

Acute and chronic complications of diabetes - DKA

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Learning outcomes

Be able to:

- Describe the condition of DKA
- Describe the change in insulin and counter regulatory hormones in DKA
- Relate the symptoms of DKA to patient presentation
- Relate the pathophysiology of DKA to diabetes and the triad of presenting symptoms
- Describe the basic approach to the emergency management of DKA

COMMONWEALTH OF AUSTRALIA

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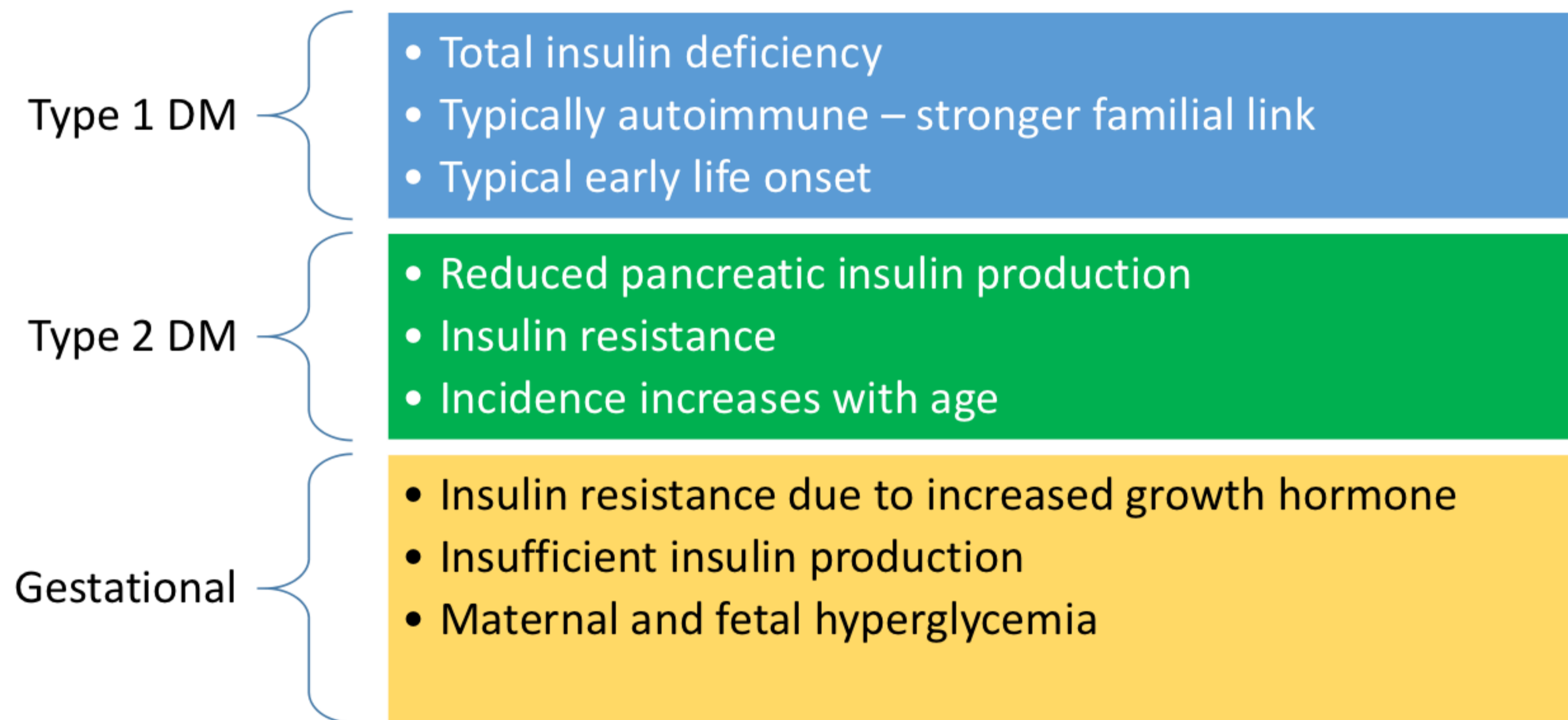
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Revision - most common types of diabetes



Acute complications of diabetes

- Diabetic ketoacidosis
- Glycaemic emergencies
- Hyperosmolar hyperglycemic state (HHS)
- Hypoglycemia



