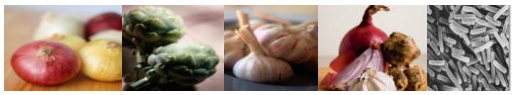
Fiber, Pre- & Probiotics: *Assisting in the Challenge of Bowel Management in the Elderly*



Course Objectives:

- Constipation
  - Definition
  - Causes
- Treatment Options for Constipation
  - Laxatives
  - Lifestyle changes
  - Fiber
  - Prebiotics
  - Probiotics
- Antibiotic Associated Diarrhea – C. *diff*
- Treatment Options for C. *diff*

Constipation

- **The most <u>widespread</u> LTC resident issue**
- **30-80% of LTC residents are constipated**
- **~75% are on a bowel management protocol**
- **~59-78% use laxatives**
- **The average cost of treating constipation (labor & supply) in a nursing home is <u>$2,253</u> per resident per yr**

American Family Physician, Sept. 1998.
J Am Diet Assoc. 2003;103:1199-1202
Frank L, Schmier J, Kleinman, et al. Time and economic cost of constipation care in nursing homes. J Am Med Dir Assoc 2002;3(4):215-223.

Rome III Criteria For Chronic* Constipation

- *Criteria >3 months w/ symptom onset >6 months prior to dx

1. Include 2 or more of the following:

During At Least 25% of Defecations

- **Straining**
- **Lumpy or Hard Stools**
- **Sensation of Incomplete Evacuation**
- **Sensation of Anorectal Obstruction or Blockage**
- **Manual Maneuvers to Facilitate Defecations**
- **<3 Defecations Per Week**

2. Loose stools are rarely present without use of laxatives

3. Insufficient criteria for IBS

Longstreth GF, Thompson WG, Chey WD, Houghton LA, Mearin F, Spiller RC. Functional bowel disorders. *Gastroenterology.* 2006;130:1480-1491.

Causes of <u>Primary</u> Constipation

- **Normal-transit**
  - Difficulty with evacuation or presence of hard stools
- **Slow colonic transit**
  - Associated with decreased motility
- **Anorectal dysfunction**
  - Inefficient coordination of the pelvic musculature in the evacuation mechanism

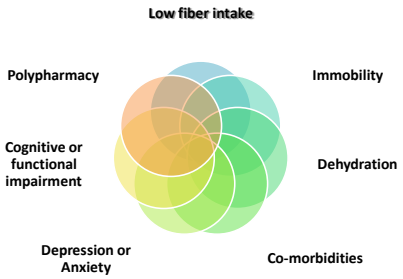
American Family Physician, Dec. 2006 http://www.aafp.org/afp/20051201/2277.html

Causes of <u>Secondary</u> Constipation

- **Dietary Factors**
- **Physical Inactivity**
- **Endocrine and Metabolic Diseases**
- **Myopathies and Neurologic Diseases**
- **Structural Abnormalities**
- **Physiological Conditions**
- **Medications**

http://www.medscape.com/viewarticle/559895_5

Risk Factors for Elderly

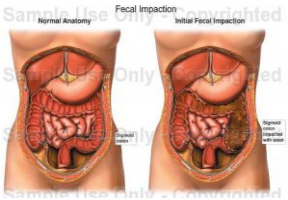


Drugs that may Cause Constipation

- Narcotics
- Antacids
- Anticholinergics
- Antidepressants
- Diuretics
- Antihypertensives
- Antidiarrheals
- Iron

Consequences

- Decline in quality of life
- A decrease in functional ability
- Increased pain
- Dysuria (painful urination)
- Fecal incontinence
- Colon ulcers
- Perforation of the colon
- **Fecal impaction**
  - intestinal obstruction
  - bowel perforation
  - death



Treatment

Pharmacologic

- Stool softeners, lubricants, osmotic laxatives, stimulant laxatives, enemas, medications

Nonpharmacologic

- Lifestyle changes
- Adequate **fiber** intake along with water
- **Prebiotics** & **Probiotics**

