Compared to human milk, cow milk formula is more likely to contain which one of the following?

A) More essential fatty acids  
B) Higher protein concentration  
C) Increased lactose content  
D) Lower Calcium-phosphate ratio  
E) Lower iron concentration

Human Milk has:

- Low protein (very bio-available)
- High lactose Low iron (very bio-available if taken alone)
- Low Calcium-Phosphate ratio
- Inadequate Vitamin K
- ? Adequate Vitamin D
- Immunoglobulins (including IgA)
A 4 mo old boy with “short gut” from extensive small bowel resection at 2 wks of life is receiving amino acids, hypertonic glucose and trace mineral by PN and is growing well. Last week drying and thickening of skin with desquamation began.

The most likely cause is a deficiency of:
A) Riboflavin
B) Protein
C) Essential fatty acids
D) Vitamin B12
E) Copper

A 4 wk old boy has diarrhea and intermittent vomiting for 2 wks. He is getting cow milk formula, 175 to 200 ml q3h (8 feeds/24 hrs). Birth wt = 3.2Kg. PE = afebrile, wt 5.0Kg (90th %ile). Abdomen is slightly protuberant. No tenderness and bowel sounds are hyperactive.

Which is most appropriate at this time?
A) Change feeds to soy-based formula
B) Obtain stool cultures
C) Determine stool pH
D) Instruct parents to reduce volume of feeds
E) Schedule rectal manometry

A 7 yr old boy who has had school problems for the past 2 months received a megavitamin that supplies 50,000 u of Vitamin A, 100 mgs of thiamine, 100 mg of niacin, 1 g of ascorbic acid, 2000 u of Vit D, and 500 mg of Vit E

The most likely effect of this regimen will be:
A) Improved school performance
B) Flushing and sweating
C) Increased thiamine level in CSF
D) Increased intracranial pressure
E) Less URIs than in his peers
Hypervitaminosis

- **Vit A** (>20,000 IU/d) – Inc ICP (pseudotumor), irritability, headaches, dry skin, Hepatosplenomegaly, cortical thickening of bones of hands and feet
- **Vit D** (>40,000IU/d) - Hypercalcemia, constipation, vomiting, nephrocalcinosis
- **Vit E** (100mg/kg/d) – NEC/hepatotoxicity - ?due to polysorbate 80 (solubilizer)

An adolescent girl on a strict vegan diet is most likely to develop deficiency of which of the following water-soluble vitamins?

A) Folic acid
B) Niacin
C) Riboflavin
D) Cobalamin
E) Thiamine

Vitamin Sources

- Thiamine – grains, cereals, legumes
- Riboflavin – dairy, meat, poultry, leafy vegetables
- Pyridoxine – all foods
- Niacin – meats, poultry, fish, wheat
- Biotin – yeast, liver, kidneys, legumes, nuts
- Folic acid – leafy vegetables, fruits, grains
- B12 (Cobalamin) – eggs, dairy, meats (not in plants)
- Vit C – fresh fruits and vegetables
Vitamin Deficiencies (fat soluble)
- **A** - night blindness, xerophthalmia, Bitot spots, keratomalacia
- **D** - rickets/osteomalacia, low Ca/Phosp
- **E** - neurologic deficit (ataxia, ocular palsy, decreased DTRs)
- **K** - coagulopathy

Vitamin Deficiencies (water-soluble)
- Thiamine (B1) – beriberi, cardiac failure
- Riboflavin (B2) – seborrheic dermatitis, cheilosis, glossitis
- Pyridoxine (B6) – dermatitis, cheilosis, glossitis, peripheral neuritis, irritability
- Vit B12 – megaloblastic anemia, post spinal column changes

Vitamin Deficiencies (water-soluble)
- Vit C – scurvy, poor wound healing, bleeds
- Folic acid – megaloblastic anemia, FTT
- Niacin – pellagra (diarrhea, dermatitis, dementia), glossitis, stomatitis
- Biotin – organic acidemia, alopecia, seizures
A previously healthy 15 mo appears pale. He has been fed goat milk exclusively since birth. Labs reveal: Hgb=6.1, WBC=4800, plt=144K, MCV=109. Diff is 29% polys, 68% lymphs, 3% monos. Polys are hypersegmented.

