

Blenderized diets: Is there any role in hospitals?

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Common myth

- Blenderized diets are less expensive than and can replace scientific enteral formulas
- (No recent citations using the search words “Blenderized diets”)

Enteral tube feeding formulas are designated *medical foods*.

The US Food and Drug Administration (FDA) provides the following definition:

- “A medical food is prescribed by a physician when a patient has special nutrient needs in order to manage a disease or health condition
 - and the patient is under the physician’s ongoing care”
-

Scientific enteral formulas : Growth

- In USA:

1974 – 36; 1989 – 200; 2006 – 350

(Ref: Campell SM; Nutr Clin Pract 2006; 21:411)

Some decrease there after as hepatic and pulmonary specific formulas are not as popular

- In India:

1992 – 1

2012 - approximately 30 “true medical nutrition products, locally made + imported; regular polymeric + disease specific

Formula Comparison

Blenderized Food vs Commercial Formulas

Blenderized Food	Commercial Formulas
Unknown nutritional content	Complete and balanced nutrition
Unknown osmolality	Low to moderate osmolality
May contain lactose	Lactose and gluten free
Poor microbial quality	Commercially sterile
High viscosity	Excellent tube flow
Difficult to make calorically dense	Calorically dense formula available

Disadvantages of hospital-prepared blenderized diets

- Unpredictable nutrient contents
- More likely to underdeliver nutrients (75% vs 25% for ready-to-use)
- Significant day-to-day variability
- Deficient in some essential vitamins (B₂, B₆, vitamin A)
- Deficient in some essential trace elements even if in bio-available form (Zn, Fe, Ca)
- Variable and high viscosity requiring large bore tubes

Safety and Nutritional Quality of Hospital-Prepared Enteral Feedings in the Philippines

- Evaluation of nutritional quality and microbial safety of enteral feedings

Sorreda-Esguerra et al, *J Hosp Infect* 2001

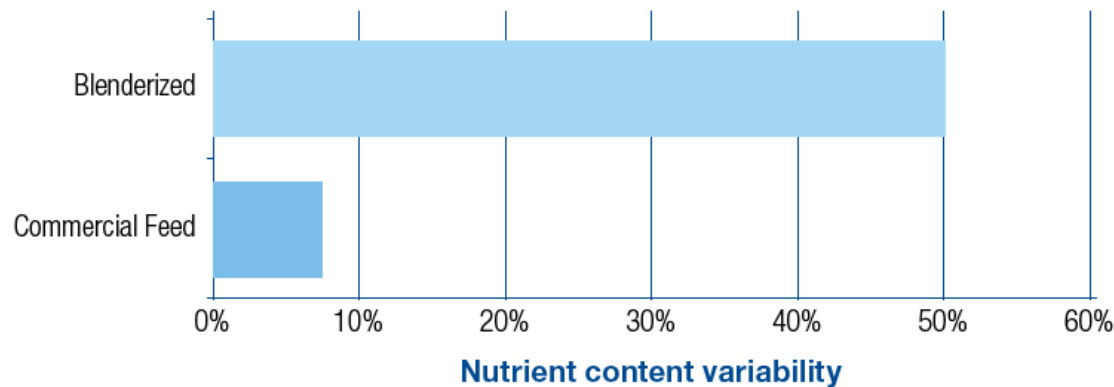
Sullivan et al, *Asia Pac J Clin Nutr* 2004

Efficacy

Clinical studies confirm that blenderized formulas contain inconsistent nutrient levels.

Mokhalalati 2004¹⁸

- > Blenderized formulas did not provide the predicted nutrient content and had a high degree of variability in nutrient content.
- > Average nutrient variability for blenderized formulas ranged from 16% to 50% compared to 4% to 7% for commercial formulas.
- > Between hospital locations, the mean concentration of most nutrients varied by two- to three-fold.



Carvalho 2000²⁰

- > Blenderized formulas provide inconsistent nutrient levels due to inconsistent nutrient levels in natural food and imprecise measurement of water and ingredients.
- > Result is significant day to day variability and unpredictable nutrient content.



