NUTRITION IN MEDICINE:
CALORIES OR THERAPEUTIC MODALITY

AMERICAN COLLEGE OF OSTEOPATHIC INTERNISTS

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UNIVERSITY OF MISSOURI – COLUMBIA

OCTOBER 30, 2016

DISCLOSURE

AMERICAN COLLEGE OF OSTEOPATHIC INTERNISTS NATIONAL MEETING

Nestle Nutrition Institute Speaker & Consultant

I will not discuss off label use or investigational use in my presentation

ACOI 75

75 YEARS OF DEDICATION TO OUR MEMBERS

Matthew Bechtold MD
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NUTRITIONAL IMPACT

WEIGHT LOSS
> 35%

↑RISK OF DEATH

PROTEIN STORAGE LOSS
> 30%

FAT STORAGE LOSS
> 70%

Feldman M, et al. Sleisenger & Fortran's Gastrointestinal and Liver Disease 2010

NUTRITIONAL IMPACT

CELIAC DISEASE
Gluten-Free Diet
Folate, Fe, Fat-Soluble Vitamins
Trace Minerals

CIRRHOSIS
Do Not Limit Protein
Watch For Hypoglycemia
Nutrition Improves Outcomes in Transplant

SHORT GUT SYNDROME
Maximize Nutrition
Avoid Too Much CHO
Ileal Adaptation

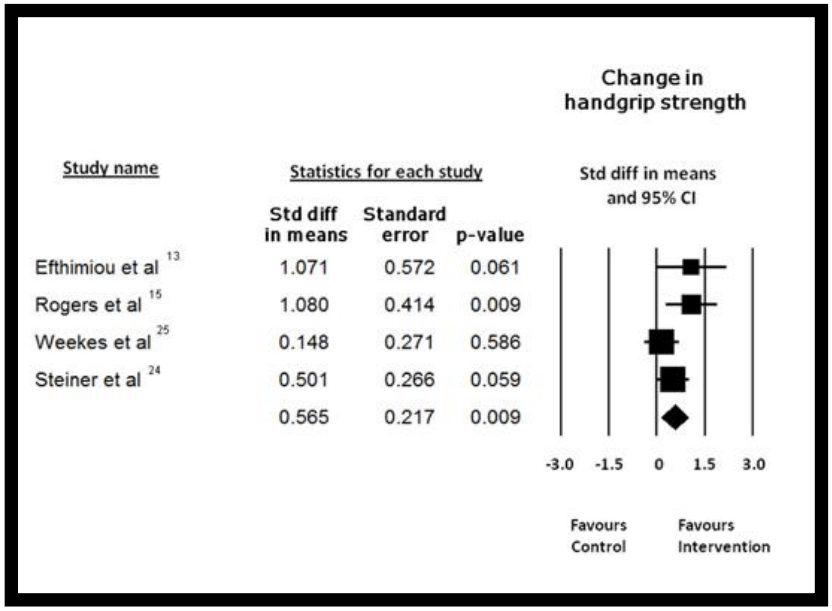
DUMPING SYNDROME
Frequent Small Meals
Avoid Simple CHO
Fluid Intake Separated From Meal

REFEEDING SYNDROME
Go Slow
Watch Phosphorus

FOOD ALLERGIES
Just Say NO
Supplements

NUTRITIONAL IMPACT COPD

Meta-analysis
12 RCTs (n=448)
Stable COPD



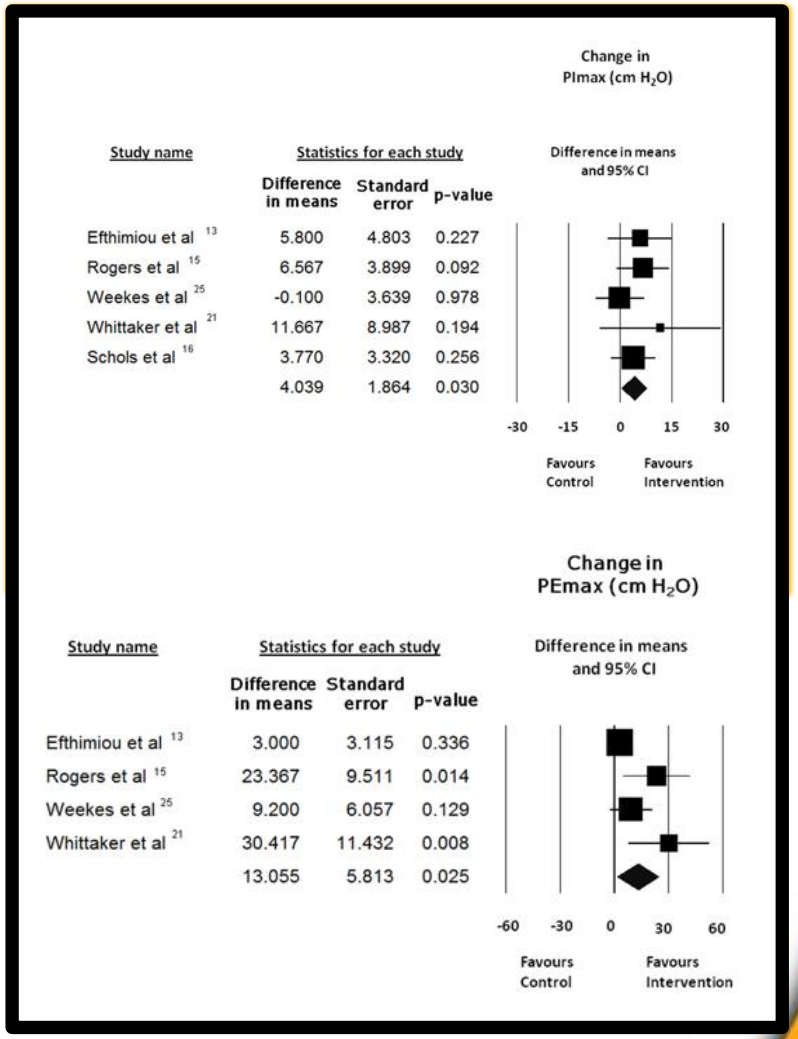
Dietary advice (1)