Caused by:

- Changes / inadequate nutrition
- Inactivity / over activity
- Improper use of hypoglycaemic medications

Or a combination of these

Acute complications of diabetes

Hyperglycaemic Emergency

- **Diabetic Ketoacidosis (DKA)**
- **Hyperosmolar Hyperglycaemic State (HHS)**

Symptoms of acute **hyperglycaemia**:

- Polydipsia – excessive thirst of drinking
- Polyphagia – extreme hunger
- Polyuria – excessive urine production
- Metabolic issues
- Hydration issues

High BGL

Hypoglycaemic Emergency

- Hypoglycaemia
→ Hypoglycaemic coma

Symptoms of acute **hypoglycaemia**

- Pale skin
- Sweating
- Shaking
- Palpitations
- Anxiety
- Hunger
- Drop in intellectual function
- Confusion
- Inappropriate behaviour
- Coma
- Seizure

Low BGL

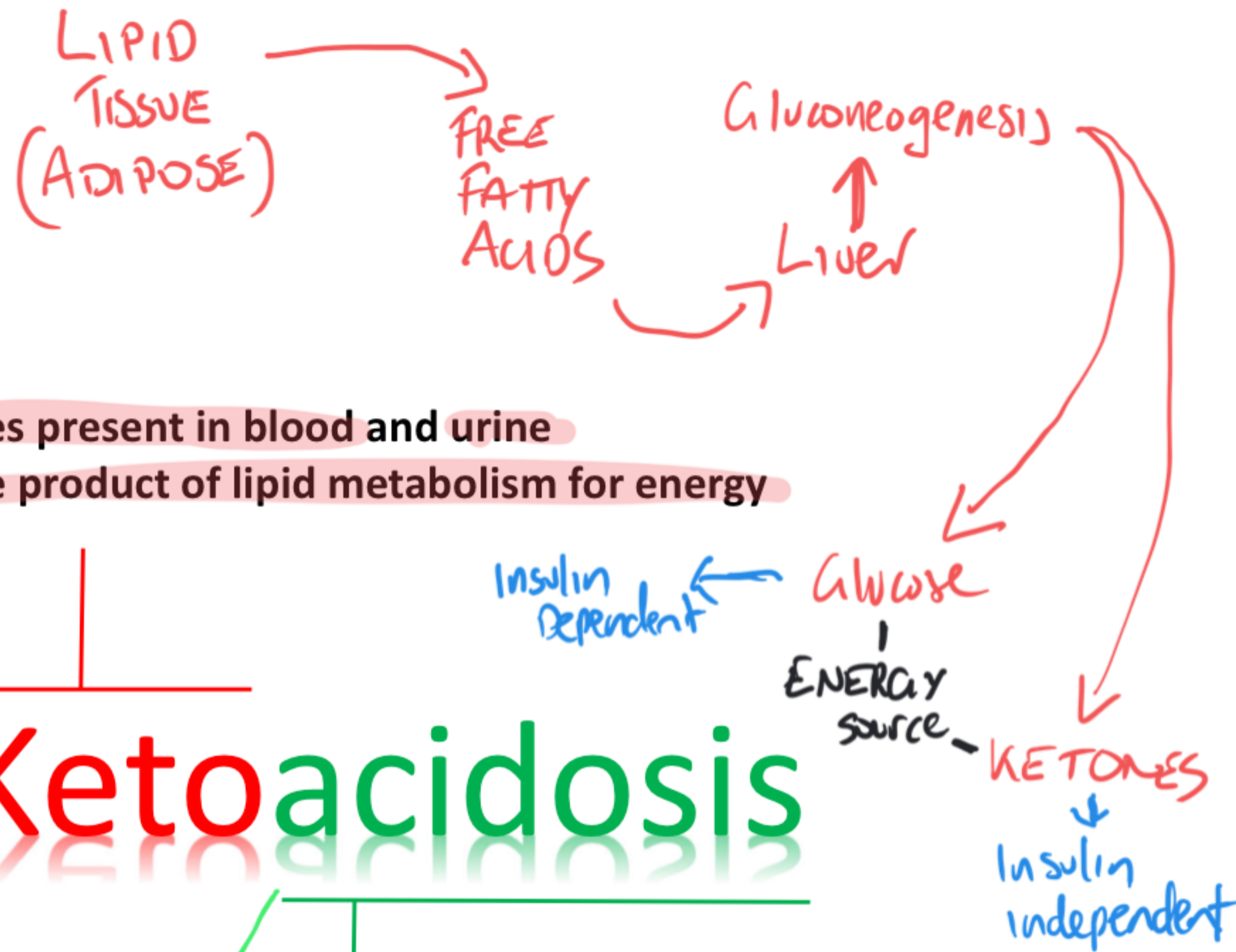
DKA triad

1. Hyperglycaemia
2. Ketonemia
3. Acidemia

Diabetic Ketoacidosis

Complication of diabetes – usually Type-1 DM
Almost always presents with hyperglycaemia
(14 mmol/l or higher)

