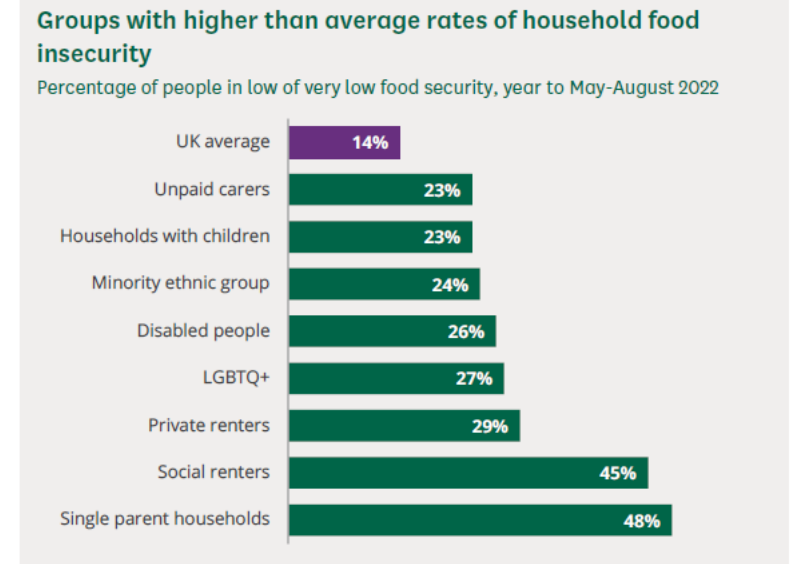
Source: DWP, [Households Below Average Income](#), Tables 9.1b, 9.3b, 9.5b, 9.7b



Source: DWP, [Households Below Average Income](#), via [Stat-Xplore](#)



Source: DWP, [Households Below Average Income](#), via [Stat-Xplore](#)



Source: Trussell Trust, [Hunger in the UK](#), June 2023

# Overnutrition is also a problem



Navigation: Home | News | Sport | Weather | iPlayer | So

**NEWS**

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England | Local News

## Children as young as three treated for obesity



Navigation: Home | News | Sport | Weather | iPlayer | So

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Health

## Millions more middle-aged are obese, study suggests

15 May · 704 Comments



Navigation: Home | News | Sport | Weather | iPlayer | So

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## Fatty liver disease affecting one in five young adults, Bristol study shows