or

Oral supplementation (10) vs Nothing

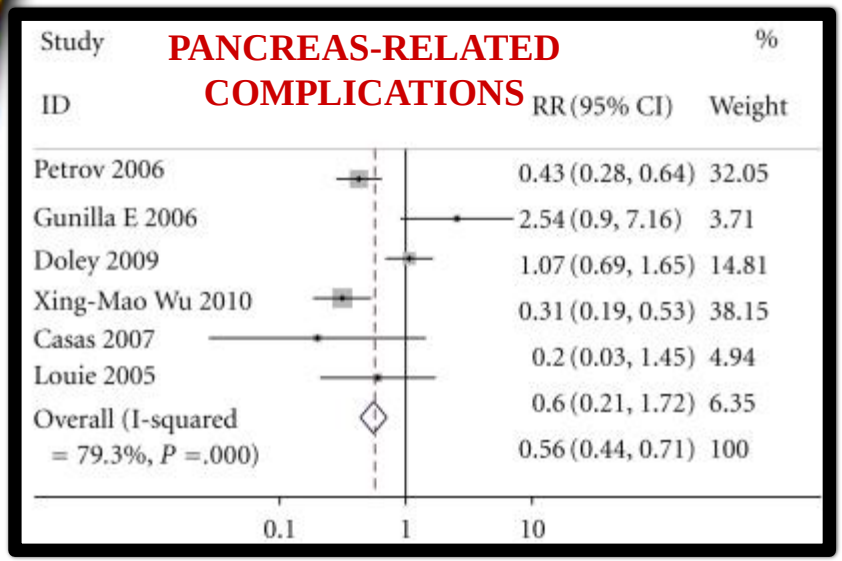
or

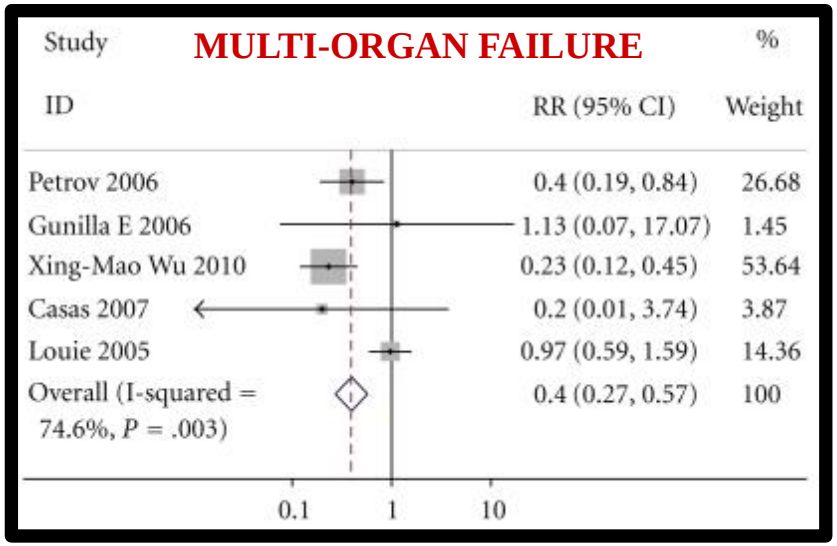
Enteral tube feeds (1)



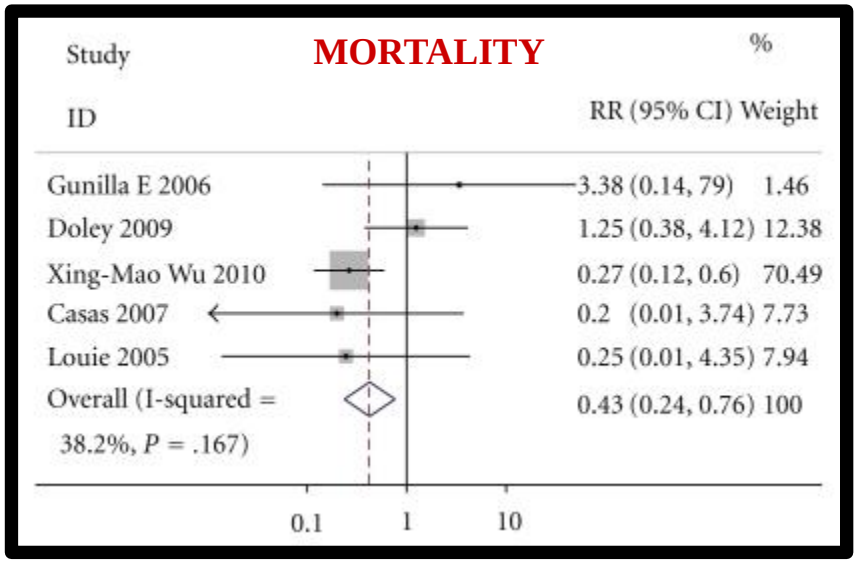
Collins PF, et al. Respirology 2013

NUTRITIONAL IMPACT PANCREATITIS





Meta-analysis
6 RCTs (n=326)
Predicted severe acute pancreatitis



EN ≤ 72 hours vs TPN

Quan H, et al. Gastroenterol Res Pract 2011

NUTRITIONAL IMPACT PANCREATITIS

RCT (n=205)
19 Dutch Centers
Predicted severe acute pancreatitis
Apache II ≥ 8
Modified Glasgow Score ≥ 3
CRP > 150 mg/L

Outcome	Early Tube Feeding (N=101)	On-Demand Tube Feeding (N=104)	Risk Ratio (95% CI)	P Value
Primary composite end point: infection or death — no. (%)	30 (30)	28 (27)	1.07 (0.79–1.44)	0.76
Secondary end points				
Infection — no. (%)†	25 (25)	27 (26)	0.97 (0.70–1.34)	0.87
Infected pancreatic necrosis	9 (9)	15 (14)	0.74 (0.43–1.26)	0.28
Bacteremia	17 (17)	18 (17)	0.98 (0.68–1.43)	1.00
Pneumonia	12 (12)	13 (12)	0.97 (0.63–1.50)	1.00
Death — no. (%)	11 (11)	7 (7)	1.27 (0.85–1.89)	0.33
Necrotizing pancreatitis — no. (%)‡	64 (63)	65 (62)	1.06 (0.77–1.47)	0.76
CT severity index§	4±2	4±3	—	0.29
ICU admission after randomization — no. (%)	18 (18)	20 (19)	0.95 (0.66–1.38)	0.86
Mechanical ventilation — no. (%)	12 (12)	14 (13)	0.93 (0.60–1.44)	0.84
New-onset organ failure — no./total no. at risk (%)¶				
Single organ failure	26/67 (39)	31/73 (42)	0.92 (0.65–1.32)	0.73
Persistent single organ failure	10/67 (15)	10/73 (14)	1.05 (0.65–1.70)	1.00
Multiple organ failure	7/67 (10)	6/73 (8)	1.14 (0.67–1.95)	0.77
Persistent multiple organ failure	4/67 (6)	4/73 (5)	1.05 (0.51–2.14)	1.00

Nasoenteric tube feeds ≤ 24 hours vs Oral Diet/tube feeds @ 72 hours

Bakker OJ, et al. N EJM 2014

NUTRITIONAL IMPACT PANCREATITIS

RCT (n=205)
19 Dutch Centers
Predicted severe acute

Outcome	Early Tube Feeding (N=101)	On-Demand Tube Feeding (N=104)	Risk Ratio (95% CI)	P Value
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Persistent multiple organ failure	4/67 (6)	4/73 (5)	1.05 (0.51–2.14)	1.00

TYPE II STATISTICAL ERROR?
LATE START OF EARLY GROUP FEEDING?
SEVERITY SCALES ACCURATE?