Classification of Laxatives

Bulk Laxatives
- Psyllium, methylcellulose, wheat dextrin, polydextrose

Lubricant Laxatives
- Mineral oil

Stool Softeners
- Colace, Surfak

Osmotic Laxatives
- Lactulose, sorbitol, polyethylene glycol (Miralax)

Saline Laxatives
- Milk of Magnesia, magnesium citrate

Stimulants
- Dulcolax, Ex-lax

Issues with Laxatives

- Worsening of symptoms
  - Bloating and gas, cramping, abdominal pain/colic
- Development of complications
  - Electrolyte imbalance, metabolic disturbances
  - Diarrhea, low blood volume
  - Interference with drug absorption
  - Structural changes in gut mucosa
  - Depletion of beneficial microorganisms→C.diff
  - Abuse potential (dependency)
- Diminished therapeutic effect
- Should not be used in people with certain conditions
  - Renal, heart, liver failure (osmotic)

Xing JH, et al. *Dis Colon Rectum*. 2003 Aug;44:1201-1209. Garcia MC, et al. *Term Med*. 2002 Aug;95:334-336. Chaussade S, et al. *Ailment Pharmacol Ther*. 2003 Jan;17:165-172. Riley SA, et al. Br J Clin Pharmacol. 1992 Jul;34:40-46. Gattuso JM, et al. *Drug Saf*. 1994 Jan;10:47-65. Wald A. *J Clin Gastroenterol*. 2003;36:386-89. Duncan A, et al. *Eur J Gastroenterol Hepatol*. 2001;13:599-601.

Weaning from Stimulants

- Habitual use of stimulant laxatives should be replaced with bulking agents gradually
- A combination of a **stimulant** + **fiber** might be useful for a 30-day pd to boost colonic function & bridge the transition from stimulant dependence to natural facilitation of bowel movements
- The goal should be permanent discontinuation of stimulants in favor of fiber intake

Lifestyle Changes

- Increase Physical Activity
- Bowel Training
  - Sitting on the toilet 1st thing in the morning or 15-20 min after meals when the colonic activity is the greatest about
- Increase Hydration

Fiber

First-line approach

which improves stool consistency & accelerates colon transit time

Adequate Intake (AI) for Fiber

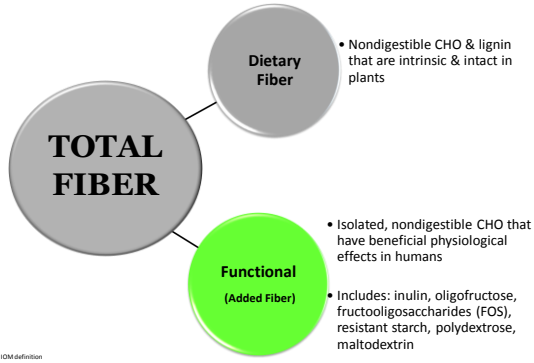
Men	Women
• 38g/d for ages 31-50y • 30g/d for ages ≥ 51y	• 25g/d for ages 31-50y • 21g/d for ages ≥ 51y

http://www.mayoclinic.com/print/fiber/NU00033/METHOD=print: The National Academy of Sciences' Institute of Medicine.

FOOD FIRST

Challenges with Getting Adequate Fiber

- Difficulty chewing & swallowing
- Poor appetite may reduce consumption
- Gas &Bloating



IOM definition

Prebiotics

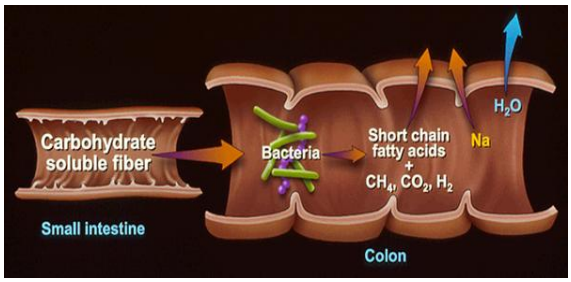
- Non-digestible food ingredients that stimulate the growth and/or activity of bacteria in the digestive system which are beneficial to the health of the body.
- Food for probiotics proliferating their growth

Gibson GR, Roberfroid MB. *Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. J Nutr.* 1995 Jun;125(6):1401-12.