HYPERGLYCAEMIA

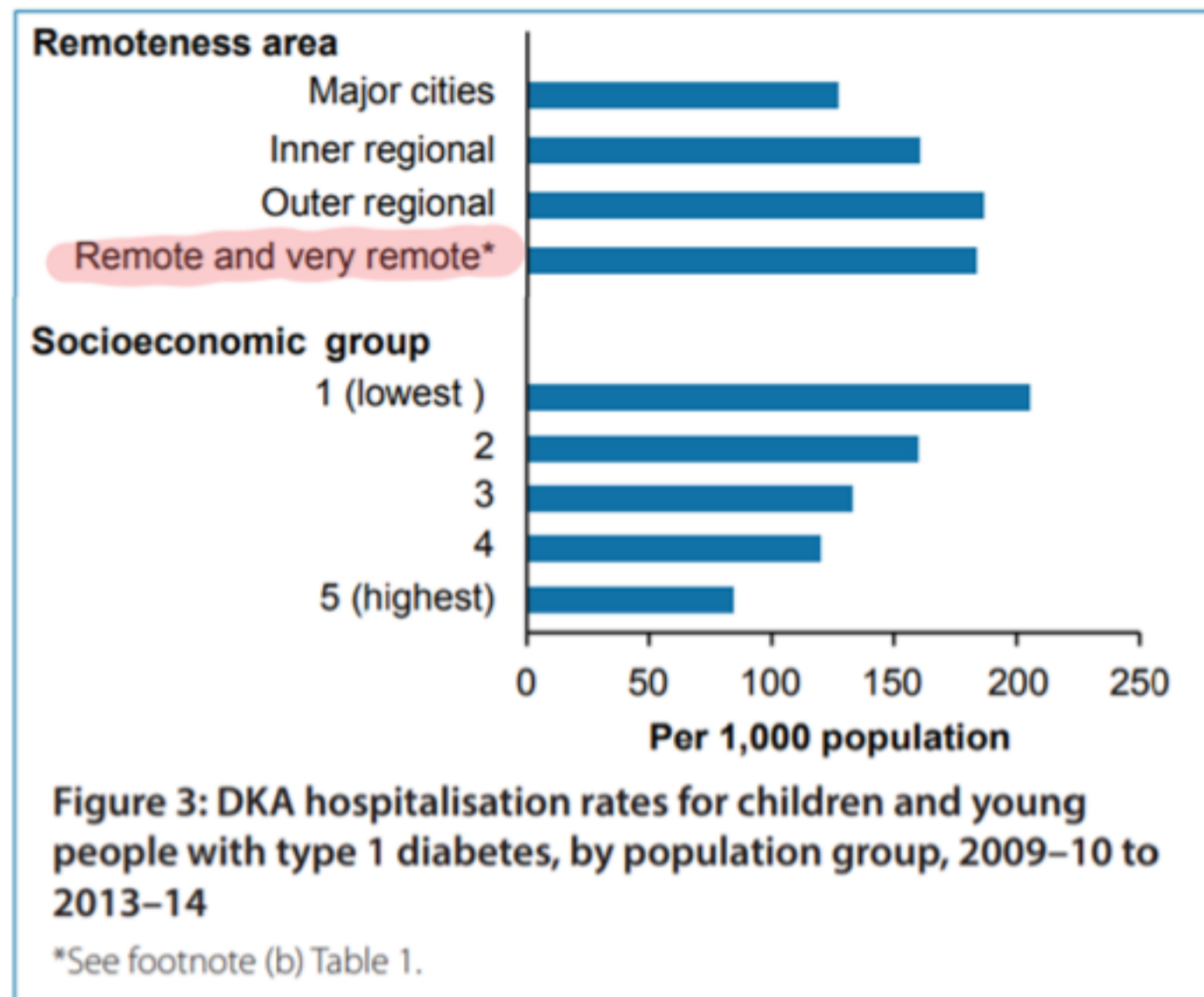


Ketones production lowers blood pH
Arterial pH is usually 7.3 or less

KEYTONES ARE ACIDS
Blood pH decreases

Figures taken from AIHW Diabetic Ketoacidosis among children and young people with type 1 diabetes <https://www.aihw.gov.au/getmedia/16775f2c-595a-4c94-af26-a7680f316b94/20443.pdf.aspx?inline=true#:~:text=The%20number%20of%20hospitalisations%20of%20population%20with%20type%201%20diabetes> .