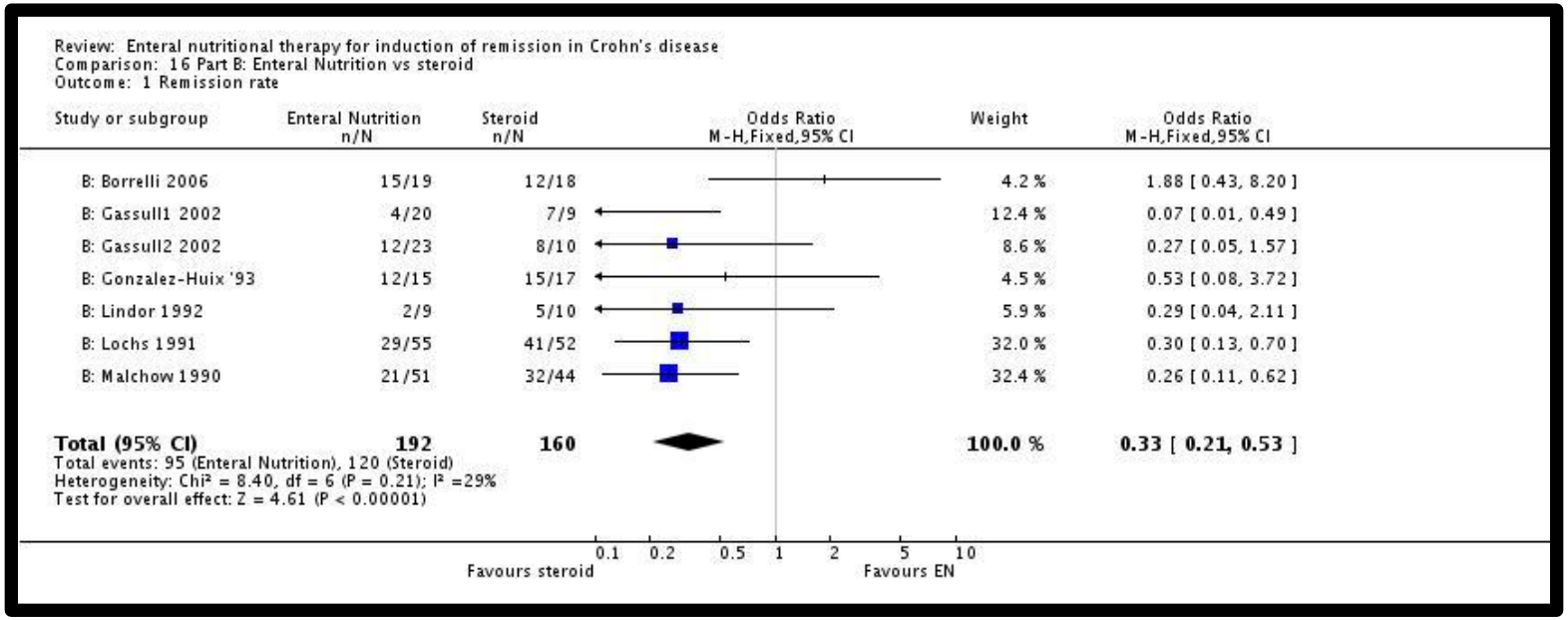
Nasoenteric tube feeds $\leq$ 24 hours vs Oral Diet/tube feeds @ 72 hours

Bakker OJ, et al. N EJM 2014

NUTRITIONAL IMPACT IBD

Meta-analysis
7 RCTs (n=352)

INDUCING REMISSION IN CROHN'S DISEASE
Enteral Nutrition vs Steroids



Dziechciarz P, et al. Aliment Pharmacol Ther 2007
Zachos M, et al. Cochrane Database Syst Rev 2008

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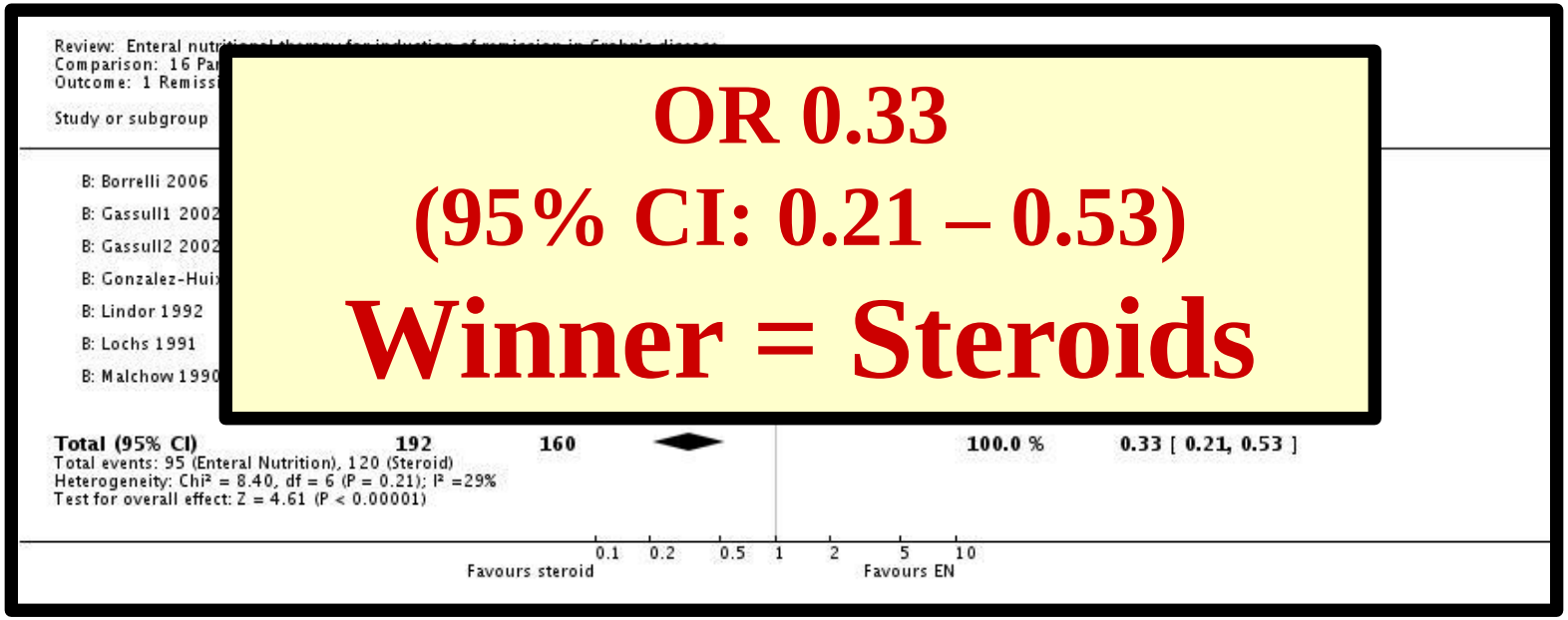


Dziechciarz P, et al. Aliment Pharmacol Ther 2007
Zachos M, et al. Cochrane Database Syst Rev 2008

NUTRITIONAL IMPACT

IBD

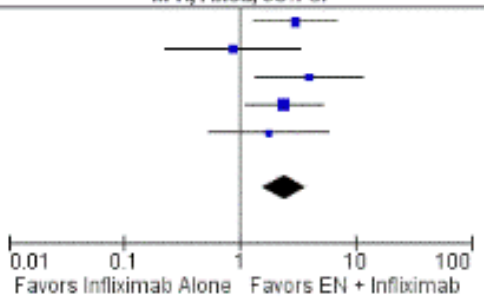
Meta-analysis
5 RCTs (n=403)

INDUCING AND SUSTAINING REMISSION IN CROHN'S DISEASE

Study or Subgroup	Favors ED + Infliximab Events	Total	Favors Infliximab Alone Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Hirai et al - 2012	31	45	24	57	24.4%	3.04 [1.34, 6.92]
Matsumoto et al - 2005	15	49	4	12	16.5%	0.88 [0.23, 3.39]
Sazuka et al - 2012	23	29	22	45	13.2%	4.01 [1.37, 11.71]
Tanaka et al - 2006	30	51	22	59	31.1%	2.40 [1.11, 5.18]
Yamamoto et al - 2009	25	32	16	24	14.8%	1.79 [0.54, 5.89]
Total (95% CI)		**206**		**197**	**100.0%**	**2.43 [1.58, 3.74]**
Total events	124		88			

Heterogeneity: Chi² = 3.56, df = 4 (P = 0.47); I² = 0%
Test for overall effect: Z = 4.03 (P < 0.0001)