Asian study on blenderized hospital diets

Original Article

Nutritional analysis of blenderized enteral diets in the Philippines

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Sullivan et al, Asia Pac J Clin Nutr
2004

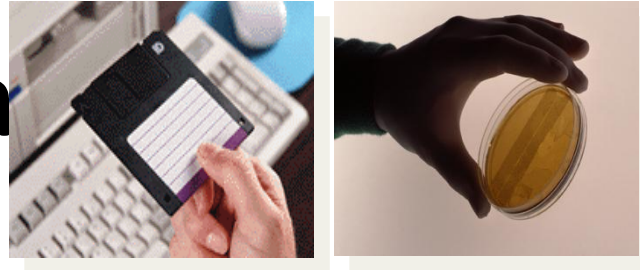


Recipes for blenderized enteral tube feedings

<i>Hospital A</i>	<i>Hospital B</i>	<i>Hospital C</i>	<i>Hospital D</i>
Standard Feedings			
Powder 333 g Tap water, 1350 mL	Powder 265 g Tap water, 960 mL	Squash, 135 g Banana, 80 g Nonfat dry milk, 17 g White bread, 150 g Corn oil, 26 mL Chicken breast, 67.5 g Lugao*, 360 mL	Banana, 4 whole peeled White bread, 5 slices Lugao*, 240 mL Egg, cooked, 1 Corn oil, 7.5 mL White sugar, 4.2 g
1500 mL Total	1200 mL Total	1000 mL Total	Total Volume NA
Modified Feedings			
<i>(Constipating Diet)</i> Powder 289 g Banana, 2.5 whole peeled Tap water, 1275 mL	<i>(Natural Formula Diet)</i> Squash, 245 g Banana, 5 whole peeled Egg cooked, 272 g Corn oil, 60 mL White sugar, 12.6 g	<i>(High Fibre Low Cholesterol Diet)</i> Squash, 180 g Banana, 120 g Pineapple juice, 120 mL Mung beans, 62 g Nonfat milk, 8.5 g Egg, cooked 12.5 g White sugar, 16.8 g Oatmeal, 227 g White bread, 110 g Corn oil, 10 mL Olive oil, 12.5 mL	<i>(Diabetic Diet)</i> Bananas 4.5 whole peeled White bread, 5 slices Egg, cooked, 1 Corn oil, 7.5 mL Lugao*, 240 mL
1500 mL Total	1000 mL Total	1000 mL Total	Total Volume NA

Sullivan et al, Asia Pac J Clin Nutr
2004

Design



- Sites: 4
- 2 diets from each site (standard, therapeutic)
- Feedings prepared on 3 separate days
- Feedings prepared by hospital staff using routine procedures and usual recipes
- Study monitor observed the preparation of the diets