Food grade commercial prebiotics

- **Fructo-oligosaccharides (FOS)**
- Galactosaccharides (GOS)
- Lactulose
- Inulin
- Polydextrose
- Isomalto-oligosccharides
- Lacto-sucrose
- Gentio-oligosaccharides
- Xylooligosaccharides

Prebiotics Produce SCFA

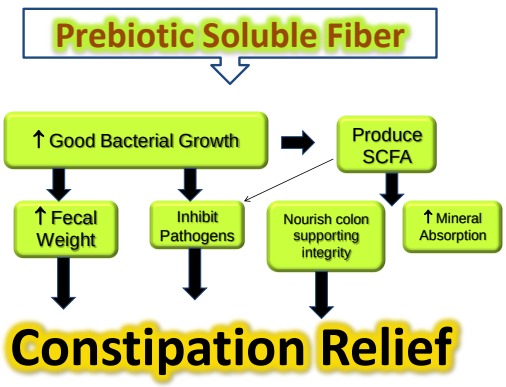


Soluble fiber: e.g prebiotic fiber

Polydextrose

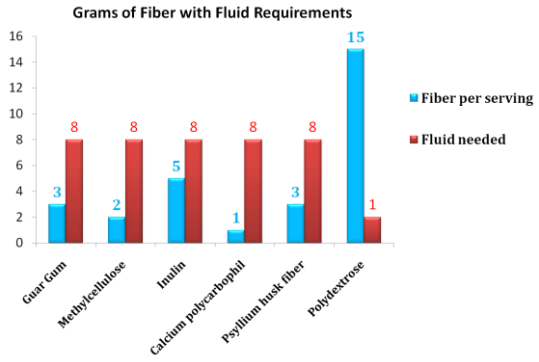
- Prebiotic soluble fiber
- Partially fermented in the large intestine, leading to increased fecal bulk, reduced transit time, softer stools, and lower fecal pH
- Fermentation leads to the growth of favorable microbiota (↑ lactobacillus, ↓ bacteroids), enhanced production of SCFAs, & suppressed production of carcinogenic metabolites supporting colon health
- Does not require additional fluid consumption
- Clinically proven

American Journal of Clinical Nutrition, Vol. 72, No. 6, 1503-1509, December 2000



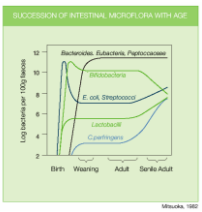
Typical Fiber Supplements

- ✓ Require 8 oz of fluid to hydrate the supplement alone
- ✓ If sufficient fluid is not consumed it may cause choking
- ✓ Excessive gas and bloating
- ✓ Can interfere with medications
- ✓ Can decrease the absorption of minerals
- ✓ Contraindicated for people with difficulty swallowing, intestinal obstruction, impacted
- ✓ Low in fiber

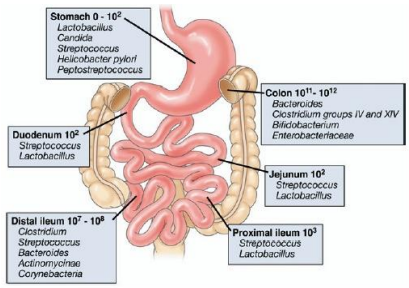


Aging Causes

- Changes in microbiota
- Decrease in beneficial microorganisms
- Increase in harmful microorganisms



