The Mark of our Microbiome:
can we better protect it to prevent pitfalls?

MICROBIOMA, DYSBIOSIS & PHGG

LONG TERM HOME ENTERAL NUTRITION:DATA ON 10 YEARS EXPERIENCE IN PIEMONT REGION

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ENTERAL NUTRITION

Enteral nutrition (EN) is required when oral intake is insufficient or is likely to be absent for a period of more than 5-7 days

It is used in the in-patients and on-patients setting in a wide range disease states, with the majority of patients requiring nutritional support for around 1 month

The duration of EN will depend depend upon the nature of the underlyng condition

Clinical Nutrition 2006 25 180-186

Clinical Nutrition (2006) 25, 180–186

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INTRODUCTION PART TO THE ESPEN GUIDELINES ON ENTERAL NUTRITION

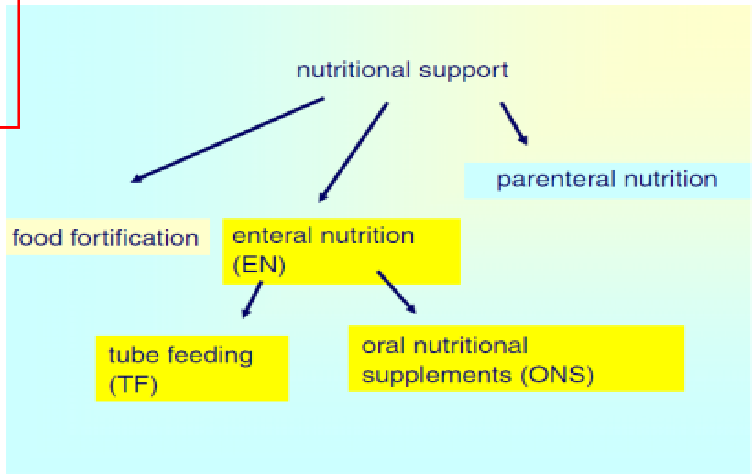
Introductory to the ESPEN Guidelines on Enteral Nutrition: Terminology, Definitions and General Topics

H. Lochs[a,*], S.P. Allison[b], R. Meier[c], M. Pirlich[a], J. Kondrup[d], St. Schneider[e], G. van den Berghe[f], C. Pichard[g]

2006

Enteral nutrition

The term EN is used to comprise all forms of nutritional support that imply the use of "dietary foods for special medical purposes" as defined in the European legal regulation of the commission directive 1999/21/EC of 25 March 1999,[1] independent of the route of application. It includes oral nutritional supplements (ONS) as well as tube feeding via nasogastric, nasoenteral or percutaneous tubes. This definition differs from definitions used in many other publications where "EN" is rather used for tube feeding only regardless if blenderized food or specific industrial products are used. This decision was based on the fact that many studies dealing with EN report on both ONS and tube feeding. Furthermore, prescription and reimbursement of EN is in many countries dependent of the use of industrial products rather than the route of application. EN is part of a qualified nutritional regimen in the in- and outpatient setting, and usually one of the tasks of professionals with special training in EN or the nutritional support team.



Standard formulae

Standard formulae are enteral formulae with a composition, which reflects the reference values for macro- and micronutrients for a healthy population. Most standard formulae contain whole protein, lipid in the form of long-chain triglycerides (LCT), and fiber. However, non-fiber containing formulae with otherwise similar composition also exist.

Most standard formulae contain neither gluten nor lactose in clinically relevant amounts. The presence of gluten or lactose should clearly be mentioned on the label.

ENTERAL NUTRITION

Enteral Nutrition is a beneficial support given to patients who are malnourished or at risk for malnutrition

EN helps to maintain gut function by:
- preventing mucosal atrophy,
- reducing endotoxin translocation
- preserving gut immunity

Fiber was introduced in EN in response to **accumulating evidence** of its effects in modulating gut function and improving immune, blood glucose, and serum lipid regulation

The introduction of fibers into the enteral formula is beneficial in reducing the incidence of diarrhea (Elia M et al Aliment Pharmac & Therap 2007)

Consensus Recommendation

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ASPEN Safe Practices for Enteral Nutrition Therapy