INDUCTION OF REMISSION



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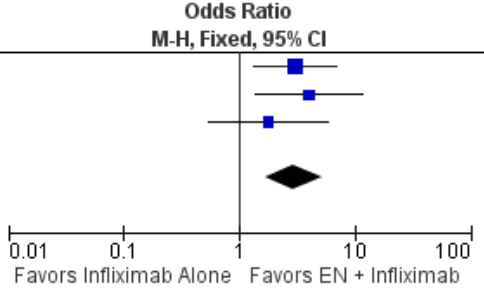
Sazuka et al - 2012	23	29	22	45	25.2%	4.01 [1.37, 11.71]
Yamamoto et al - 2009	25	32	16	24	28.3%	1.79 [0.54, 5.89]
Total (95% CI)		**106**		**126**	**100.0%**	**2.93 [1.66, 5.17]**
Total events	79		62			

Heterogeneity: Chi² = 1.00, df = 2 (P = 0.61); I² = 0%
Test for overall effect: Z = 3.71 (P = 0.0002)

REMISSION > 1 YEAR



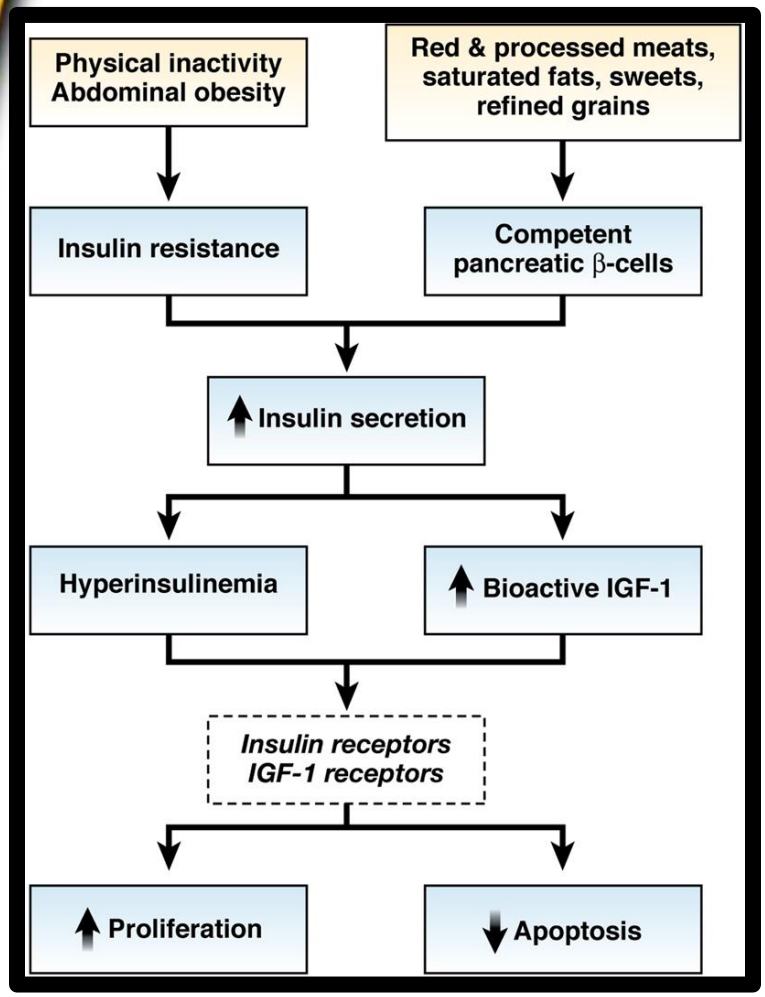
Enteral nutrition therapy (elemental or polymeric formula, with or without low-fat diet restriction) with infliximab

VS

Infliximab alone with no dietary manipulation

Nguyen DL, et al. Therap Adv Gastroenterol 2015

NUTRITIONAL IMPACT COLORECTAL CANCER



INCREASE RISK

Red Meat

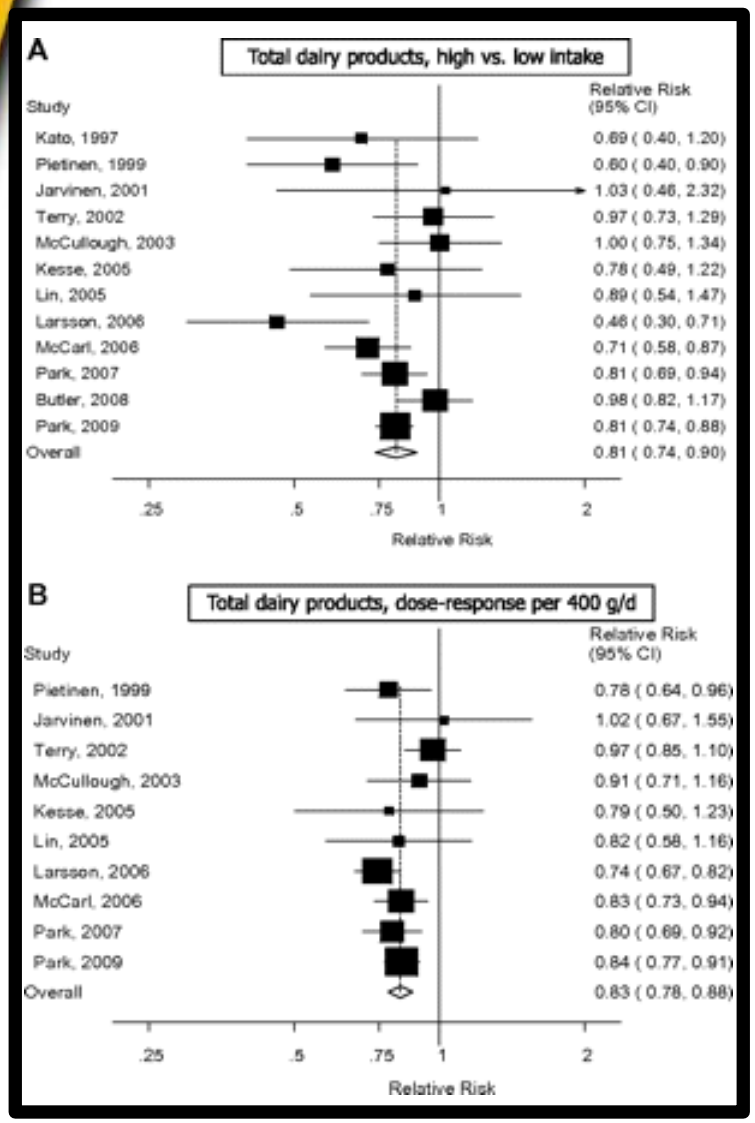
Processed Meat

Highly Refined Grains and Starches

Sugars

Chan AT, et al. Gastroenterology 2010

NUTRITIONAL IMPACT COLORECTAL CANCER



Meta-analysis
12 Prospective Cohort Studies
(n=1,170,942)

FUTURE IMPACT
Vitamin D
Fiber
Folic Acid
Magnesium

Aune D, et al. Ann Oncol 2012

NUTRITIONAL ASSESSMENT

MEDICAL HISTORY

Nutritional deficiencies in diet

Eating habits

Food diary

Dieting???