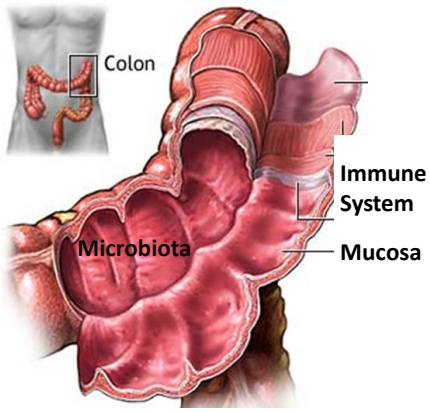
Highest Concentration in the Colon



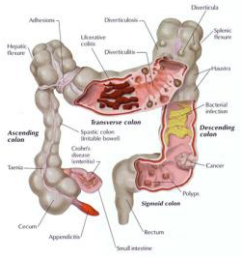
Sartor et al. Gastroenterology 134: 577-594 (2008)

Microbiota

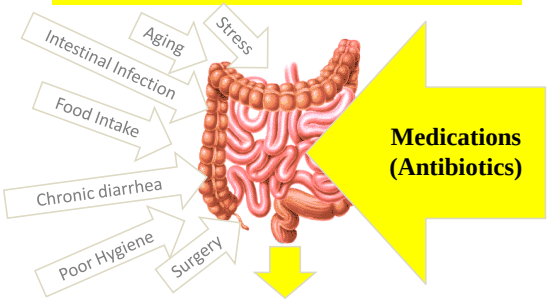
- Living microorganisms that coat the inner wall of our intestines
- ~100 trillion microorganisms
- Weighing ~3lbs
- Outnumbering the cells in our body by a factor of 10



A Healthy Colon keeps things Moving



Factors Disturbing Intestinal Microbiota



A disturbed microbiota makes patients extremely susceptible & vulnerable to infection & disease

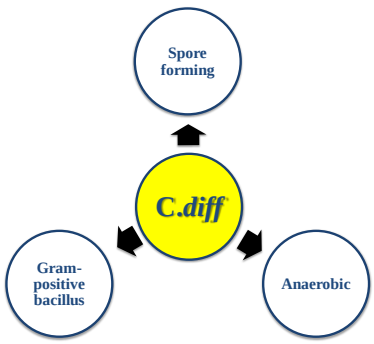
Antibiotic Use in LTC

- 50% to 75% of residents
- 3 months to restore microbiota to normal levels

Antibiotic Associated Diarrhea (AAD)

- ≥ 3 abnormally loose bowel movements/24hrs
- Occurs in 5-62% of residents
- Depends on antibiotic type, health, & exposure
- 15-25% of AAD is caused by *C. diff*

Pepin J, Valiquette L, Alary ME, Villemure P, Pelletier A, Forget K, et al. CMAJ. 2004;171:466-72.
McFarland LV, Surawicz CM, Greenberg RN, Fekety R, Elmer GW, Moyer KA, et al. JAMA. 1994;271:1913-8.
Gerding DN, Muto CA, O'Leary MM. Clin Infect Dis. 2008;46 Suppl 1:S32-42.
Kuijper EJ, van Dissel JT, Wilcox MH. Lancet Infect Dis. 2007;7:59-62.
Riccardi R, Rothenberger DA, Madoff RD, Baxter NN. Arch Surg. 2007;142:624-31.

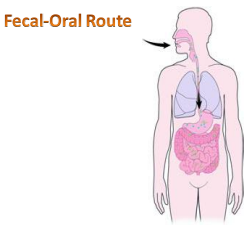


Past 10 yr, prevalence, case-fatality rates, total attributable mortality rates, & colectomy rates for persons with CDAD have markedly ↑

Gastroenterol Clin North America 2006; 35: 315 - 335

Fecal-Oral Route Transmission

- Colonized Humans
- Environmental Surfaces
- Contaminated Equipment



New Super Bug Surpassed MRSA

- *C. diff* have surpassed MRSA
- Epidemic outbreaks are becoming a widespread problem
- These newer hypervirulent mutated strains are far more deadly than the organisms of 30 years ago
- Possibly due to over utilization of antibiotics