17 April



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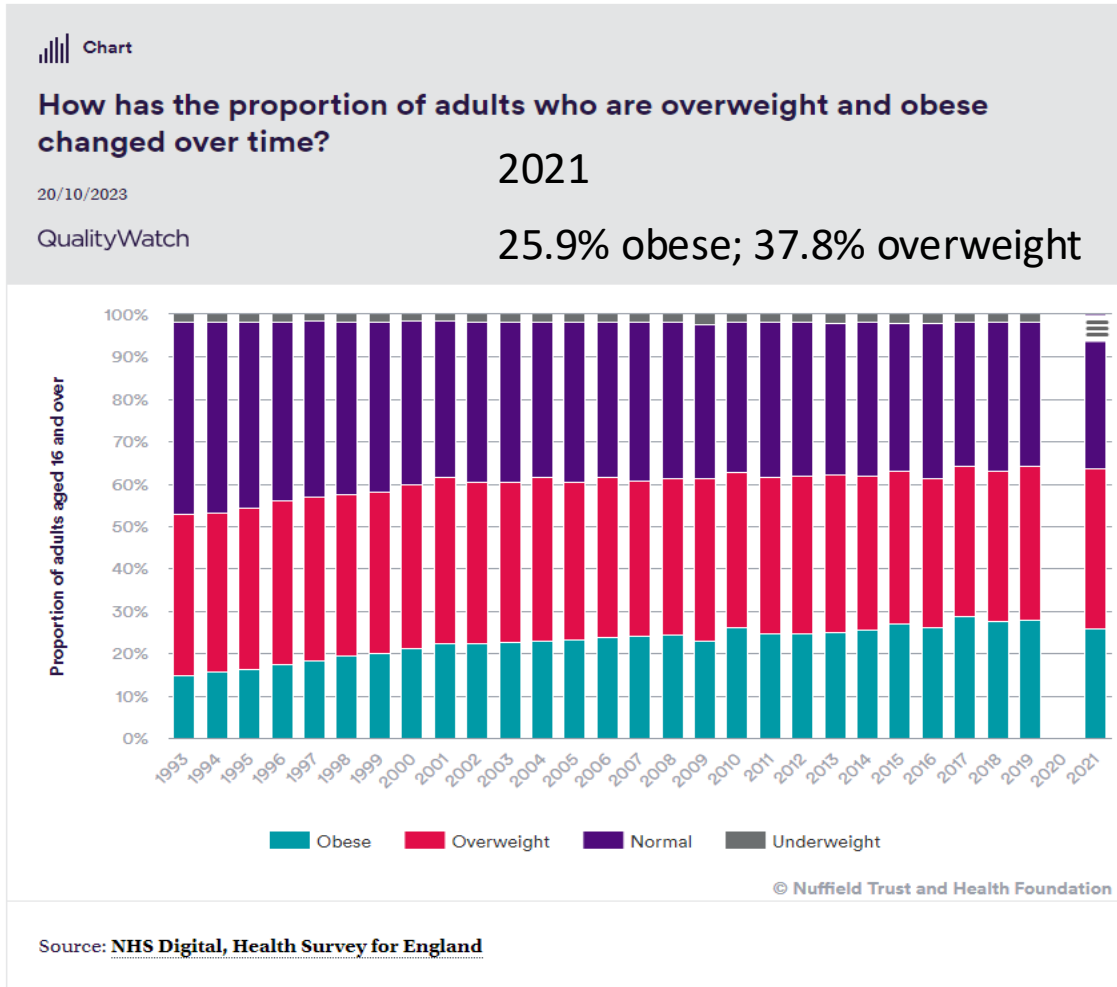
**NEWS**

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Health

## Pharmacists warn over fake weight-loss jabs

# Overnutrition is also a problem



Source: *Bell, Woolley, Toms and Lebre de Freitas (2023)*

	Costs from obesity (% total)	Costs from overweight (% total)	Costs from overweight and obesity (% total)
<b>Individual costs – reduction in longevity and quality of life, informal social care</b>	54 (72%)	9 (40%)	63 (64%)
<b>NHS costs</b>	11 (15%)	8 (20%)	19 (20%)
<b>Wider society costs – costs of inactivity in work, formal social care</b>	9 (13%)	6 (26%)	16 (16%)
			<b>4% GDP</b>
<b>Total in £bn</b>	74	24	98

Bariatric surgery (and consequent intestinal failure in some)

Novel medical therapies (and the adverse consequences)

Health tourism (and the complications)

# Beware the malnourished obese...

**Objective Measurements**

Complete all relevant fields and your results will automatically appear below. [Clear all values](#)

Current weight (Metric)  kg Imperial Metric

Current height (Metric)  m Imperial Metric

Weight 3-6 months ago (Metric)  kg Imperial Metric

Acute disease effect (ADE)\*\*  \*\*Acute Disease Effect (ADE) - select yes if acutely ill and if there has been or is likely to be no nutritional intake for more than 5 days. Note that ADE is unlikely to occur outside hospital.

BMI:	BMI Score:	Weight Loss:
18.3 kg/m <sup>2</sup>	2	3.6%
Weight Loss Score:	Acute Disease Score:	Total Score:
0	0	2

**Risk Category: HIGH**

**Objective Measurements**

Complete all relevant fields and your results will automatically appear below. [Clear all values](#)