PHYSICAL EXAM

BMI

Ideal body weight (IBW)

Present body weight (PBW)

Deviation from average body weight over past 3-6 months

NUTRITIONAL ASSESSMENT

ANTHROPOMORPHIC MEASUREMENTS

HAND-HELD CALIPERS

BODY MASS INDEX

BIOCHEMICAL MEASUREMENTS

ALBUMIN

PREALBUMIN

TRANSFERRIN

CREATININE

IMMUNOLOGIC MEASUREMENTS

LYMPHOCYTE COUNT

Feldman M, et al. Sleisenger & Fortran's Gastrointestinal and Liver Disease 2010

NUTRITIONAL ASSESSMENT

- BMI = Weight (kg) / Height $(m)^2$

BMI TABLE	Caucasians	Asians
Normal	< 25	< 23
Overweight	25 – 29.9	23 – 29.9
Obese	30 – 39.9	30 – 39.9
Severe Obesity	≥ 40	≥ 40

- Problems:
  - Muscle mass does not count:

    Terrell Owens BMI = 6'3" and 224 lbs = 28

    Dwayne Johnson (AKA The Rock) BMI = 6'5" and 260 lbs = 31

Feldman M, et al. Sleisenger & Fortran's Gastrointestinal and Liver Disease 2010

NUTRITIONAL ASSESSMENT GLOBAL ASSESSMENTS

Formulas

Harris-Benedict Equation
Protein Assessment

Research Tools

Electric Impedence Testing
Infared Refractance
Densitometry

Indirect Calorimetry

Heat produced by oxidation
Resting energy expenditure: Measured by ventilated hood over pt's head x 2 hrs
(O_2 and CO_2 content)

Subjective Global Assessment

Feldman M, et al. Sleisenger & Fortran's Gastrointestinal and Liver Disease 2010

NUTRITIONAL ASSESSMENT
GLOBAL ASSESSMENTS

NO SINGLE TOOL IS AN ACCURATE PREDICTOR OF NUTRITIONAL STATUS

Heat produced by oxidation

Resting energy expenditure: Measured by ventilated hood over pt's head x 2 hrs (O_2 and CO_2 content)

Subjective Global Assessment

Feldman M, et al. Sleisenger & Fortran's Gastrointestinal and Liver Disease 2010

SUBJECTIVE GLOGAL ASSESSMENT

(Select an appropriate category with a checkmark, or enter numerical value where indicated by "#")

A. History

1. Weight change
   Overall loss in past 6 months: amount = # _____ kg; percent loss = # _____
   Change in past 2 weeks: _____ increase,
   _____ no change,
   _____ decrease.

2. Dietary intake change (relative to normal)
   _____ No change,
   _____ Change_____ duration = # _____ weeks.
   _____ type: _____ suboptimal solid diet, _____ full liquid diet
   _____ hypocaloric liquids, _____ starvation.

3. Gastrointestinal symptoms (that persisted for >2 weeks)
   _____ none, _____ nausea, _____ vomiting, _____ diarrhea, _____ anorexia.

4. Functional capacity
   _____ No dysfunction (eg, full capacity),
   _____ Dysfunction _____ duration = # _____ weeks.
   _____ type: _____ working suboptimally,
   _____ ambulatory,
   _____ bedridden.

5. Disease and its relation to nutritional requirements
   Primary diagnosis (specify):_____
   Metabolic demand (stress): _____ no stress, _____ low stress,
   _____ moderate stress, _____ high stress.

B. Physical (for each trait specify: 0 = normal, 1+ = mild, 2+ = moderate, 3+ = severe).
   # _____ loss of subcutaneous fat (triceps, chest)
   # _____ muscle wasting (quadriceps, deltoids)
   # _____ ankle edema
   # _____ sacral edema
   # _____ ascites

C. SGA rating (select one)
   _____ A = Well nourished
   _____ B = Moderately (or suspected of being) malnourished
   _____ C = Severely malnourished

Charney P. Nutr Clin Pract 1995

FEEDING

METHODS

ENTERAL FEEDING
By Mouth
Tube Feeding

PARENTERAL FEEDING
Total Parenteral Nutrition
Peripheral Parenteral Nutrition

WHICH ONE?

“If the gut works, use it!”

- Stevan Whitt MD

PEGs

BENEFIT

Strokes

Head & Neck Cancers

Life-Expectancy > Few Months

MAY NOT BENEFIT

Alzheimer's Dementia

Roth. Biomedical Ethics Seminar 2007
Finucane, et al. J Am Med Dir Assoc 2007
Finucane, et al. JAMA 1999
Cervo, et al. Geriatrics 2006
Roth, et al. Stroke 2002

PEGs

FAMILY ON FEEDING TUBES

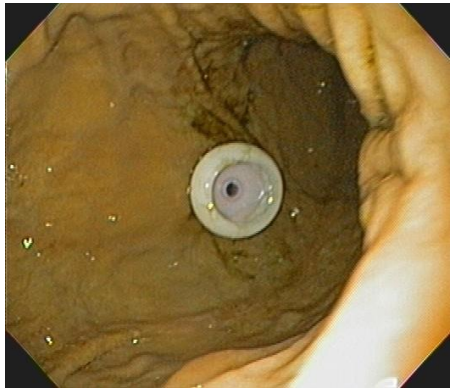
Improve nutrition and hydration

Prevent aspiration pneumonia

Improve or maintain function

Improve survival

Improve patient comfort



Roth. Biomedical Ethics Seminar 2007
Finucane, et al. J Am Med Dir Assoc 2007
Finucane, et al. JAMA 1999
Cervo, et al. Geriatrics 2006
Roth, et al. Stroke 2002

PEGs

REALITY OF PEG TUBES

Nutritional status does not necessarily improve

Diarrhea, clogging of tube, pulling out of tube

Increased nutrients do not necessarily result in meaningful clinical outcomes

Continued risk of aspiration

Survival rates same for PEG and spoon fed patients

Mortality rates

2% to 27% at 30 days and 50% or more at 1 year

Restraints often required leading to discomfort and compromised autonomy

Denied pleasure of eating

Adverse effects with feeding tube due to complications

Roth. Biomedical Ethics Seminar 2007

Finucane, et al. J Am Med Dir Assoc 2007

Finucane, et al. JAMA 1999

Cervo, et al. Geriatrics 2006

Roth, et al. Stroke 2002

PEG COMPLICATIONS

Major Complications

Necrotizing Soft Tissue Infection

Buried Bumper Syndrome

Colocutaneous Fistula

Inadvertent PEG Removal

Minor Complications

Wound Infection

Peristomal Leakage

Pneumoperitoneum

Ileus

Bleeding

Ulceration

Clogging

Tube Dysfunction

Gastric Outlet Obstruction

POST-PEG FEEDING

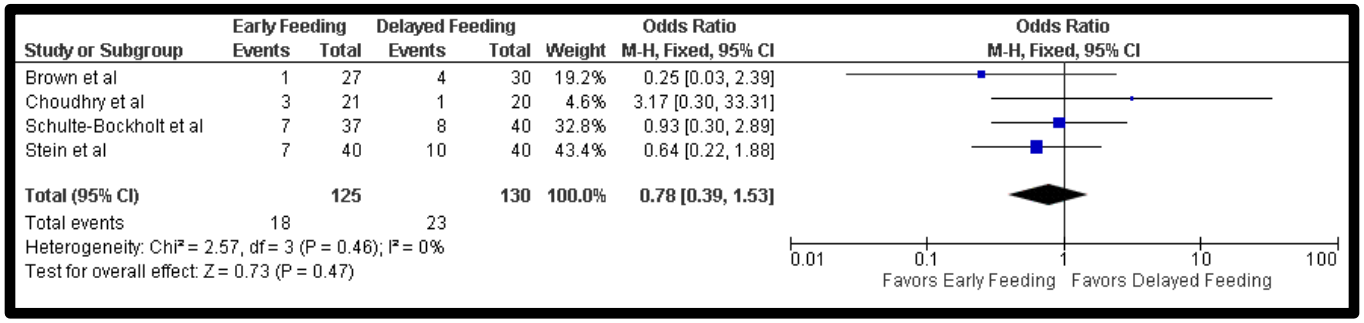
TABLE 2. RESPONSES TO PEG-RELATED QUESTIONS