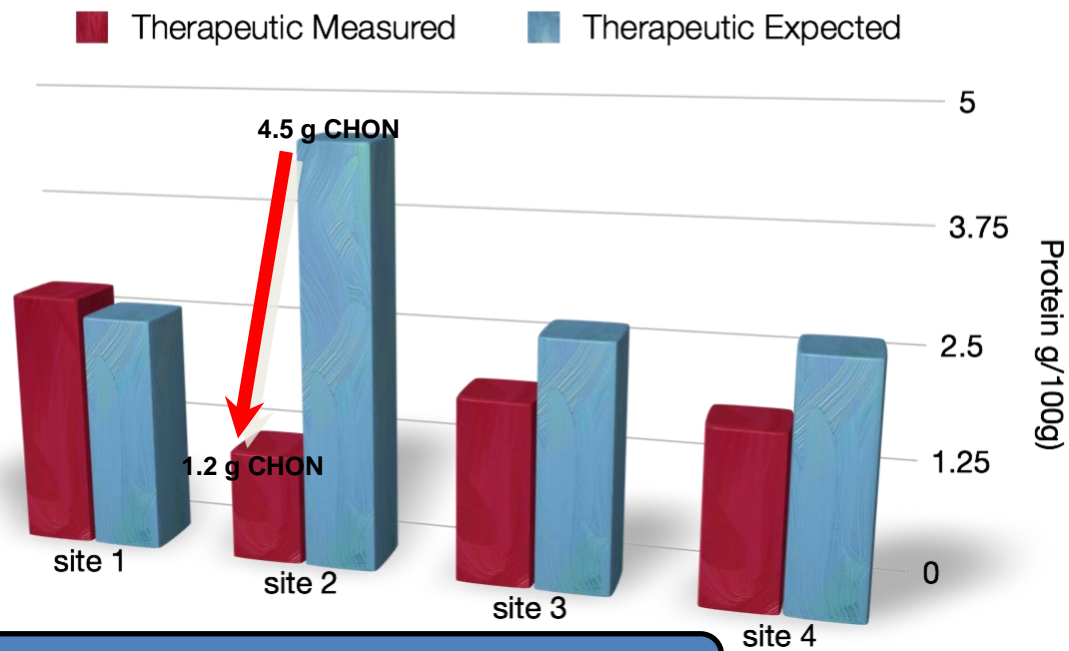
Caloric Density



There was a clear trend for the feedings to have a lower caloric density than would be expected by the recipe analysis.

Sullivan et al, Asia Pac J Clin Nutr 2004

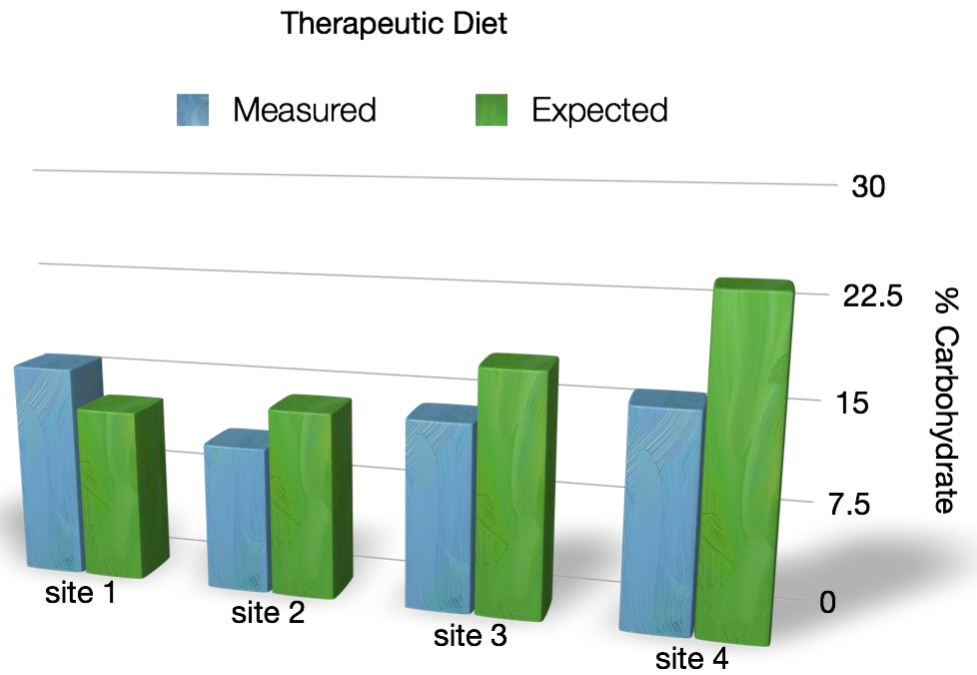
Protein



For the patient receiving 1.5 liters of feeding per day, this would mean a difference of 51 grams of protein per day!