Diabetic Ketoacidosis

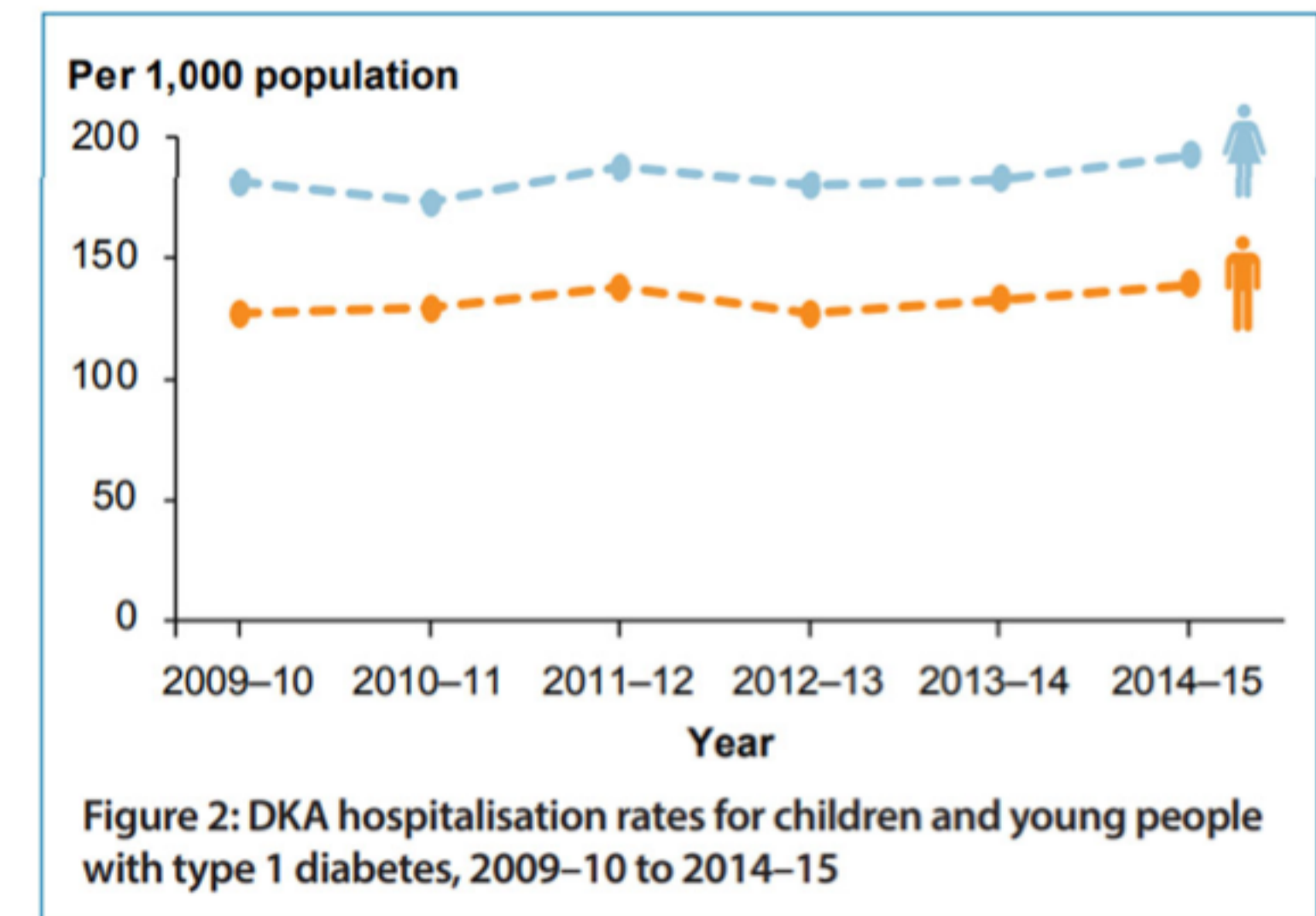