	%
PEG tubes performed per month	
1–5	64.3
6–10	32.1
>11	3.6
Awareness of recent literature regarding early feeding after PEG tube	
Aware	81.5
Unaware	18.5
Respondents timing of initiation of feedings after PEG tube	
<3 hr	10.7
4–8 hr	28.6
9–15 hr	17.9
16–24 hr	39.3
>24 hr	3.5

Srinivasan R, et al. Dig Dis Sci 2000

POST-PEG FEEDING

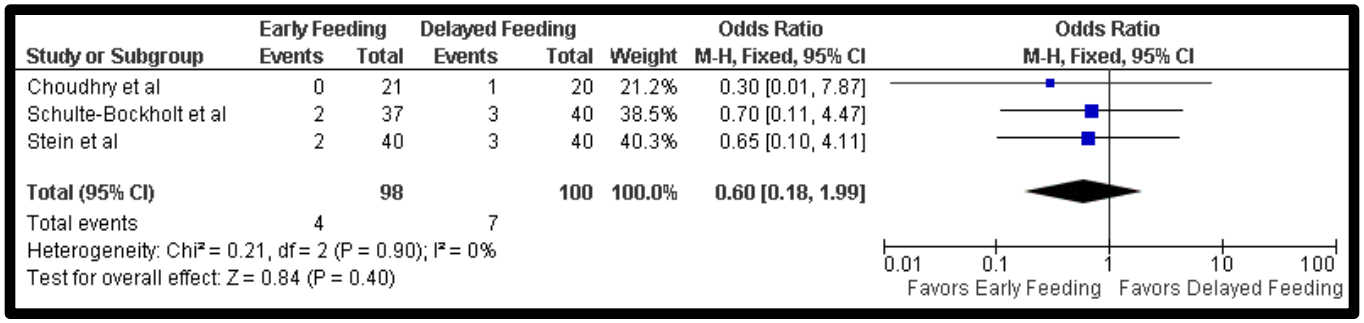
- **Complications:**



Study or Subgroup	Early Feeding Events	Early Feeding Total	Delayed Feeding Events	Delayed Feeding Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Brown et al	1	27	4	30	19.2%	0.25 [0.03, 2.39]
Choudhry et al	3	21	1	20	4.6%	3.17 [0.30, 33.31]
Schulte-Bockholt et al	7	37	8	40	32.8%	0.93 [0.30, 2.89]
Stein et al	7	40	10	40	43.4%	0.64 [0.22, 1.88]
Total (95% CI)		**125**		**130**	**100.0%**	**0.78 [0.39, 1.53]**
Total events	18		23			

Heterogeneity: Chi² = 2.57, df = 3 (P = 0.46); I² = 0%
Test for overall effect: Z = 0.73 (P = 0.47)

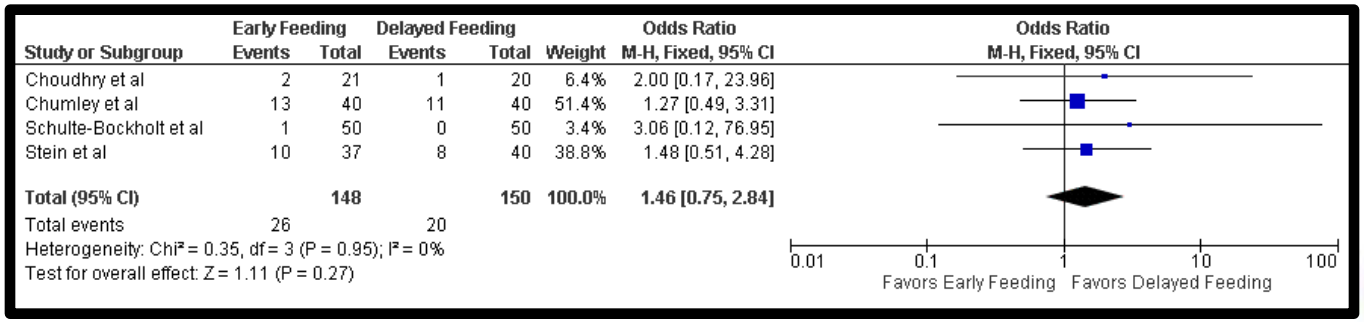
- **Death ≤ 72 hours:**



Study or Subgroup	Early Feeding Events	Early Feeding Total	Delayed Feeding Events	Delayed Feeding Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Choudhry et al	0	21	1	20	21.2%	0.30 [0.01, 7.87]
Schulte-Bockholt et al	2	37	3	40	38.5%	0.70 [0.11, 4.47]
Stein et al	2	40	3	40	40.3%	0.65 [0.10, 4.11]
Total (95% CI)		**98**		**100**	**100.0%**	**0.60 [0.18, 1.99]**
Total events	4		7			

Heterogeneity: Chi² = 0.21, df = 2 (P = 0.90); I² = 0%
Test for overall effect: Z = 0.84 (P = 0.40)

- **Residuals during first 24 hours:**



Study or Subgroup	Early Feeding Events	Early Feeding Total	Delayed Feeding Events	Delayed Feeding Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Choudhry et al	2	21	1	20	6.4%	2.00 [0.17, 23.96]
Chumley et al	13	40	11	40	51.4%	1.27 [0.49, 3.31]
Schulte-Bockholt et al	1	50	0	50	3.4%	3.06 [0.12, 76.95]
Stein et al	10	37	8	40	38.8%	1.48 [0.51, 4.28]
Total (95% CI)		**148**		**150**	**100.0%**	**1.46 [0.75, 2.84]**
Total events	26		20			

Heterogeneity: Chi² = 0.35, df = 3 (P = 0.95); I² = 0%
Test for overall effect: Z = 1.11 (P = 0.27)

Szary NM, et al. J Clin Gastroenterol 2011

POST-PEG FEEDING

Ali T, et al. Dig Liv Dis 2011

POST-PEG FEEDING

444 PEGs

June 2006 – December 2011

PARAMETER	EARLY FEEDING (≤ 4 HOURS)	DELAYED FEEDING (> 4 HOURS)	P-VALUE
MORTALITY			
< 24 hours	0	0	NS
24-72 hours	2	0	0.20
3-30 days	14	19	0.86
COMPLICATIONS			
Wound Infection	5	4	0.52
Melena	0	3	0.26
Vomiting	9	16	0.42
Leakage	4	2	0.41
Stomatitis	0	4	0.13
Other	27	28	0.47