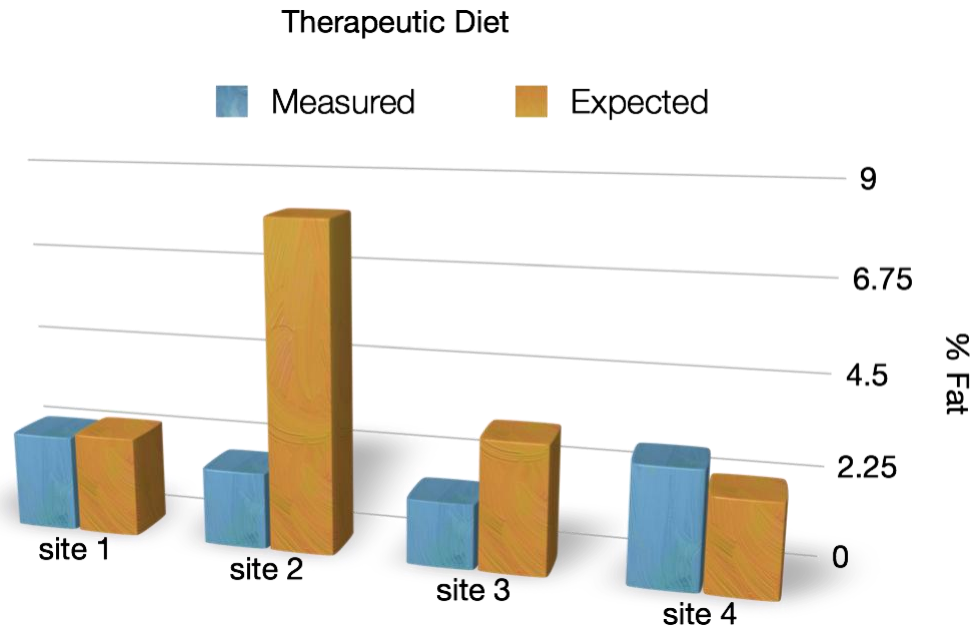
Sullivan et al, Asia Pac J Clin Nutr 2004

Carbohydrate



Sullivan et al, Asia Pac J Clin Nutr
2004

Fat



Sullivan et al, Asia Pac J Clin Nutr
2004

Nutritional Analysis: Conclusion

- Blenderized foods provide highly variable nutrients and calories because:
 - there is day to day variability
 - the recipe does not accurately predict actual content
 - natural foods provide inconsistent nutrients
 - measurements of ingredients and water are imprecise and inaccurate

Safety

Clinical studies confirm that blenderized formulations contain unsafe levels of bacteria.

Sullivan 2001¹⁹

- > Microbial quality of the majority of hospital prepared blenderized formulas were not within published guidelines for safety.
- > At preparation, 96% of samples had unacceptable standard plate counts greater than 10 cfu/mL and 58% were coliform positive.
- > After 4 hours, 88% of samples had standard plate counts in excess of 10³ cfu/g and samples that were coliform positive increased to 79%.

Mokhalalati¹⁸

- > All blenderized formula samples had detectable aerobic plate counts ≥ 10 cfu/g that increased significantly after 4 hours.
- > Coliform contamination varied between sites with 100% contamination at one hospital.

Carvalho 2000²⁰

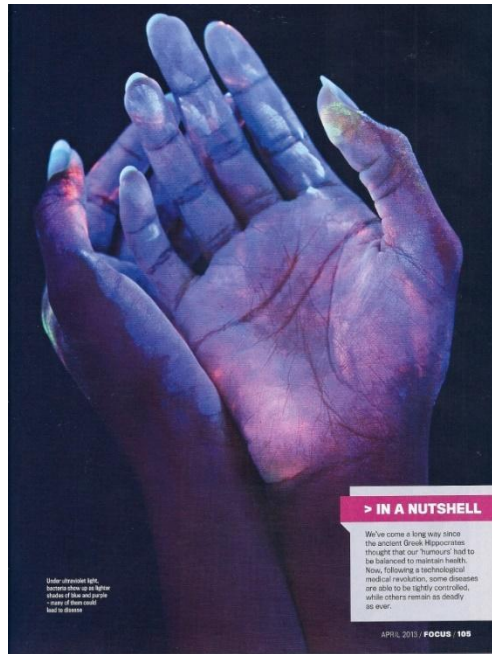
- > Blenderized formulas were more likely to have bacterial contamination than other hospital prepared diets.
- > Microbial contamination levels in blenderized formulas can reach those associated with foodborne illness.