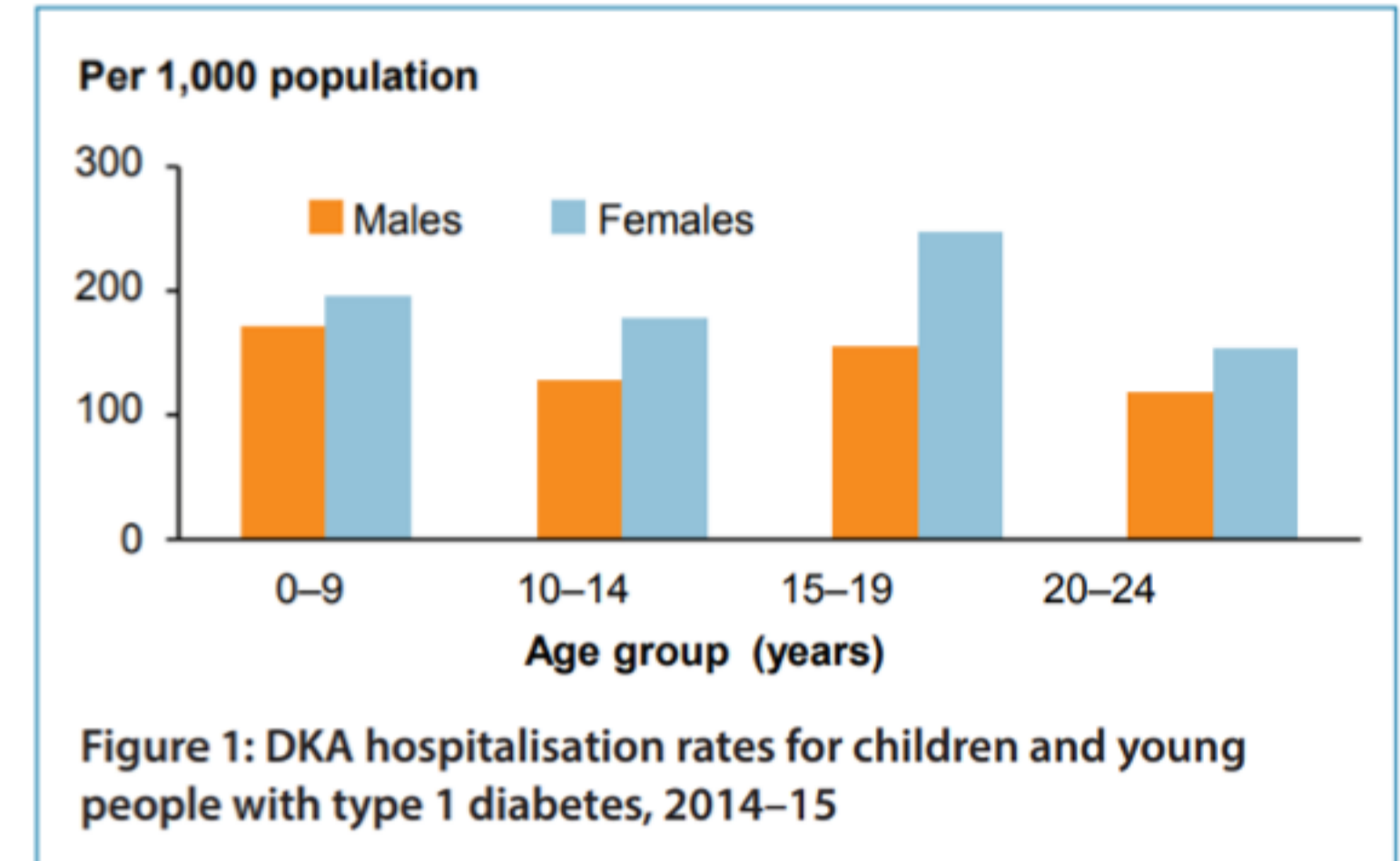