What is the most likely cause of lab findings?
A) ALL
B) Fanconi anemia
C) Folate deficiency
D) Iron deficiency
E) Vitamin B12 deficiency

An 8 mo old white infant is noted to have yellow skin. The sclerae are normal in color. Of the following, which is the most useful diagnostic test:
A) Measure serum bilirubin level
B) Measure urine urobilinogen conc
C) Measure serum Vitamin A level
D) Evaluate dietary history
E) Measure serum T4 level

A previously well 10 yr old has fever and persistent vomiting. Initially the emesis was clear, then bile-stained and now it contains bright red blood. Brother has AGE 1 wk ago. PE and CBC/BMP are normal.

The most likely cause of the hematemesis is:
A) Esophageal varices
B) Esophagitis
C) Gastric duplication
D) Mallory-Weiss tear
E) Peptic ulcer disease
Upper Presentation
- Hematemesis
- Rapid bleeding lesion
- Coffee ground emesis
  - Slower bleed
- Hematochezia
- Melena

Upper GI Bleeding
- Esophagitis
- Gastritis
- Ulcer disease
  - H. pylori
  - Mallory-Weiss Tear
- Caustic Ingestion/Foreign Body
- Esophageal varices
- Esophageal and gastric tumors
- Vascular anomalies
- Coagulopathy
- Epistaxis
- Tonsillitis/ENT
- Varices
- Duplication of gut
- IBD
- HSP
- Munchausen's syndrome by proxy

Upper GI Bleeding (Infants)
- Swallowed maternal blood
- Hemorrhagic disease of the newborn
- Coagulopathy
- Stress ulceration/gastritis
- Mallory-Weiss tear
- Allergy
- Esophagitis (GERD)
- Vascular anomaly
- Epistaxis
- Varices
- Duplication of gut
- Munchausen's syndrome by proxy
A 5 yr old girl was tx with amoxicillin for OM. One week later, she developed abd pain, and has been passing 6 stools daily that contain blood and mucus. PE has T of 101, abdominal distention and diffuse abd tenderness.

Among the following, the most appropriate initial diagnostic study to perform is:

A) Barium enema  
B) Colonoscopy  
C) Clostridium difficile toxin evaluation  
D) Stool for O & P  
E) Stool for rotavirus

A 4 week old is brought to you for streaks of bright red blood in the stool. Child is breast fed, thriving and content. Exam shows seborrhea, benign abdomen and perianal exam. Your next intervention:

a) Remove milk and soy from the maternal diet  
b) GI referral for colonoscopy  
c) Call child welfare for possible abuse

**Lower GI Bleed – 0 to 30 days**

- Anorectal lesions
- Swallowed maternal blood (APT test)
- Milk allergy
- NEC
- Midgut volvulus
- Hirschsprung’s disease
Lower GI bleed – 30 days to 1 yr

- Anorectal lesions
- Milk Allergy
- Intussusception
- Meckel's diverticulum
- Infectious diarrhea
- Hirschsprung’s disease

Allergic Colitis

- Well appearing
- ± Irritable
- Occurs with formula and breast milk
- Remove milk and soy from diet
- Protein hydrolysate
- Flex sig
- Reintroduce dairy at 1 year

For the past 6 wks, a 4 yr old has had painless, bright red rectal bleeding assoc with bowel movements. PE of abdomen and anus are normal. The rectal vault is empty and no blood is noted on gross inspection.

The most likely cause of the hematochezia is:

A) Hemolytic-Uremic syndrome
B) Henoch-Schonlein purpura
C) Intussusception
D) Juvenile Poly(p(s)
E) Meckel’s diverticulum
Lower GI Bleed – 1-12 years

**COMMON:**
- Anal fissure
- Juvenile polyp
- Meckel's diverticulum
- Infectious diarrhea
- IBD

**LESS COMMON:**
- Henoch-Scholein purpura
- Hemolytic uremic syndrome
- Intestinal duplication
- Hemorrhoids

Meckel Diverticulum

- Painless rectal bleeding
- < 4 years of age
- Failure of omphalomesenteric duct to obliterate
- 2% of population
- Within 2 feet of ileocecal valve
- Meckel scan
  - technetium 99m pertechnetate scan

A 3,200 gm newborn is noted to be jaundiced on postnatal day #10. Total Bili is 9.0 with a direct Bili of 0.8 mg/dl. Hct is 48%. Baby and mom are blood type O, Rh+. Baby is breast fed exclusively.