Risk factors

- Antibiotic use
- Age >65 years
- Hospitalization
- Feeding tube
- Anti-gastric ulcer drugs
- Anti-peristaltic drugs
- Low albumin level
- Severe underlying illness
- Length of stay in LTC facility
- Poor infection control
- GI surgery
- Immunosuppressive therapy
- Intensive care unit

Pathogenesis of C. *diff* Associated Disease

Antibiotic therapy

↓

Disturbed colonic microbiota

↓

C. diff exposure and colonization

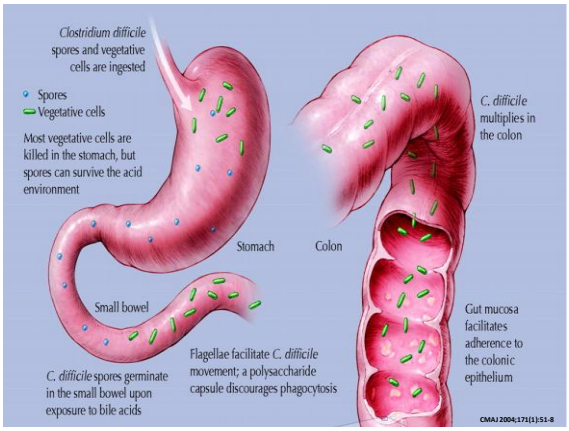
↓

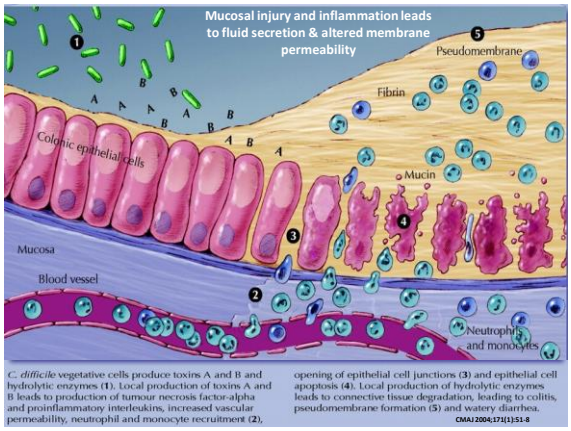
Release of toxin A and toxin B

↓

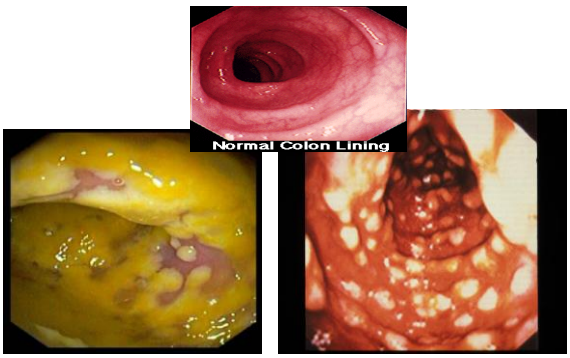
Diarrhea and Colitis

Adapted from Kelly CP et al Ann Rev Med 1998;48:375-390





C. Diff toxin-induced Pseudomembranous colitis



Clinical Presentations

- ❑ Profuse watery diarrhea
- ❑ Abdominal pain, distention
- ❑ Fever
- ❑ Nausea
- ❑ Dehydration
- ❑ Loss of appetite
- ❑ Hypoalbuminaemia
- ❑ Possible occult blood in stool
- ❑ Colitis (severe case)
- ❑ Risk increases for development of paralytic ileus, toxic megacolon, sepsis, electrolyte imbalance, hypotension, & volume depletion

Treatment for C. *diff*

- Discontinuation of antibiotics, if possible
- Metronidazole (250mg **4X/d** or 500mg TID/d) for **10-14d** or
- Vancomycin (125mg **4X/d**) for 10-14 d