1.4 x higher in females

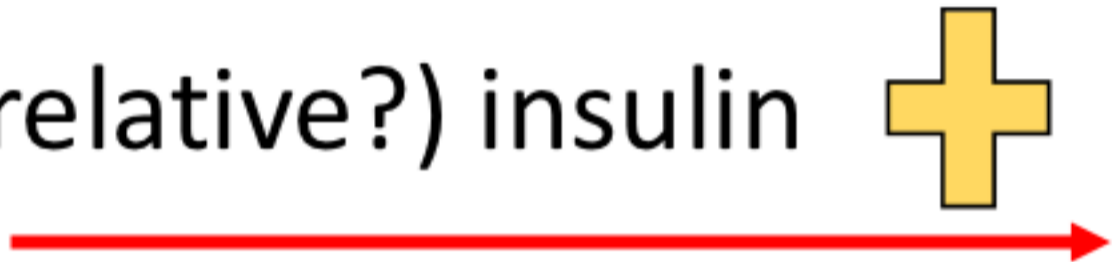
1.5 x higher in outer regional to remote areas

2.4 x higher in lowest SES groups

192/1000 (F) --- 138/1000 (M) with T-1 diabetes



Diabetic Ketoacidosis

- Medical emergency
- Absolute (or relative?) insulin deficiency 
- Problem in T-1 DM mostly
 - Can also occur with sodium-glucose co-transporter 2 (SGLT2) inhibitors
- Potential for morbidity (T1D) rate around 10%
- Associated with an increase in insulin counter-regulatory hormones
 - ↑ catecholamines
 - ↑ cortisol
 - ↑ glucagon
 - ↑ growth hormone