The most likely explanation for high Bili is:
A) Biliary atresia
B) "breast milk" jaundice
C) Choledochal cyst
D) Hypothyroidism
E) Neonatal hepatitis
Unconjugated Hyperbilirubinemia

- Physiologic – exaggerated by hemolysis or hematoma
- Breast feeding
- Breast Milk (late onset)
- Crigler-Najjar syndrome I & II
- Hypothyroid
- Intestinal obstruction

A 3 wk old girl has fever and vomiting. PE include bulging fontanelle and hepatomegaly. The pt had jaundice and vomiting during the 1st wk after birth. She has been breast-fed.

What is the most likely Dx?
A) Fructose aldolase deficiency
B) Fructose 1,6 diphosphatase deficiency
C) Glycogen Storage Disease type 1
D) Neonatal adrenoleukodystrophy
E) Galactosemia

Direct Hyperbilirubinemia

- Extrahepatic
  1. *** Extrahepatic Biliary Atresia
  2. *** Choledochal Cyst
  3. Choledocholithiasis
  4. Extrinsic bile duct compression
**Direct Hyperbilirubinemia**

- **Intrahepatic**
  1. Metabolic
  2. Familial intrahepatic cholestasis
  3. Infectious
  4. Anatomic – Paucity of intrahepatic bile ducts
  5. Misc – TPN, Neonatal Lupus

**EHBA**

- Direct Hyperbili
- Acholic stool
- Elevated transaminases and GGT
- DISIDA scan (99mTc-disofenin)
- Liver biopsy
- Kasai portoenterostomy <8 weeks

**Alagille syndrome**

- Hereditary condition
  - Mutations JAGGED-1 gene
  - Bile duct paucity
  - Peripheral pulmonary artery stenosis
  - Vertebral anomalies
  - Posterior embryotoxin
  - Characteristic facies
A 12 yr old girl has recurrent bouts of scleral icterus, often after viral illnesses. She is otherwise well and is taking no meds. Labs reveal: Total Bili of 3.4 mg/dl with direct Bili of 0.3 mg/dl. ALT/PT/APPT are all normal.

The most likely cause of the hyperbilirubinemia:
A) Chronic active hepatitis
B) Dubin-Johnson syndrome
C) Gilbert syndrome
D) Hepatitis A
E) Infectious Mononucleosis

Hepatitis
- Most common infectious cause viral
- Mild-Asymptomatic transaminase elevation
  - Hep A, EBV, CMV
- Clinical Hepatitis
- Fulminant Hepatic Failure
  - Rare in HepA, Hep B
Hepatitis A
- Transmission oral/fecal
- RNA virus
- Incubation 2-6 weeks
- Milder in young children
- Does not cause chronic infection
- Some patients may experience a relapsing course
- Hepatitis A vaccine to all children at 1 year

Severe RUQ pain, intense jaundice and dark urine in a 9 yr old girl w chronic mild jaundice from spherocytosis.

Which diagnostic test is most likely to give correct diagnosis of her current state:
A) Determine AST/ALT levels
B) Determine presence of Hepatitis B surface Ag
C) Radionuclide scan of liver
D) Ultrasound of abdomen
E) Percutaneous liver biopsy

A 6 year old boy is brought to your office with a history of 36 hours of increasing anorexia and periumbilical pain. Last night he had his first episode of nocturnal enuresis in 3 years. He is afebrile and has a benign abdominal exam. Your diagnosis:

a) Acute appendicitis
b) Strep Pharyngitis
c) School (first grade) avoidance
d) Constipation
A 12 year girl comes to the office with 36 hours of abdominal pain, fever and anorexia. Pain is peri-umbilical and worse in the car than now. You think of appendicitis. Helpful lab tests could include all except:

a) Stool for guaiac  
b) CBC  
c) Urinalysis  
d) Abdominal sonogram

A 17 year old member of the track team comes in with epigastric discomfort and nausea. The big meet is tomorrow and he has been training hard for his last chance to win the medal in his event. He has no significant past medical history other than mild exercise induced asthma and uses an inhaler as he needs. He also uses ibuprofen for muscle pain when training. Your diagnosis:

a) Atypical asthma  
b) Performance anxiety  
c) Intestinal parasite  
d) NSAID complication
An 18 year old who saw you to start birth control pills prior to going to college now comes in with recurrent, crampy post-prandial epigastric pain that sometimes travels below her right ribs. On exam you find that she has slight scleral icterus, vague epigastric tenderness and a belly button ring. Her urine pregnancy test is negative. Your next step:

   a) GI referral for upper endoscopy  
   b) Counseling for drug and alcohol abuse  
   c) Switch the form of birth control  
   d) Order an abdominal sonogram

A seven year old is seen for a bicycle accident. He is fine other than a few abrasions and an ecchymotic area on his abdomen where he hit the handlebars. 24 hours later, he has significant abdominal and back pain and recurrent non-bilious vomiting. You make the diagnosis with:

   a) Further family and social history  
   b) Liver chemistries  
   c) An upper GI series  
   d) Stool for guaiac

Trauma

- Duodenal Hematoma  
  - Handlebar, seatbelts, abuse  
  - NGT relieves distention  
- Pancreatic pseudocyst  
- Pancreatitis
A 2 year old is brought to you for trouble stooling. Over the last 18 hours he has become "tired and miserable". He now seems to vomit when straining to pass stool. On exam you notice that he appears lethargic and has a palpable mass in the mid-abdomen. Your next intervention is:

a) disimpaction dose of PEG (polyethylene glycol)
b) counseling on toilet training
c) stat abdominal CT scan for appendicitis
d) barium enema

Intussusception

- Most common cause of intestinal obstruction between 3 months – 6 years
- Sudden acute onset of severe, paroxysmal colicky pain that recurs at frequent intervals
- Well in between, can become weak and lethargic
- Current jelly stools
- 70-90% reduction

A 11 year girl comes to see you for recurrent periumbilical pain for the last 9 months. It is worse in the morning, especially on school days. There is no vomiting or weight loss but she does frequently have non-bloody diarrhea with resolution of the pain. Her exam is benign and stool is guaiac negative.
Your preferred working diagnosis:

a) Celiac Disease  
b) Crohn Disease  
c) irritable bowel syndrome  
d) ulcerative colitis

Her symptoms persist so you plan an evaluation that should include all of the following EXCEPT:

a) celiac serology  
b) lactose breath test  
c) abdominal CT scan  
d) stool for ova and parasites

Reasonable interventions for this patient would not include:

a) Cognitive behavioral therapy  
b) Dietary manipulation  
c) Trial of low dose Tri-cyclic antidepressants  
d) Empiric therapy for Helicobacter pylori  
e) Symptom-based therapy
Functional GI Disorders:
Red Flag Symptoms

- Nocturnal awakening
- Persistent Vomiting
- Dysphagia
- Bleeding
- Systemic Signs (Fever, Rash, Arthritis)
- Affected Growth/Development

Functional GI Disorders:
Organic Etiologies

- Crohn's Disease
- Celiac Disease
- Acid-Peptic/GERD
- Carbohydrate malabsorption
- Infection (eg Giardia)

Functional GI Disorders:
Symptom Based Diagnoses

- Irritable Bowel Syndrome:
  - Diarrhea Predominant
  - Constipation Predominant
  - Alternating Stool Pattern
- Nonulcer Dyspepsia
- Functional Abdominal Pain
- Abdominal Migraine
- Aerophagia
Functional GI Disorders: Treatment
- Education and reassurance
- Proper nutrition/food avoidance
  - Some studies up to 50% improve with fiber
- Counseling/Cognitive-Behavior
- Medications:
  - Antispasmodic
  - Anti-diarrheal
  - Probiotics
  - Tricyclic antidepressants
  - Serotonin receptor agents

A concerned 22 year old first time mom brings in her 6 week old "vomiter". After every feed her son "vomits the whole thing". You note the child is slightly above birth weight and the mother states he seems to be urinating less. You make the diagnosis with:

a) A metabolic evaluation
b) Stat head CT scan
c) Upper endoscopy by your local Pediatric GI
d) Abdominal sonography