Source of microbial contamination of enteral feeds

- Handling technique
 - Unsanitary equipment
 - Unsterile ingredients
 - Improper storage and hang time
 - Formula manipulations (medications)
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Bacteria on hands after “routine” scrub



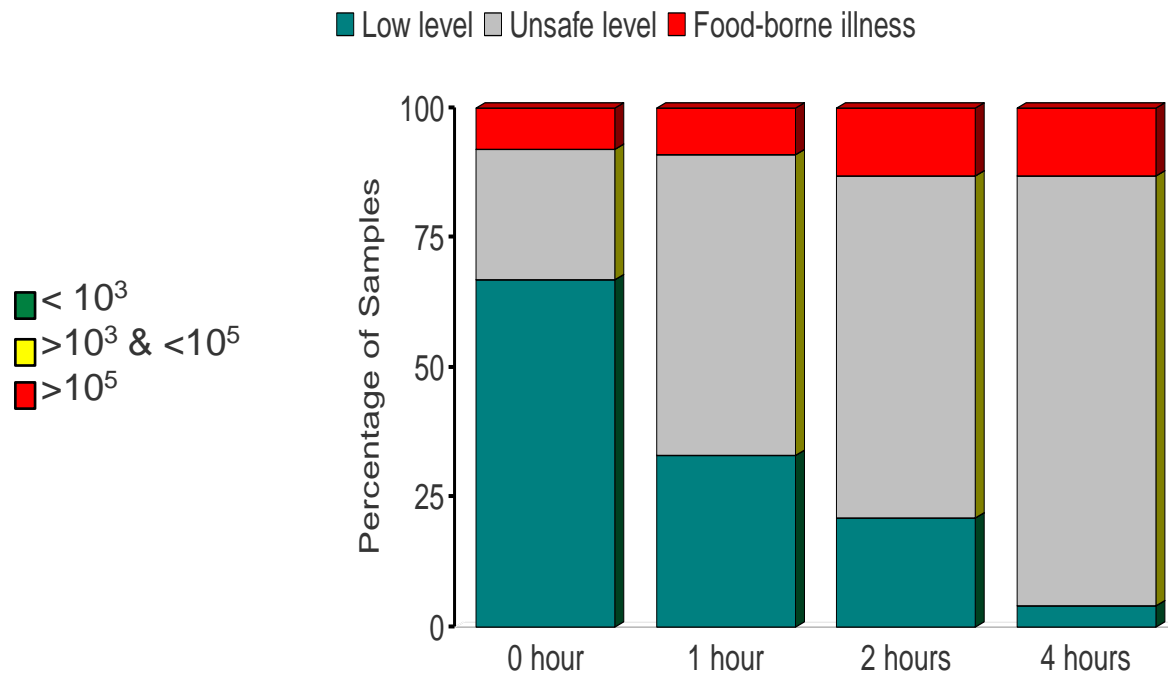
Contamination of blenderized enteral feeds

- Contaminated enteral formulas play a significant role in the etiology of diarrhea¹
- Blenders used in reconstituting or preparing feeds is the main source of bacterial contamination²

1. Okuma T et al. Nutrition 2000; 16:719

2. Oliviera MH et al. 2000; Nutrition 16:729

Bacterial contamination



Sorreda-Esguerra et al, *J Hosp Infect* 2001

Functionality

Clinical studies confirm that blenderized formulas have high and inconsistent viscosity and osmolality which can result in patient tolerance and feeding issues such as diarrhea and potential tube clogging.

Mokhalalati 2004¹⁸

- > Blenderized formulas had a 200 times higher viscosity and 2 times higher osmolality than commercial formula.
- > There is a wide range of variability in osmolality and viscosity within different locations between blenderized preparations.