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Peggi Guenter, PhD, RN, FAAN[18]; ASPEN Safe Practices for Enteral Nutrition Therapy Task Force, American Society for Parenteral and Enteral Nutrition

2017

Abstract

Enteral nutrition (EN) is a valuable clinical intervention for patients of all ages in a variety of care settings. Along with its many outcome benefits come the potential for adverse effects. These safety issues are the result of clinical complications and of process-related errors. The latter can occur at any step from patient assessment, prescribing, and order review, to product selection, labeling, and administration. To maximize the benefits of EN while minimizing adverse events requires that a systematic approach of care be in place. This includes open communication, standardization, and incorporation of best practices into the EN process. This document provides recommendations based on the available evidence and expert consensus for safe practices, across each step of the process, for all those involved in caring for patients receiving EN. (*JPEN J Parenter Enteral Nutr*. 2017;41:15-103)

COMPLICATION GI:

- CONSTIPATION: FIBER
- DIARRHEA: FOS

GI Issues

Constipation

HEN teams address a number of GI issues of tube feeding, including constipation, diarrhea, nausea, cramps/bloating, and aspiration. To prevent constipation, HCPs should determine fluid needs when tube feeding is initiated and follow published guidelines when making those calculations (Table 2).[28] In addition to fluid needs, registered dietitians/nutritionists (RDNs) need to calculate water flushes and percent-free water in the tube-feeding formula to ensure that patients receive adequate hydration. Infant formulas often provide sufficient free water such that additional water is not usually needed. However, pediatric and adult formulas vary in free-water content from 63% to 85%, making additional water flushes necessary. Using formula with additional fiber or adding fiber products to enteral feeding has little clinical utility in treating constipation for most patients and increases the risk of clogging the tube, reduces the absorption of medications, and may cause

Diarrhea

Diarrhea may be categorized by duration (acute: up to 2 weeks; persistent: 2–4 weeks; chronic: longer than 1 month) or by etiology.[30,31] The mechanism of diarrhea is correlated to the classification.[30,31] A number of variables may cause diarrhea in patients receiving HEN, including predisposing diagnoses (malabsorption syndromes, diabetes, pancreatic insufficiency, and fecal impaction), infec-

feeding or a low-fat or peptide-based formula. Formula wit fructooligosaccharides (FOS) may provide the proper typ of fiber to optimize stool transit time. FOS may be adde to standard formulas (eg, banana flakes, psyllium, and gua gum) if *Clostridium difficile* is ruled out.[30-32] For patient with antibiotic-induced diarrhea, prebiotics (FOS) may hel with recolonization of GI bifidobacteria.[32] However, thi would not be a viable option for patients unable to tolerat fermentable oligosaccharides, disaccharides, monosaccha rides, and polyols. Some patients may require pancreati enzyme replacement therapy.[30]

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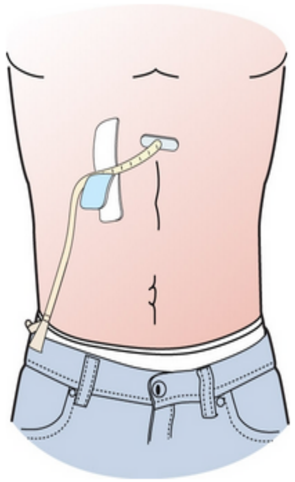
Addressing Frequent Issues of Home Enteral Nutrition Patients

**Teresa W. Johnson, DCN, RDN, FAND[1]; Sara Seegmiller RN, GIM[2];
Lisa Epp, RDN, LD, CNSC[2]; and Manpreet S. Mundi, MD[2]**