Pyloric Stenosis
- Projectile, non-bilious emesis
- Most common cause of gastric outlet obstruction in neonates, M>F
- "olive"
- pyloric sonogram
- Hypochloremic metabolic alkalosis
- Surgery
Your previous patient is now 2 and accompanies his mother with his 6 week old brother who has “vomiting”. This has increased over the last 24 hours. The mother is tired, overwhelmed and complains of her increased dry cleaning expenses as she shows you her vomit stained white blouse that now has green and yellow stains. As your nurse provides her a sympathetic ear, you

a) Get samples of a low allergy formula
b) Order a pyloric sonogram
c) Call the ED to alert them of a neonatal bowel obstruction patient
d) Send in your junior partner “to deal with it”

Once in the emergency room, proper management of this infant would include:
a) Intravenous fluid resuscitation
b) Stat pediatric surgical consultation
c) Contrast imaging of the bowel
d) Nasogastric decompression
e) All of the above

**Volvulus**
- Abnormal fixation of bowel mesentery during fetal development
- Most occur in utero or early infancy
- Sudden onset of abdominal pain and **bilious** emesis
- Ischemia and necrosis
- UGI series
The previous mother is grateful and sends her own 45 year old post-partum mother to see you with her Trisomy 21 infant who was just sent home from the hospital “vomiting”. The child is just at birth weight. You send her to the ED and a series of radiographs do not show an obstructive pattern. Rather, there are only two pockets of air in the epigastric region. You are again the star as you diagnose:

a) Vulnerable child syndrome
b) Celiac disease
c) Milk protein allergy
d) Duodenal atresia

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**Duodenal Atresia**

- Double-bubble sign
- 1:4,500 newborns
- 2-5% Trisomy 21
- Assoc with obstructive processes i.e. annular pancreas
- Also found in fetal alcohol syndrome

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Ingestions

- Foreign bodies present with dysphagia and possibly poor handling of secretions
- Not all foreign bodies are seen on plain film—may need barium
- Endoscopic removal by 24 hours
- Alkali ingestions may burn esophagus and not the mouth

Diarrhea--Infectious

- Viral—less than one week
  - Rotavirus: most common cause of viral diarrheal disease in infants and toddlers
- Bacterial—sick, blood
  - Salmonella, Shigella, Yersinia, Campylobacter, E Coli
- Parasitic—persistent
- **C. Difficile:**
  - After antibiotics/hospitalization
  - Check for toxin A and B
  - Colonization not pathogen in neonates

Diarrhea

- Leading cause of morbidity and mortality in developing countries
- Daycare centers important reservoir
- In US
  - 35-40 million episodes annually in kids <5 yrs
  - 170,000 hospitalizations
  - 300 deaths
Food Borne
- Fecal-oral
- Salmonella and Campylobacter
  - Poultry, unpasteurized milk
- Yersinia enterocolitica
  - Pork
- Norwalk virus
  - Raw seafood
- Water
  - Giardia lamblia, Campylobacter, Cryptosporidium, Norwalk virus

E. Coli 0157:H7: associated Hemolytic Uremic Syndrome
- Often presents with colitis (bloody diarrhea)
- Hemolysis, uremia develop
- Poly-- then oligouric renal failure
- Thrombocytopenia
- Severity varies
- Risk factors
  - Uncooked meat, unpasteurized milk
**associated with anti-diarrheal and antibiotic use***

Malabsorption
- Defect in intraluminal digestion
  - Cholestasis
  - Pancreatic insufficiency
- Damage to intestine
  - Infection
    - Viral, giardia
  - Allergic enteropathy
  - Celiac disease
  - Short Bowel
Malabsorption Evaluation
- Carbohydrate
  - Check stool pH
  - Check stool reducing substances
- Fat
  - Qualitative vs. Quantitative (72 hour) measures
  - Think CF—treated with enzyme replacement
- Protein

Dietary Diarrhea
- Clinically:
  - Well
  - No blood, fever, etc.
- Contributors:
  - Sorbitol, fruit juice, excessive fluids
  - Lactose intolerance