Current weight (Metric)  kg Imperial Metric

Current height (Metric)  m Imperial Metric

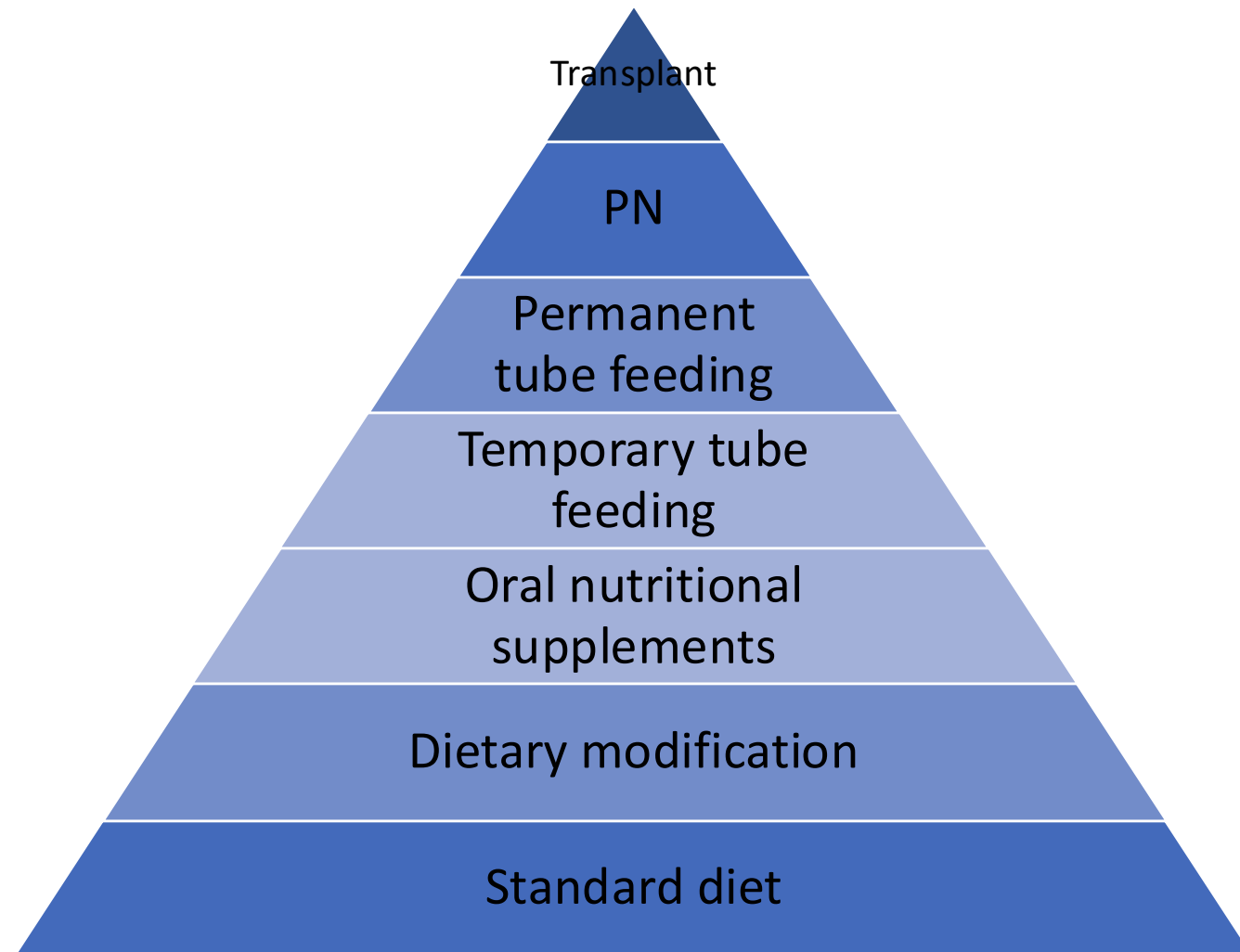
Weight 3-6 months ago (Metric)  kg Imperial Metric

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BMI:	BMI Score:	Weight Loss:
32.1 kg/m <sup>2</sup>	0	10.4%
Weight Loss Score:	Acute Disease Score:	Total Score:
2	0	2

