ACUTE DIARRHOEAL DISEASE

AHMED LAVING

OUTLINE

- Definition
- Epidemiology
- Physiology of water absorption
- Aetiology
- Pathogenesis
- Clinical presentation
- Management
- Prevention

DIARRHOEA

- Defined as passing **three or more** loose stools in 24-hours.
  - a loose stool is one that takes shape of the container

- Duration:
  - Acute: 2 weeks
  - Persistent: 2-4 weeks
  - Chronic: 4 weeks

- Stool vol. >10g/kg/day in infants & toddlers
  >200g/day in older children

- Dysentery: bloody diarrhea
  - Blood staining determines the etiology and also the management of the patient

EPIDEMIOLOGY: DIARRHOEAL DISEASE

- Second leading cause of death in children under five
- Account for 9% of all deaths among children under age 5 worldwide in 2015
  - over 1400 children dying each day, or about 530,000 children a year
- From 2000 to 2015, total number of deaths from diarrhoea in children under 5 decreased by >50 per cent – from over 1.2 million to half a million
- In Kenya, deaths due to diarrhoeal diseases reached 23,374 or 6.98% of total deaths (KDHS 2014)

http://data.unicef.org/child-health/diarrhoeal-disease

GIT PHYSIOLOGY

Input

Diet/Saliva : 3 L/d

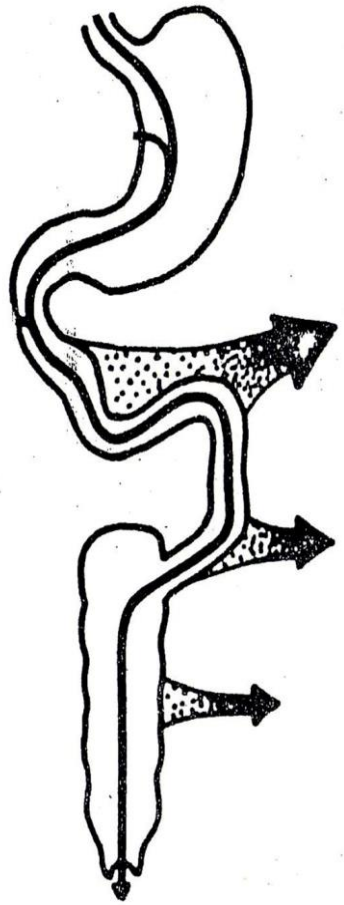
Stomach : 2 L

Bile : 1 L

Pancreas : 2 L

Bowel : 1 L

Total 9 L



Absorption

Jejunum 5 L/d

Ileum : 2-3 L

Colon : 1–2 L

Total 8.8 L

Diarrhoea defined as >200 mL liquid excretion/day. In extremes, the GIT can both absorb and secrete 20 L of water per day

Fecal Water 100–200 mL/d

PATHOPHYSIOLOGY

- 4 main mechanisms:
  - Osmotic e.g. Lactose intolerance
  - Inflammatory e.g. Salmonella infection
  - Secretory e.g. Cholera infection (activation of cAMP)
    - Secretion outweighs absorption
  - Motility e.g. Irritable colon of infants