Toddler’s Diarrhea
- Clinically well
  - Good wt gain and growth
- Stool
  - Frequent, undigested food
- Low fat
  - most commonly due to milk restriction
  - High osmolarity fluids
    - juice, gatorade, powerade, ice tea, etc.
Lactose Intolerance

- Primary vs Secondary
  - Primary rare < 5 years
- Management
  - Restriction v. supplement
  - If restriction → supplement calcium
- Diagnosis:
  - Clinical
  - Breath test
  - Disaccharidase levels in tissue
  - ??genetics

Celiac Disease

- Autoimmune
- Triggered by gluten
- Associated with hi risk populations
  - Type 1 DM
  - Down syndrome
  - Chronic lymphocytic thyroiditis (Hashimoto)
  - IgA deficiency
  - Family history

Non-Gastrointestinal Manifestations

Most common age of presentation: older child to adult

- Dermatitis Herpetiformis
- Dental enamel hypoplasia of permanent teeth
- Osteopenia/Osteoporosis
- Short Stature
- Delayed Puberty
- Iron-deficient anemia resistant to oral Fe
- Hepatitis
- Arthritis
- Epilepsy with occipital calcifications

Listed in descending order of strength of evidence
Serological Tests
- Antigliadin antibodies (AGA)
- Antiendomysial antibodies (EMA)
- Anti tissue transglutaminase antibodies (TTG)
  - first generation (guinea pig protein)
  - second generation (human recombinant)
- HLA typing

Histological Features
- Normal
- Infiltrative
- Hyperplastic
- Partial atrophy
- Subtotal atrophy
- Total atrophy

Treatment
- Only treatment for celiac disease is a gluten-free diet (GFD)
  - Strict, lifelong diet
  - Avoid:
    - Wheat
    - Rye
    - Barley
Hirschsprung’s Disease
- History of delayed passage of meconium
- Failure to thrive
- Abdominal distension
- Vomiting/obstructive picture
- Potential complications:
  - Perforation esp. cecal
  - Enterocolitis/sepsis
  - death

Hirschsprung’s Disease: Diagnosis
- CLINICAL SUSPICION
  - Obstructive series radiographs
  - Barium enema (older child)
  - Suction rectal biopsy—gold standard

A six year old is brought to you for diarrhea. Child stools multiple times during the day—seems to be all day. Often there is stool in the underwear. Your exam is notable for a tympanic abdomen and LLQ mass. Your diagnosis:

a) Neuroblastoma
b) Giardiasis
c) Lactose intolerance
d) Fecal overflow incontinence
Treatment of Constipation
- Stimulant laxatives—
  - Senna, bisacodyl
- Stool softeners/osmotics
  - PEG
  - Lactulose
  - ducosate
- Lubricants
  - Mineral oil

Rectal Prolapse
- CF till proven otherwise
- Constipation more common cause

INFECTION?          GENETIC
ENVIRONMENTAL       PSYCHOGENIC
IBD                DIETARY
DRUGS?             SMOKING
Crohn Disease
• Autoimmune
• Inflammatory process
  • Mouth to the anus; TI
• Presentation
  • Abdominal pain, diarrhea, rectal bleeding, growth failure
• Associated symptom—GI/systemic
• Extra-intestinal manifestations
  • Peri-anal changes, Fever, Apthous stomatitis, Uveitis/iritis, Skin Manifestations, Joint, Ankylosing spondylitis, Clubbing

IBD
• Interaction between genetic predisposition and environment
• Increased in Northern European and Jewish population
• Family History increased risk
• Typically presents in adolescence and young adulthood
• Steroids: for induction only, NEVER maintenance

Crohn’s and Growth Failure
• Can be presenting symptom
• Multi-factorial
  • Nutritional ie. Poor intake
  • Malabsorption
  • Direct cytokine/inflammatory effect on bone
Ulcerative Colitis

- Inflammatory
- "the bloody diarrhea"
- Limited to colon
- Continuous disease
- Extra-intestinal manifestations

Refeeding Syndrome

- Malnourished patients
- Electrolyte abnormalities
  - Hypophosphatemia
- Fluid retention
- Careful monitoring and slow refeeding
- Edema, muscle weakness, arrhythmias