**Risk Category: HIGH**

# Overview of nutritional management



But these are not mutually exclusive routes and some patients will be on a combination of strategies

# Estimating requirements

## Macronutrients

- Total calories 25-35 kcal/kg/day (including that derived from protein)
- Protein 0.8-1.5 g/kg/day
- 4 kcal/g of carbohydrate (glucose) and protein, and 9 kcal/g of lipid

## Micronutrients

## Fluid and electrolytes

- 30-35 mL/kg/day
- Don't overload and caution with saline
- Remember magnesium, calcium and phosphate

# How to estimate - macronutrients

You must involve dietetic colleagues as the experts in this

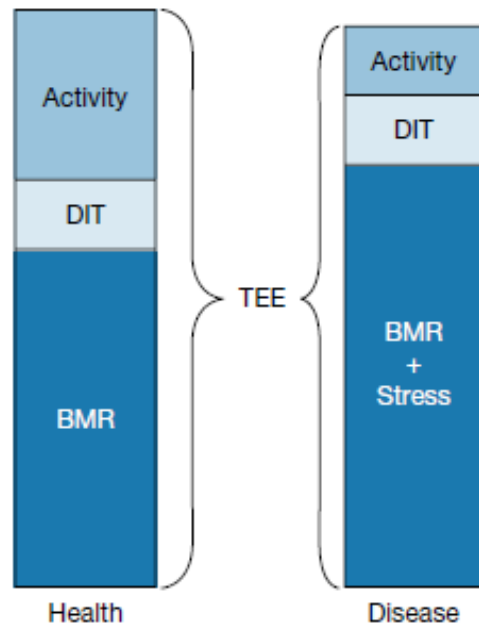


Figure 6.1.1 Energy expenditure in health and disease (source: The British Dietetic Association, 2013. Reproduced with permission from The British Dietetic Association, www.bda.uk.com)

Energy: basal metabolic rate (and illness factor), dietary induced thermogenesis and activity

-Harris-Benedict; Schofield; Henry

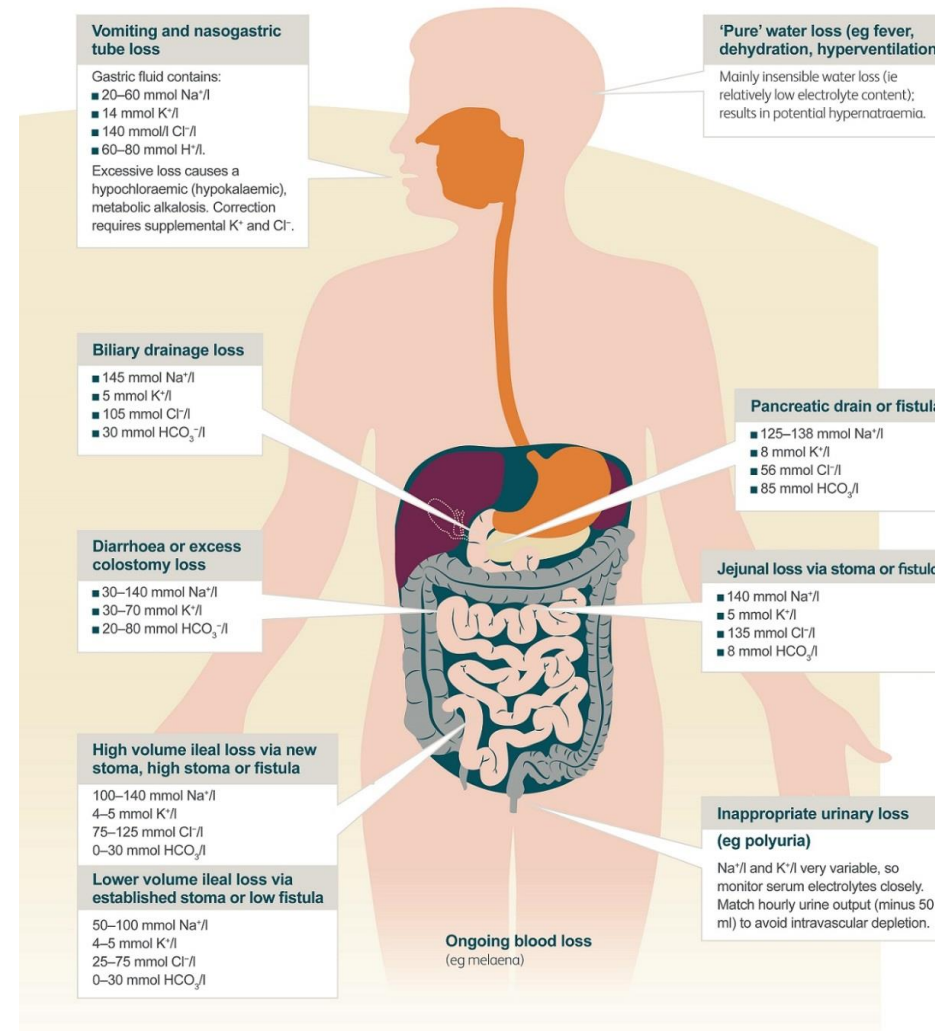
-BUT, data for BMR derives from healthy people; and 'fudge' factors for illness and activity are not founded in solid evidence