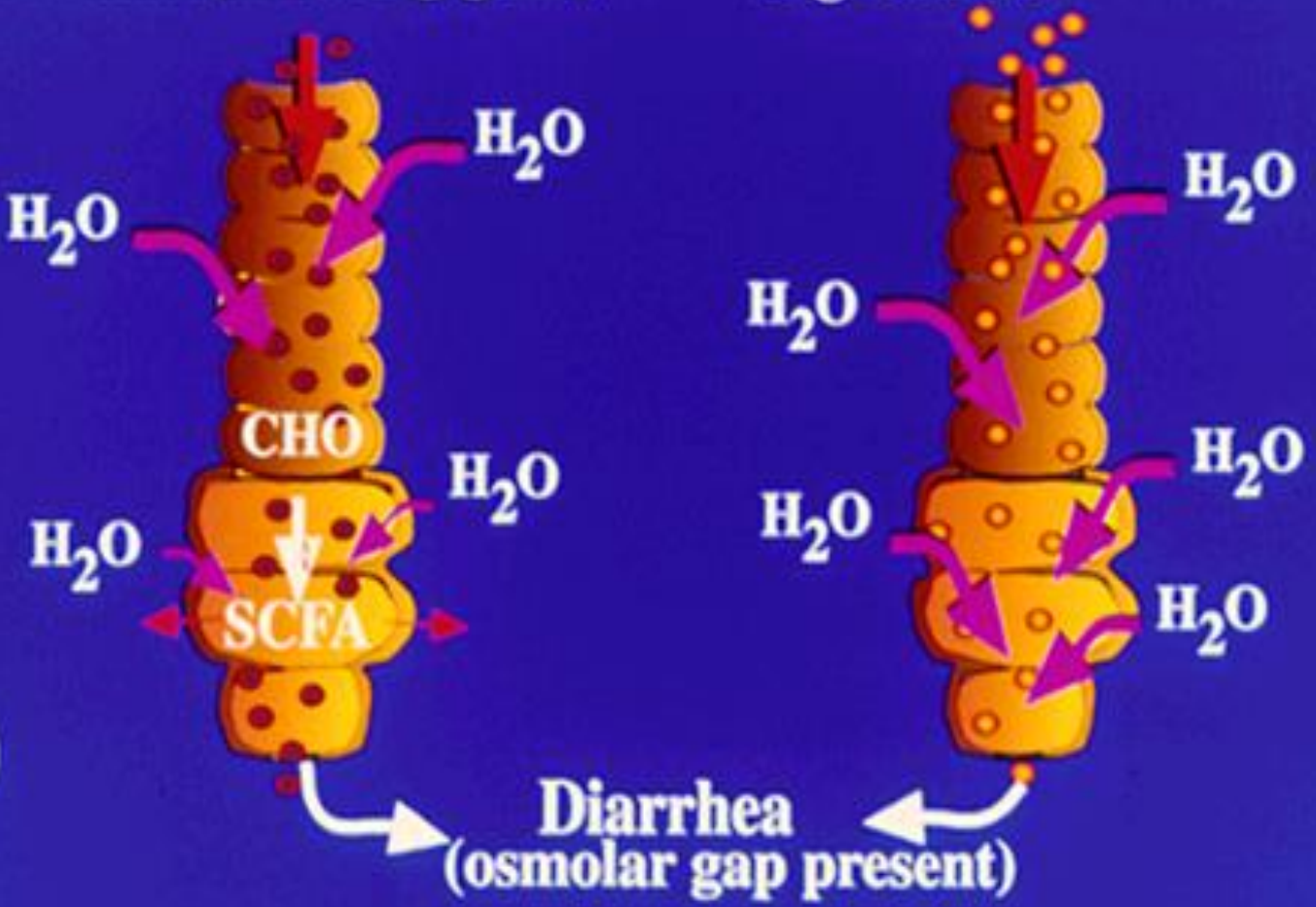
Osmotic diarrhea is caused by the presence of poorly absorbed luminal osmols

CARBOHYDRATES

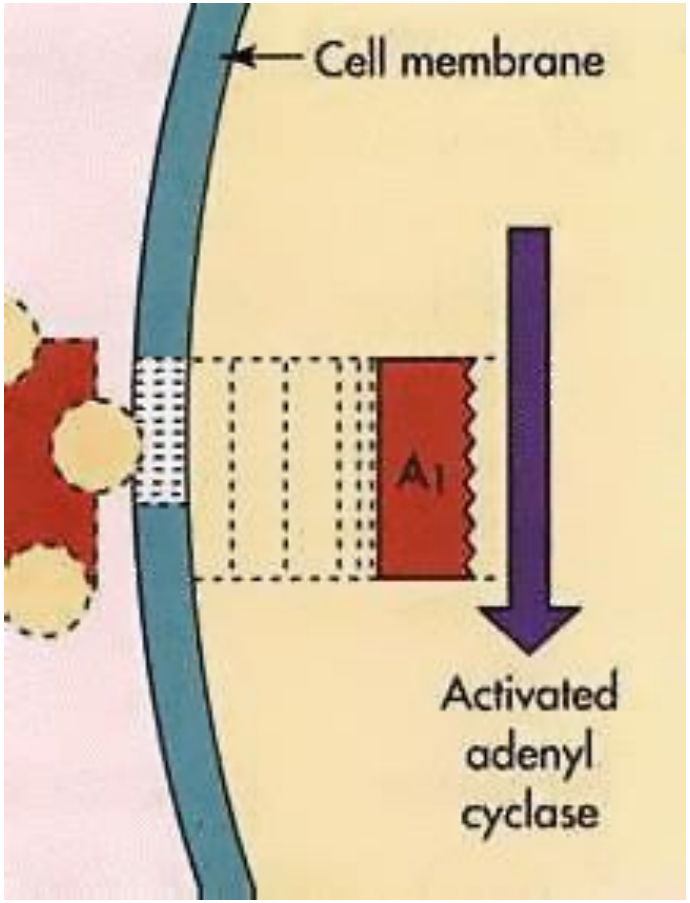
Lactose (lactase deficiency)
Sorbitol (chewing gum)