Cobell, et al. South Med J 2014

FUTURE NUTRITIONAL ISSUES

SHORT GUT SYNDROME

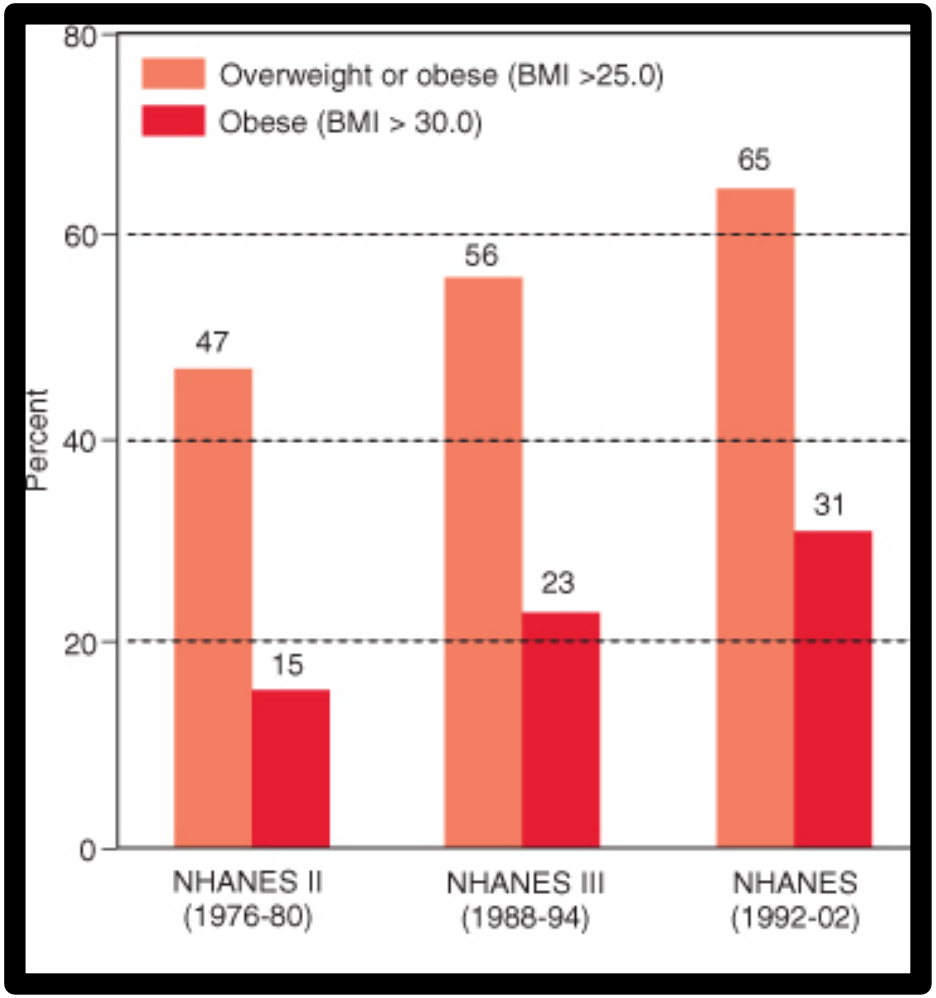
ELDERLY

EATING DISORDERS

OBESITY

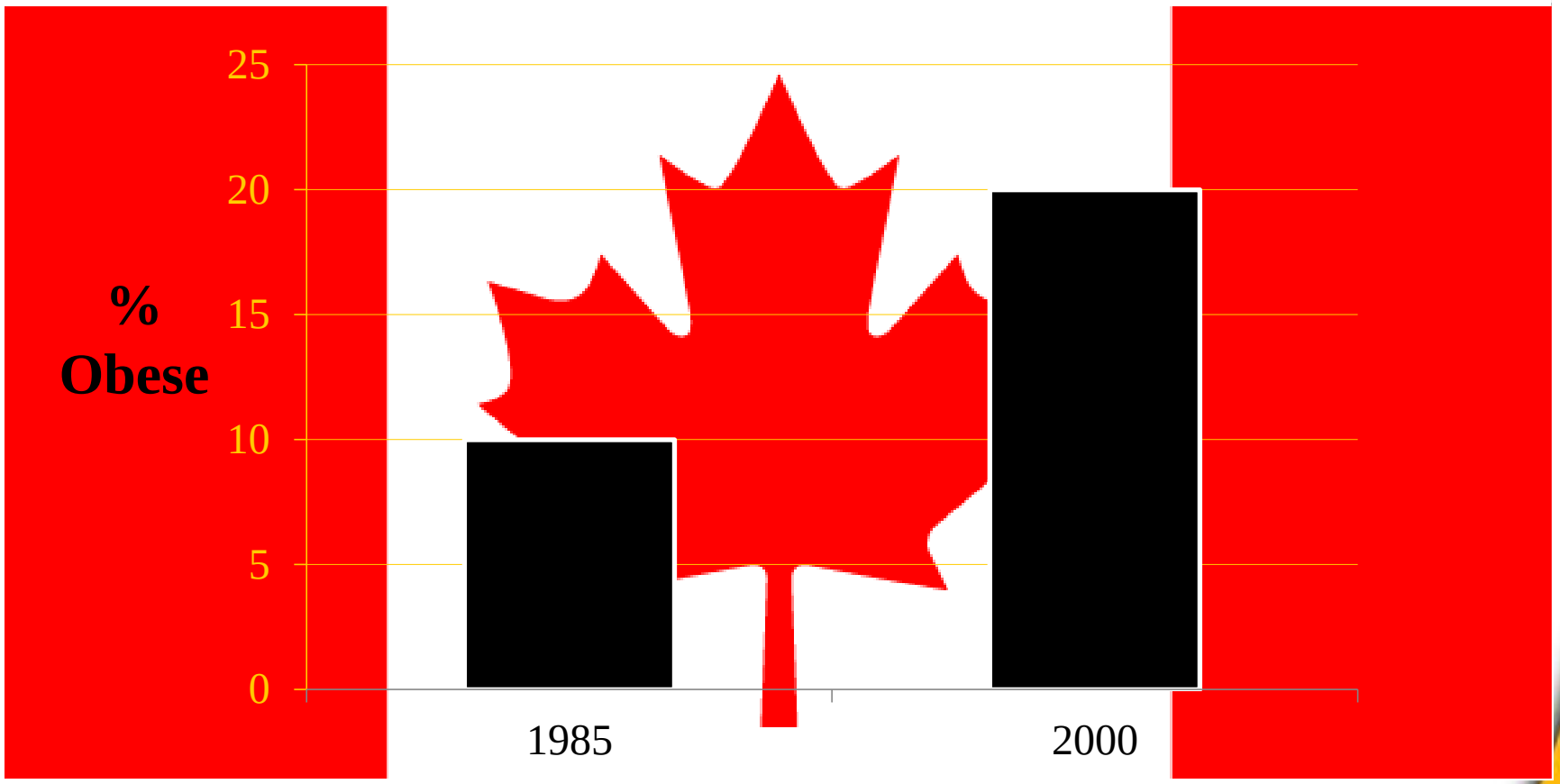
ICU

OBESITY



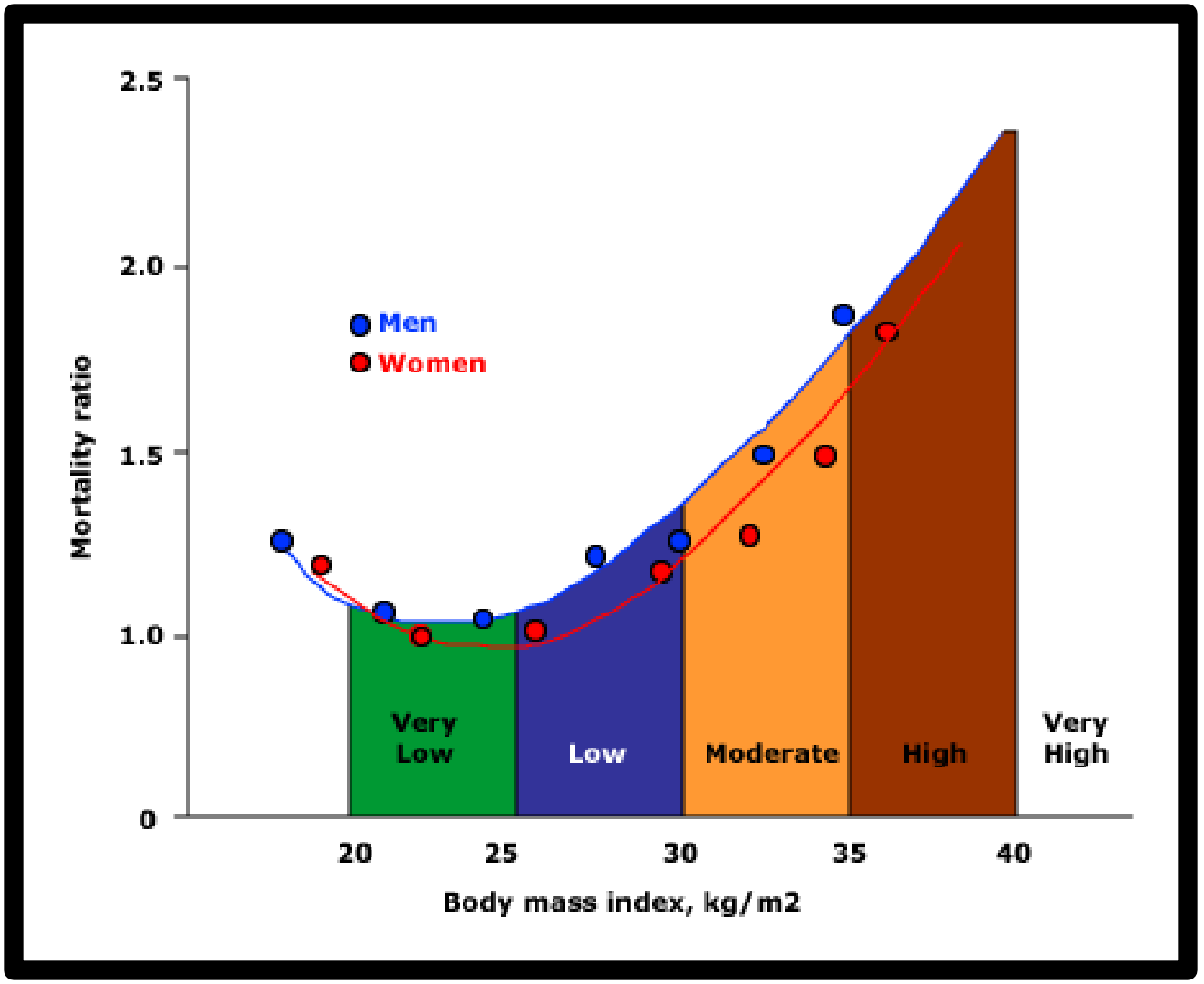
National Center for Health Statistics. CDC website – 2004
Feldman M, et al. Sleisenger & Fortran's Gastrointestinal and Liver Disease 2010

OBESITY



Katzmarzyk et al. CMAJ 2002

OBESITY

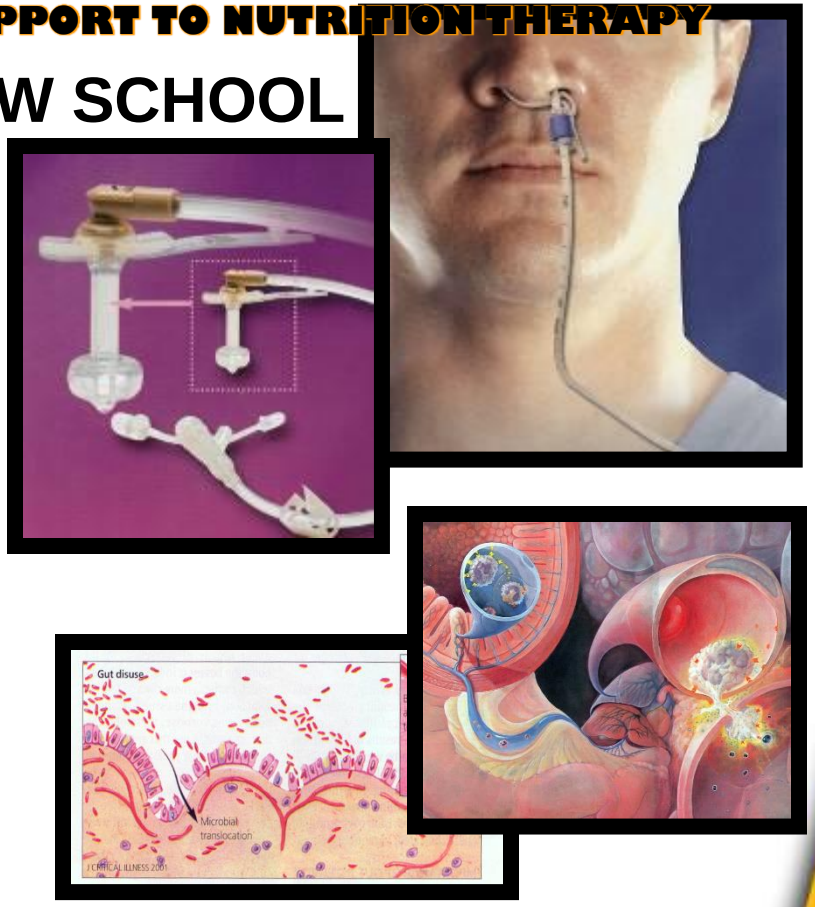


Klein S, et al. Gastroenterology 2002

CRITICAL CARE

CHANGING PARADIGM: NUTRITION SUPPORT TO NUTRITION THERAPY