-Lipid important for fat soluble vitamins and essential fatty acids (omega-3 and omega-6)

Protein: increased requirements may be needed in post-operative settings, elderly, cirrhosis etc



# How to estimate - fluid



NICE CG174, 2013



# Water-soluble vitamins

Vitamin		Deficiency state
B1	Thiamine	
B2	Riboflavin	
B3	Niacin	
B5	Pantothenic Acid	
B6	Pyridoxine	
B7	Biotin	
B9	Folic Acid	
B12	Cobalamin	
C	Ascorbic Acid	

# Water-soluble vitamins

Vitamin		Deficiency state
B1	Thiamine	Dry beriberi – peripheral neuropathy Wet beriberi – dilated cardiomyopathy, fluid overload Wernicke’s encephalopathy (acute; ophthalmoplegia, ataxia, confusion) Korsakoff’s psychosis (chronic; amnesia, confabulation)
B2	Riboflavin	Stomatitis, seborrhoeic skin lesions, corneal vascularisation
B3	Niacin	Pellagra (3 Ds: (photosensitive) dermatitis, diarrhoea, dementia)
B5	Pantothenic Acid	Rare
B6	Pyridoxine	Rare
B7	Biotin	Hair loss, scaly dermatitis
B9	Folic Acid	Megaloblastic anaemia
B12	Cobalamin	Megaloblastic anaemia, nerve myelination
C	Ascorbic Acid	Scurvy, iron deficiency

# Fat-soluble vitamins, and minerals

Vitamin	Deficiency state
A	Night blindness, xerophthalmia, reduced immune function, hyperkeratosis (NB excess can cause birth defects so caution in pregnancy)
D	Rickets (children), osteomalacia (adults)
E	Haemolytic anaemia, thrombocytosis, dysarthria, retinopathy
K	Bleeding

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Mineral	Deficiency state
Copper	Fatigue, anaemia, neurological deficits (neuropathy, myelopathy), neutropenia
Selenium	Cardiomyopathy, hypothyroidism (needed for T4 to T3 conversion)
Zinc	Acne, alopecia, stomatitis, mouth ulcers, disturbance in taste and smell, diarrhoea, reduced testosterone, stunted growth
Iron	Anaemia