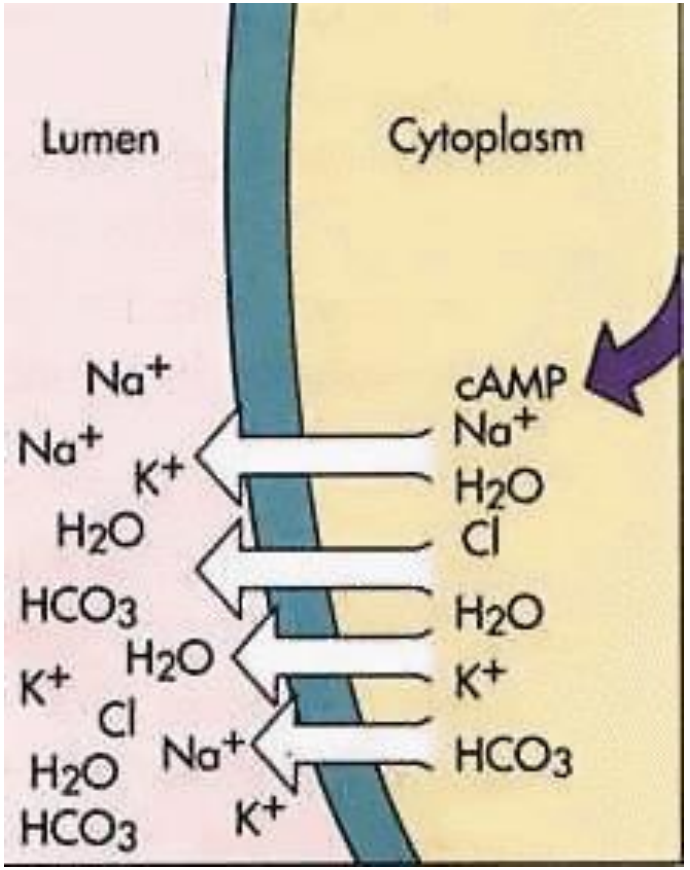
MINERALS

Na Sulfate Lavage Solutions
Mg Citrate



SECRETORY DIARRHOEA:





AETIOLOGY OF ACUTE DIARRHOEA

Infectious:- Viruses sp. Rotavirus

- Bacteria
- Parasites

Non-infective:- Food (allergy, poisoning, intolerance)

Drugs: (direct effects, dysmotility, normal flora)

Table 1 Overview of causative agents in diarrhea

Bacteria	Viruses	Parasites
• Diarrheagenic *Escherichia coli* • *Campylobacter jejuni* • *Vibrio cholerae O1* • *V. cholerae O139** • *Shigella species* • *V. parahaemolyticus* • *Bacteroides fragilis* • *C. coli* • *C. upsaliensis* • Nontyphoidal *Salmonellae* • *Clostridium difficile* • *Yersinia enterocolitica* • *Y. pseudotuberculosis*	• Rotavirus • Norovirus (calicivirus) • Adenovirus (serotype 40/41) • Astrovirus • Cytomegalovirus*	**Protozoan** • *Cryptosporidium parvum* • *Giardia intestinalis* • *Microsporida** • *Entamoeba histolytica* • *Isospora belli** • *Cyclospora cayetanensis* • *Dientamoeba fragilis* • *Blastocystis hominis* ***Helminths*** • *Strongyloides stercoralis* • *Angiostrongylus costaricensis* • *Schistosoma mansoni, S. japonicum*

VIRUSES

- Rotavirus accounts for 15-25% of all diarrheal causes
- Replicate within villous epithelium of the small bowel causing patchy epithelial cell destruction and villous shortening
- Loss of the absorptive capacity of villous cells leading to loss of disaccharides especially lactose
- Recovery occurs when villi regenerate and villous epithelium matures

BACTERIA

TOXINS THAT CAUSE SECRETIONS :

- ✓ Entero-toxigenic *E. coli* and *V. cholerae* 01 produce toxins that alter epithelial cell function

- ✓ Reduce absorption of sodium and increase secretion of chloride causing secretion of water and electrolytes

MUCOSAL INVASION

- ✓ *Shigella, E. coli* and *salmonella* cause bloody diarrhea by invading and destroying mucosal epithelial cells

- ✓ Occurs in colon and distal part of the ileum

PROTOZOA

- Mucosal adhesion: *G. lamblia* and Cryptosporidium adhere to small bowel epithelium causing shortening of the villi

- Mucosal invasion: *E. histolytica* causes diarrhoea by invading epithelial cells in colon and Ileum causing micro abscesses and ulcers

CLINICAL PRESENTATION

- **HISTORY**

✓ Consistency, color, volume, and frequency of stool

✓ Systemic symptoms

✓ Daycare use: *rotavirus; Astrovirus; Calicivirus*; *Campylobacter, Shigella, Giardia,* and *Cryptosporidium* species.