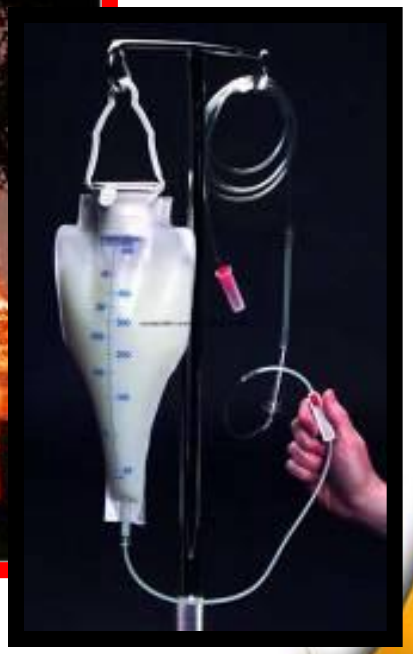
OLD SCHOOL → NEW SCHOOL



"Skeletons in the Closet"
PEM in 50% pts US hospitals
Support to prevent PEM
PN-based, little effect

Maintain gut integrity
Immune-modulation
Down-regulate inflammation
EN-based, huge effect

PERSPECTIVE ON ENTERAL FEEDING, OXIDATIVE STRESS, AND PHARMACONUTRITION



McClave S, et al. JPEN 1997

CRITICAL CARE NUTRITION

GUT DOES MORE THAN CALORIES

GUT PLAYS A CRUCIAL ROLE IN INFLAMMATION

GUT CAN BE USED TO OUR ADVANTAGE

CONTROVERSY OF IMMUNE FORMULAS

THANK YOU FOR YOUR TIME

*** Dramatization only. No animals were hurt during the making of this lecture.**