Abstract

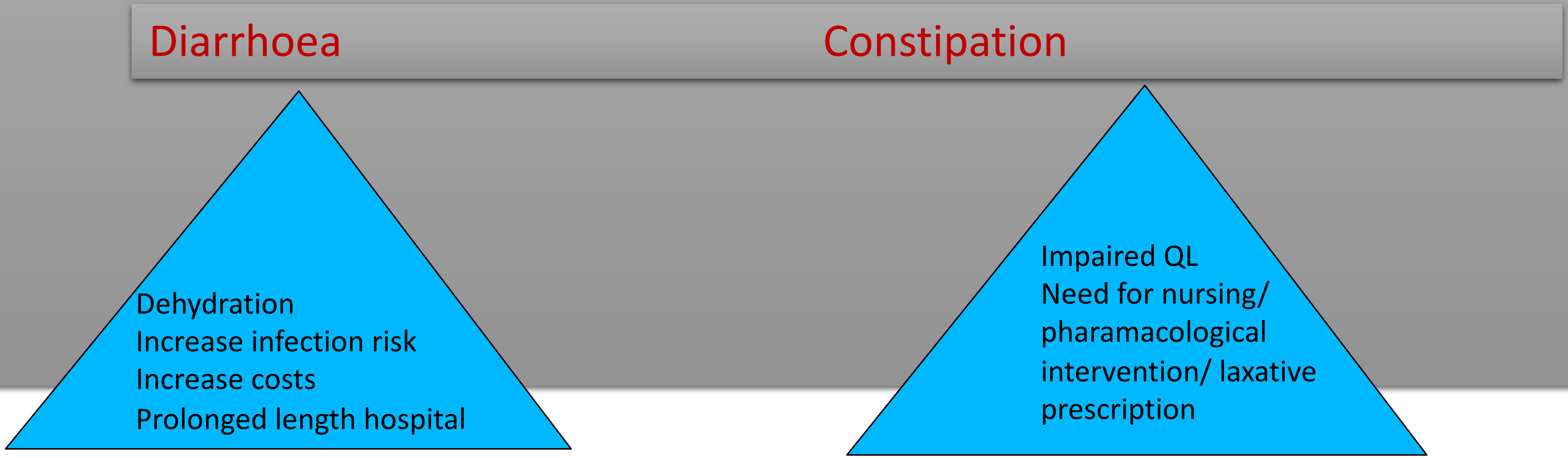
The home enteral nutrition (HEN) population is a medically diverse group whose number has increased substantially in recent decades. Although medically stable compared with acute care patients requiring nutrition support, HEN population needs are unique and require a team approach to manage nutrition. Frequently encountered issues by the HEN team include mechanical issues of the tube site, gastrointestinal and metabolic problems, and patient preferences regarding tube weaning, formula selection compliance. A thorough search of the published literature on how to manage these issues was conducted using scientific healtl databases with the following inclusion criteria: English only, last 10 years, and reviews and clinical trials. Where approp references from the retrieved articles were hand-searched for relevant articles older than 10 years and cited in this review. purpose of this review is to provide the HEN team with strategies to address the top issues of home enteral feeding. (*Nutr Pract.* 2019;00:1–10)



Complications of enteral nutrition

Diarrhoea and constipation representing the two extremes of bowel function, continue to be the most common problems associated tube feeding

Diarrhoea in a notable feature in the acute care setting



CONSTITUENTS OF DIETARY FIBER

Non-Starch Polysaccharides and Resistant Oligosaccharides
- Cellulose
- Hemicellulose
  - Arabinoxylans
  - Arabinogalactans
- Polyfructoses
  - Inulin
  - Oligofructans
- Galactooligosaccharides
- Gums
- Mucilages
- Pectins