- Bentley D. *Pediatric Gastroenterology and Clinical Nutrition*. London, UK: ReMedica Publishing; 2001.
- Types of formula and their use: intact enteral formulas. Available at: <http://www.csun.edu/cjh78264/tubefeeding/formulas/index.html>. Accessed March 9, 2006.
- Mokhalalati JK. *Saudi Med J*. 2004;25:331
- Sullivan MM. *Asia Pac J Clin Nutr*. 2004;13:385
- Sullivan MM. *J Hosp Infect*. 2001;49:268



Viscosity

- Mean measured viscosity = 2617 cps
- range = 2.3 - 45000 cps
- **Scientific formulas = 10 - 60 cps**
- 3 samples = too viscous to measure !
- *Viscosity of reconstituted powder formulas without added food was acceptable and more consistent than blenderized foods*



A feeding that is too viscous may clog a feeding tube.
High viscosity feedings with a bolus-syringe delivery which tends to be poorly tolerated by hospitalized patients.

Sullivan et al, Asia Pac J Clin Nutr 2004

CPS: Centi Poise per second

Complications of large bore tubes – needed for high viscosity feeding

- Maxillary sinusitis
 - Esophageal erosions
 - Gastro-esophageal reflux
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Nasal erosion from NG tube



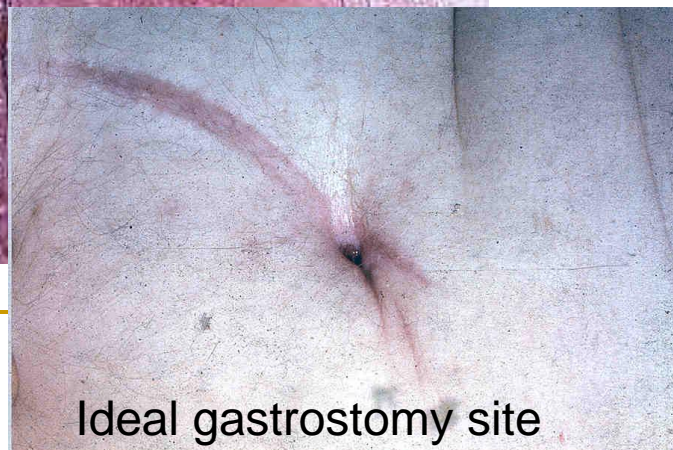
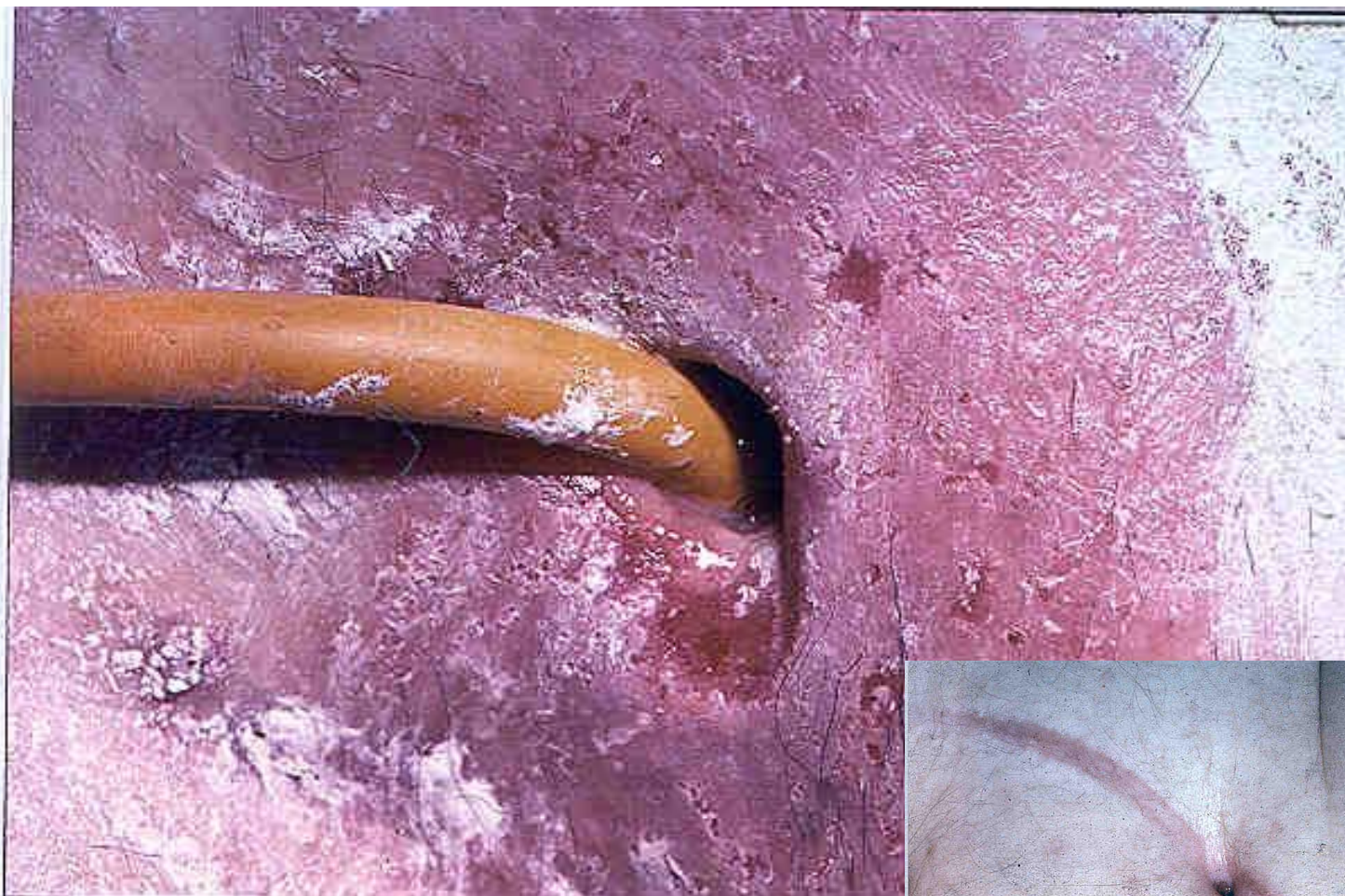
Maxillary sinusitis due to large bore nasogastric tubes