# Difficult to measure with inflammation

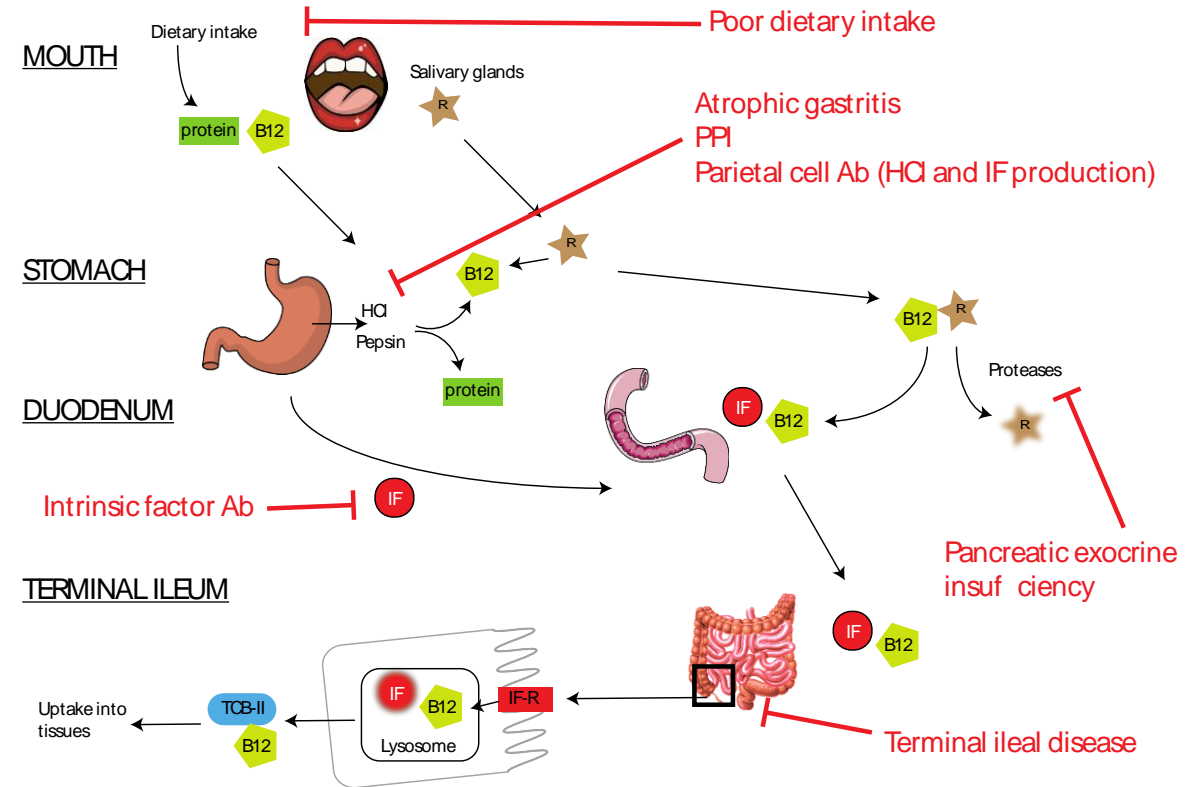
	Effect of systemic inflammation		
	Decreased levels	No change	Increased levels
Plasma	Copper (in severe inflammation)	Vitamin E/lipid ratio	Copper*
	Zinc**	Vitamin K/triglyceride ratio	
	Selenium*		
	Vitamin A**		
	Vitamin C*		
	Vitamin D**		
Whole blood		Manganese	
		Vitamin B1	
Red cells		Selenium	
		Vitamin B2	
		Vitamin B6	