✓ Travel history: *Entero-toxigenic E. coli*

✓ Food history:

- Dairy food - *Campylobacter* and *Salella* species
- Eggs -*Salmonella* species*mon*
- Meats – *C. perfringens* and *Aeromonas, Campylobacter*, and *Salmonella* species
- Ground beef - *Enterohemorrhagic E coli*

Stool Characteristics	Small Bowel	Large Bowel
Appearance	Watery	Mucoid and/or bloody
Volume	Large	Small
Frequency	Increased	Highly increased
Blood	Possibly positive but never gross blood	Commonly grossly bloody
pH	Possibly < 5.5	>5.5
Reducing substances	Possibly positive	Negative
WBCs	< 5/high power field	Commonly >10/high power field
Serum WBCs	Normal	Possible leukocytosis, bandemia
Organisms	•**Viral** •Rotavirus, Adenovirus, Calicivirus •Astrovirus •Norovirus	•**Invasive bacteria** •*Escherichia Coli* (enteroinvasive, enterohemorrhagic) •*Shigella, Salmonella* •*Campylobacter, Yersinia* •*Aeromonas* species •*Plesiomonas* species
	•**Enterotoxigenic bacteria** •*E coli,Klebsiella, Clostridium* •*Cholera* ,*Vibrio* species	•**Toxic bacteria** •*Clostridium difficile*
	•**Parasites:** *Giardia* species •*Cryptosporidium* species	•**Parasites:** *Entamoeba organisms*

Organism	Incubation	Duration	Vomiting	Fever	Abdominal Pain
Rotavirus	1-7 d	4-8 d	Yes	Low	No
Adenovirus	8-10 d	5-12 d	Delayed	Low	No
Norovirus	1-2 d	2 d	Yes	No	No
Astrovirus	1-2 d	4-8 d	+/-	+/-	No
Calicivirus	1-4 d	4-8 d	Yes	+/-	No
Aeromonas species	None	0-2 wk	+/-	+/-	No
Campylobacter species	2-4 d	5-7 d	No	Yes	Yes
C difficile	Variable	Variable	No	Few	Few
C perfringens	Minimal	1 d	Mild	No	Yes
Enterohemorrhagic E coli	1-8 d	3-6 d	No	+/-	Yes
Enterotoxigenic E coli	1-3 d	3-5 d	Yes	Low	Yes
Plesiomonas species	None	0-2 wk	+/-	+/-	+/-
Salmonella species	0-3 d	2-7 d	Yes	Yes	Yes
Shigella species	0-2 d	2-5 d	No	High	Yes
Vibrio species	0-1 d	5-7 d	Yes	No	Yes
Y enterocolitica	None	1-46 d	Yes	Yes	Yes
Giardia species	2 wk	1+ wk	No	No	Yes
Cryptosporidium species	5-21 d	Months	No	Low	Yes
Entamoeba species	5-7 d	1-2+ wk	No	Yes	No

PHYSICAL EXAMINATION

- Dehydration: principal cause of morbidity and mortality
- Abdominal pain
- Malnutrition
- Peri-anal erythema – due to persistent loose stool and excoriation

Symptom	Minimal or No Dehydration (<3% Loss of Body Weight)	Mild to Moderate Dehydration (3%–9% Loss of Body Weight)	Severe Dehydration (>9% Loss of Body Weight)
Mental status	Well; alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty; eager to drink	Drinks poorly; unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, with bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skin fold	Instant recoil	Recoil in <2 seconds	Recoil in >2 seconds
Capillary refill	Normal	Prolonged	Prolonged; minimal
Extremities	Warm	Cool	Cold; mottled; cyanotic
Urine output	Normal to decreased	Decreased	Minimal

INVESTIGATIONS

- Stool pH
- Reducing substances
- Leukocytes in stool
- Stool culture
- Enzyme immunoassay and latex agglutination: rotavirus antigen, adenovirus antigens
- Examination of stool for ova and parasites
- stool anion gap : **290 - [(Na^+ + K^+) X 2].**
  - > 100, osmolar diarrhea
  - <100, secretory diarrhea

MANAGEMENT

- Fluid therapy: depending on level of dehydration:
  - Rehydration therapy
  - Replacement of ongoing losses
    - Ringers lactate
    - ORS

- Zinc sulphate

- Antimicrobial therapy: majority of bacterial causes are self limiting and do not require antibiotics.

PREVENTION

- Access to safe water and adequate sanitation
- Good hygiene practices: hand-washing with soap
- Adequate nutrition
- Breastfeeding
- Micronutrient supplementation: vitamin A , zinc.
- Immunization: rotavirus vaccination

REFERENCES

- WHO/UNICEF Joint Statement: Clinical management of acute diarrhoea
- Up to date
- Medscape
- Paediatrics in review