Diabetic Ketoacidosis

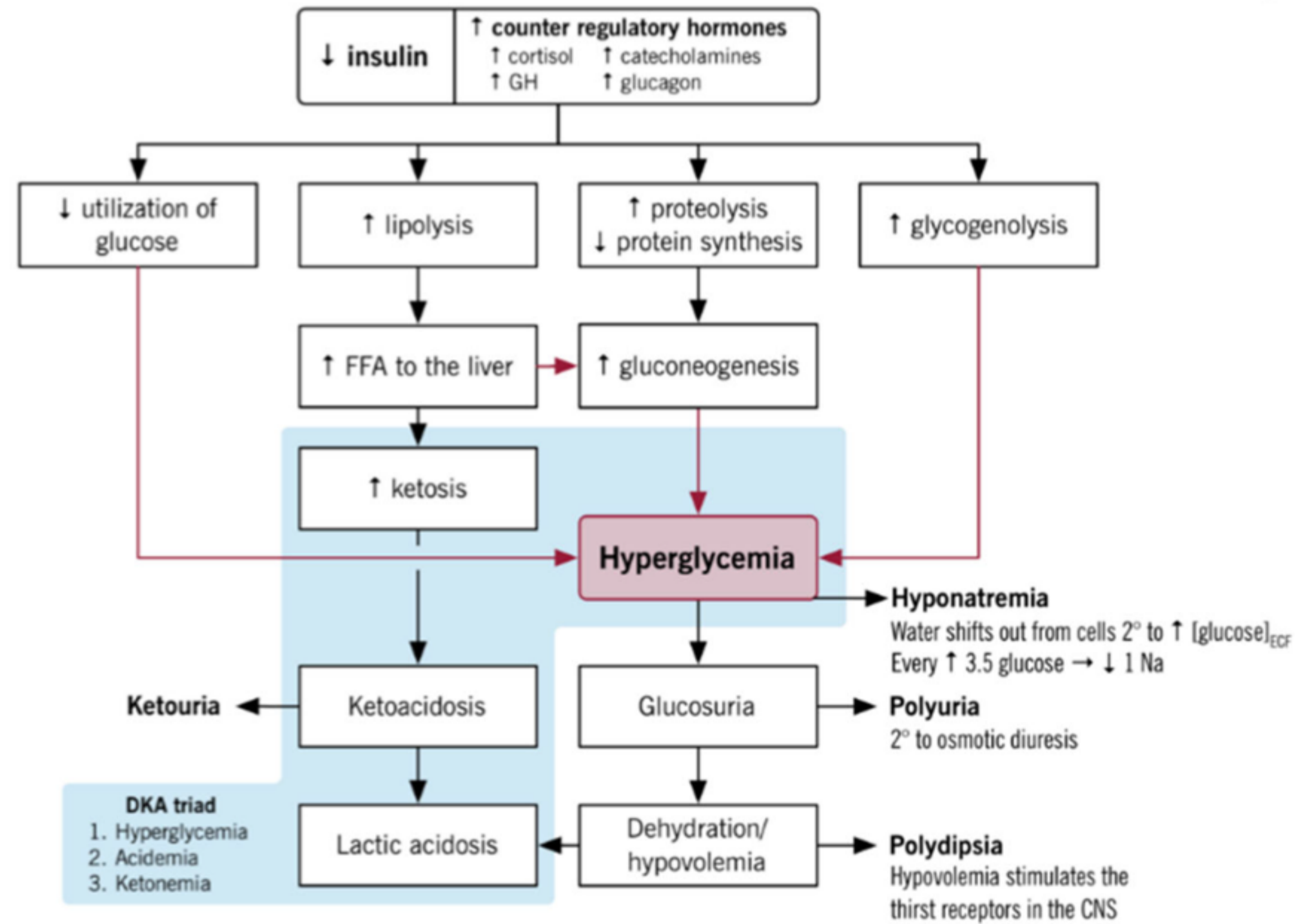
- Characterised by
 - Dehydration
 - Hyperglycaemia,
 - Polyuria
 - Polydipsia
 - Tachypnoea
- Deep sighing respiration
- Acetone smell on breath
- Nausea and vomiting
- Abdominal pain
- Confusion
- Drowsiness
- Decreased level of consciousness

Pathogenesis and pathophysiology of DKA

Pathogenesis and pathophysiology of diabetic ketoacidosis

Sultan Chaudhry

- Characterised by
 - Absolute insulin deficiency
 - Ketosis
 - Acidosis
 - Hyperglycaemia
 - Osmotic driven dehydration / hypovolemia
 - Hyponatremia



Diagnosis of DKA

- No definitive test for DKA diagnosis
- Based on clinical symptoms and pathology
- Serum glucose > 14mmol/L
- ↓ Bicarb
- ↓ K⁺
- ↓ Na⁺
- Arterial pH <7.3
- Ketones present in urine
- Ketones present in serum
- Plus clinical symptoms and presence of diabetes (may be undiagnosed)

Typical Fluid and electrolyte losses in DKA	
Water	5-10 liters
Sodium	500mmol
Chloride	300-600mmol
Potassium	300-1000mmol
Magnesium	30-60mmol
Phosphate	50-100mmol
Calcium	50-100mmol

Management of DKA

- Fluid replacement - normally isotonic saline
- IV insulin therapy
 - Monitor blood glucose levels
- IV potassium infusion if K^+ is low
- Continue with patients usual long acting insulin
 - (if on a continuous ambulatory insulin pump – remove it)
- Then
- Continued fluid therapy
- When BGL decreases continue with IV insulin + glucose
 - Glucose stimulates pancreatic insulin secretion
 - ?to protect against hypoglycaemia
 - ? Protect against hyperkalaemia

Summary - DKA

- Occurs when there is an absolute or relative insulin deficiency
- Switch to lipolysis → gluconeogenesis to produce glucose in cell
- Byproduct is ketones
- Characterised by
 - Hyperglycaemia
 - Acidemia
 - Elevated ketone
- Symptoms
 - Dehydration, confusion, drowsiness, polyuria, polydipsia, dec LOC, tachypnoea, ketone breath, foul smelling urine

Next

- Hyperosmolar Hyperglycaemic State (HHS)