\* if CRP >10mg/L; \*\* if CRP >20mg/L

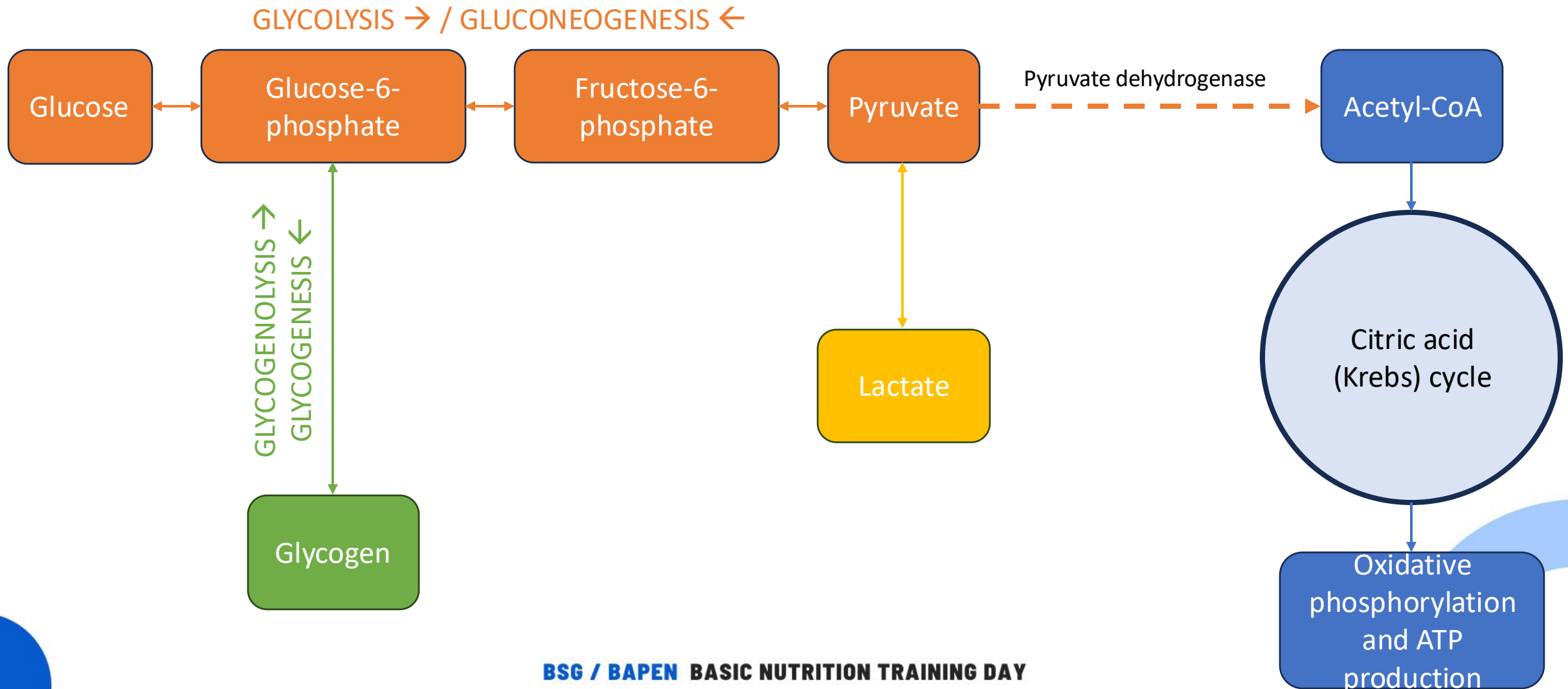
Ideally measure micronutrients when CRP less than 10, or better still less than 5