Poutanen, S. M. et al. CMAJ 2004;171:51-58

Non-antibiotic Management

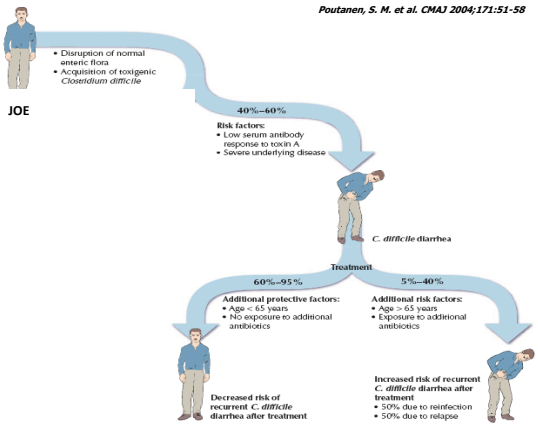
- Correct loss of benefical microorganisms due to profuse diarrhea & antibiotic use
- Correction of fluid losses & electrolyte imbalances
- Monitor weight
- Avoid antiperistaltic drugs
- Implementation of infection control policies

LaMont, 2006
Mahan-Butarro, Aznavorian, & Dick, 2006

Effective treatment of *c.diff* needs to do 3 things:

1. **Reduce** the burden of *c.diff* & its toxins in the intestine
2. **Assist** the host's immune system
3. **Restore** the normal colonic micobiota

Poutanen, S. M. et al. CMAJ 2004;171:51-58

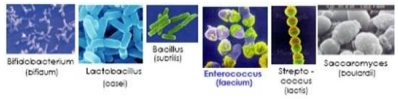


Since residents taking antibiotics are already in a weakened state, they are even more vulnerable after antibiotic use.

Could there have been a way to help Joe restore his microbiota during antibiotic use to decrease his susceptibility to *c.diff*?

Probiotics

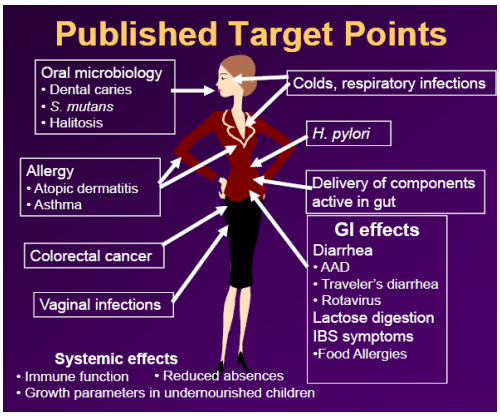
- Probiotics are **live microorganisms** that have been shown to **confer a health benefit**
- *Lactobacillus, Bifidobacterium, Saccharomyces (a yeast)* are the most common



Thomsen M. Probiotics—enhancing health with beneficial bacteria. *Altern Complement Ther.* 2006;12(1):14-20.

Probiotics: Mechanism of Action

- **Inhibit the growth of bacteria**
- **Blocks attachment or invasion by pathogens**
- **Improve mucosal barrier function**
- **Alter host immune response**



Lactobacillus casei shirota

↑ Genus ↑ Species ↑ Strain

Products Containing Probiotics

Probiotics Proven For AAD & C.diff

Probiotic	Product
Saccharomyces boulardii	Florastor (capsule)
Saccharomyces boulardii + bacillus coagulan + FOS	Diff-Stat (chewable tablet, powder)
Lactobacillus rhamnosus GG	Culturelle (capsule) (children)
Lactobacillus Reuteri ATCC 55730	BioGaia Probiotic Chewable tablets (children)
Lactobacillus casei DN-114 001	DanActive (fermented milk)
Lactobacillus acidophilus CL1285, Lactobacillus casei LBC8OR	BioK+CL1285 (fermented milk,capsule)

Are live cultures the same as probiotics?