Common cause of fever of
“unknown” origin

Rouby JJ. Am J Resp CCM 1994;
150:776
Van Zanten ARH. Crit Care 2005



Erosion of abdominal wall due to large bore gastrostomy tube, inserted for ease of administration of blenderized diet



Necrotizing soft tissue infection due to large bore gastrostomy tube



Poor outcomes of microbially contaminated blenderized diets

- ● diarrhea
- ● gastrointestinal (GI) colonization
- ● pneumonia
- ● infection
- ● prolonged length of hospital stay
- ● mortality

Anderson KR. *JPEN J Parenter Enteral Nutr.* 1984;8:673
Fernandez-Cruhueta Navajas M. *J Hosp Infect.* 1992;21:111
Thurn J. *J Hosp Infect.* 1990;15:203
Casewell MW. *BMJ.* 1981;282
Freedland CP. *JPEN J Parenter Enteral Nutr.* 1989;13:18
Pingleton SK. *Am J Med.* 1986;80:827
Jacobs S. *JPEN J Parenter Enteral Nutr.* 1990;14:353

Cost factors: Scientific formulas vs kitchen- prepared enteral diets

- If the cost of procurement of ingredients, storage, cooking, handling, transport, wastage, etc. are considered, commercial preparations are NOT more expensive than kitchen prepared diets

(Unpublished data)

BLENDERIZED DIETS, conclusions

- Current evidence strongly supports the use of scientific enteral preparations in hospitalized patients
 - Hospitals should not even provide kitchen-prepared blenderized diets for tube feeding
 - For long-term care patients:
 - Oral route or via tubes : Kitchen- prepared diets , esp for cultural reasons,
 - with SUPPLEMENTAL enteral preparations
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