# Most absorbed proximally but B12 more complex

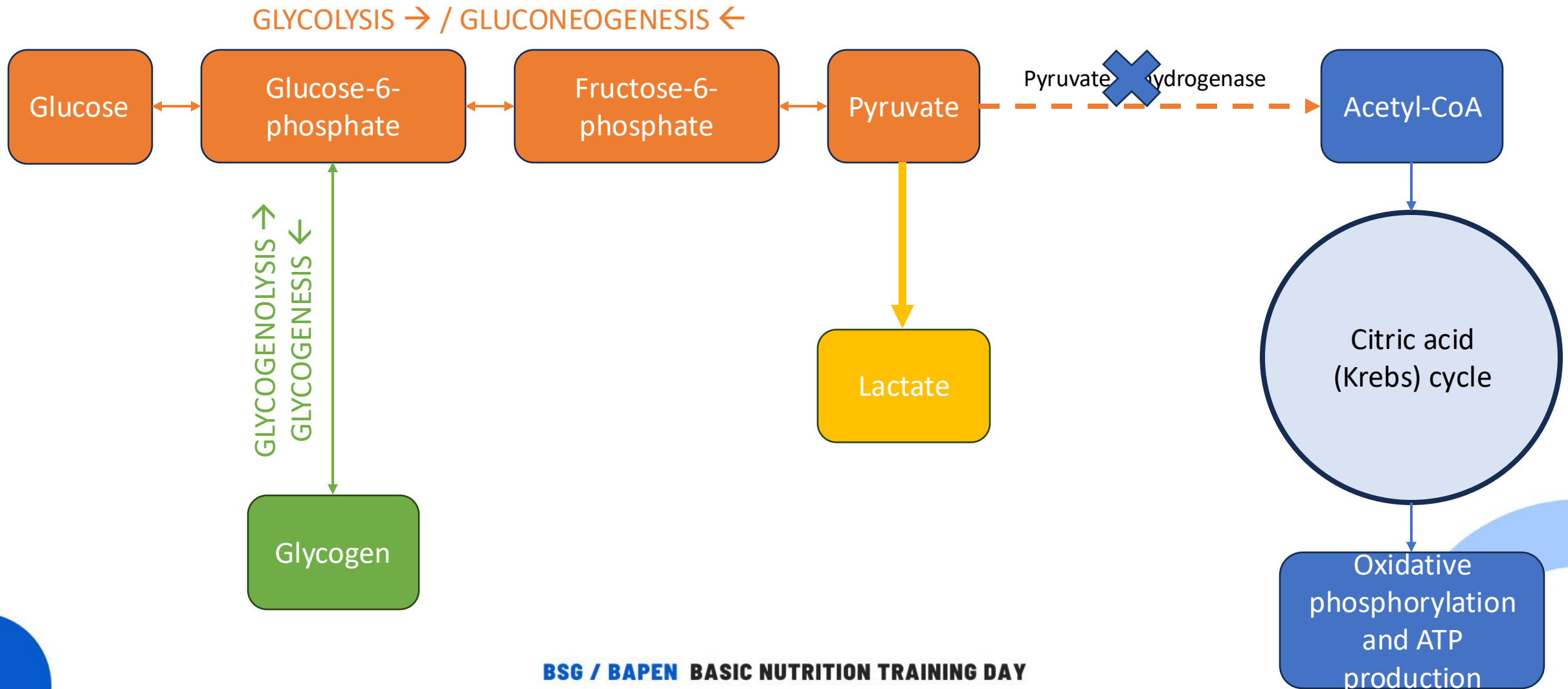
Location of gut absorption	Class of micronutrient	Micronutrient
Duodenum	Minerals	Calcium, iron, magnesium
Jejunum	Water soluble vitamins	B1, B2, B3, B5, B6, B7; Folate (B9); C
	Minerals	Calcium, magnesium
Ileum	Water soluble vitamins	B1, C
	Fat soluble vitamins	A, D, E, K
Terminal ileum	Water soluble vitamin	B12



# The importance of thiamine for ATP generation and lactic acidosis



# The importance of thiamine for ATP generation and lactic acidosis





# Why nutrition matters: nutrition as therapy

- Anorexia nervosa
- Alcoholic hepatitis
- Intestinal failure
- Crohn's disease - induction of remission and pre-operative optimisation
- Eosinophilic oesophagitis
- Irritable bowel syndrome
- Supportive therapy in cancer treatment and palliative care, decompensated liver cirrhosis, ?reduction of colectomy risk in ASUC etc

# Why nutrition matters: careers in nutrition



Cross-specialty and multi-disciplinary; friendly, supportive network of professionals across the country

Get to be a physician, surgeon, psychologist, psychiatrist, physiologist, endoscopist, ethicist, and pragmatist

Sometimes you are the only person who can distil complex problems into constituent parts

Your opinion will always be sought after

Lots of room for research and progression

Whatever you decide to do, fundamentally a good grounding in nutrition helps you provide quality care to your patients, assist your colleagues, and support the wider health service

# Summary

Why malnutrition and obesity are important to patients and the NHS

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Why nutrition matters in clinical practice and for your training/careers