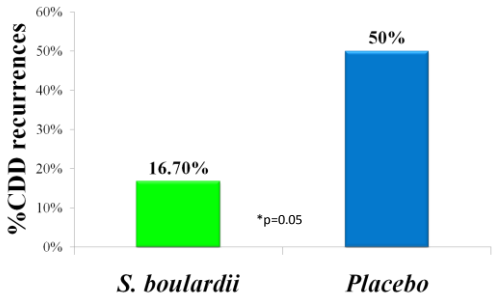
- Live cultures are microbes that are used to ferment foods
- During production live cultures can die
- Not all live cultures are probiotics
- NYA Live & Active Culture Seal = ≥ 100 M cultures/g at the time of manufacture
- Does not differentiate btw starter cultures + added probiotics

Saccharomyces boulardii

- A non-pathogenic yeast with over 56 years of use & clinical research
- #1 Probiotic that has been clinically shown to prevent AAD & c.*diff* worldwide
- Genetically resistant to antibiotics & resistant to heat & acid
- Inactivates bacterial toxins, inhibits toxin binding to intestinal receptors & lessens toxin-induced inflammation
- Stimulates host immune defenses

Walker WA. Mechanisms of action of probiotics. Clin Infect Dis 2008; 46:S87-591. A very interesting review of the mechanisms of action of probiotics . McFarland LV, et al. Am J Gastro 2002:97:1769

S. boulardii & High Dose Vancomycin for *C. diff*



Surawicz CM. Clin Infect Dis 2000;31:1012-7.

Bacillus coagulans

- A lactic acid producing bacteria, probiotic
- Naturally encapsulated in a spore for protection
- Has over 50 yrs of history of safe use
- Reaches the intestines→ coat dissolves →bacteria multiply →producing lactic acid
- Inhibits growth of pathogens, alleviates abdominal pain & bloating
- In a recent clinical study, *b. coagulans* with FOS was shown to prevent AAD

Challenges with Probiotics

- Manufacturing
- Shelf stability
- In the body
- With antibiotics
- Appropriate use

Synbiotics (Probiotic + Prebiotic)

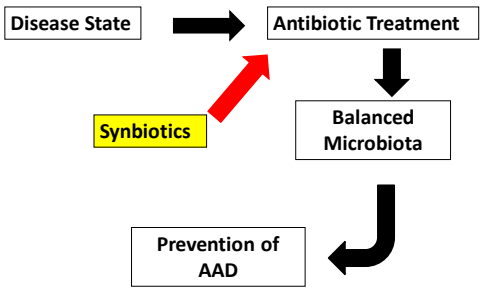
- Produce a synergistically beneficial effect
- More effective than probiotics alone
- Offer improved chance of survival in GI tract

(Nagpal et al, 2007)

Potential Benefits of Using Synbiotics

- ✓ Fewer outbreaks & transmissions of infection within the facility
- ✓ A reduction in dehydration & malabsorption associated with AAD
- ✓ A reduction in the inappropriate use of antibiotics
- ✓ A reduction in the # of patients with infections who are transferred to acute-care settings
- ✓ A reduction in direct & indirect patient care costs as a result of more appropriate resource utilization

Prevention of AAD



Affects of Aging on Colon Health

Function	Colon	Inability to function leads to	Conditions	Prevention with Nutrition
1) **Absorbs water forming stool & lubricates**	Mucosa	Hard stool, watery stool	•Constipation •Diarrhea	•Prebiotics •Probiotics •Dietary Fiber
2) **Eliminates waste, keeps things moving**	Muscle	Increase in toxins & bacterial growth, hard stool	•Constipation •Diarrhea	•Prebiotics •Probiotics •Dietary Fiber
3) **Prevents pathogen adhesion**	Mucosa, Microbiota	Increase in pathogens, destruction of intestinal cells	•Constipation •Diarrhea/AAD	•Prebiotics •Probiotics •Dietary Fiber
4) **Provides immunity**	Microbiota, Antibodies (immunoglobulins)	Infections	•Diarrhea/AAD	•Prebiotics •Probiotics •Dietary Fiber

Healthy intestinal microflora is a fundamental characteristic of a healthy organism.

A. Nissle, 1917

THANK YOU

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