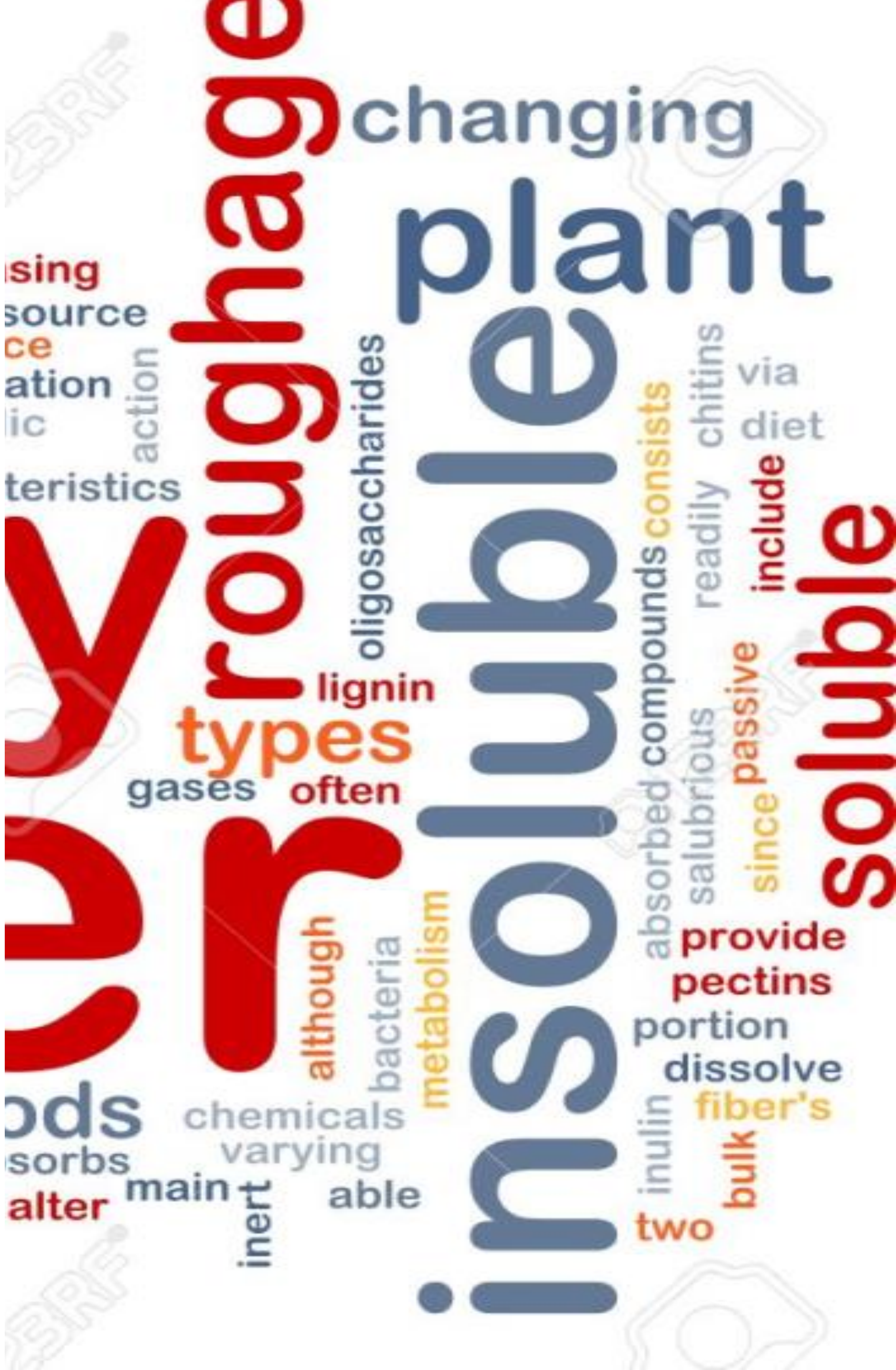
Substrati prebiotici

Analogous Carbohydrates
- Indigestible Dextrins[b]
  - Resistant Maltodextrins (from corn and other sources)
  - Resistant Potato Dextrins
- Synthesized Carbohydrate Compounds
  - Polydextrose
  - Methyl cellulose
  - Hydroxypropylmethyl Cellulose
- Indigestible ("resistant") Starches[c]

Lignin

Substances Associated with the Non-Starch Polysaccharide and Lignin Complex in Plants
- Waxes
- Phytate
- Cutin
- Saponins
- Suberin
- Tannins

Composti bioattivi



Describtion of the fiber with probiotic (Roberfroid M 2010)

Generic name and structural characteristics (abbreviation used in text*)	Usual names and average DP (DP_{av})
<u>INULIN-TYPE FRUCTANS</u> Linear $\beta(2 \rightarrow 1)$ fructosyl-fructose $G_{py}F_n$ and/or $F_{py}F_n$ ITF	**Inulin**
<u>Short to large size polymers</u> (DP 2-60) $ITF_{-DPav12}$	**Inulin** (especially chicory inulin) (DP_{av} 12)
<u>Short Oligomers</u> (DP 2-8) $ITF_{-DPav3\text{-}4}$	**Fructo-oligosaccharides (FOS)** FOS scFOS (enzymatic synthesis from sucrose) (DP_{av} 3-6) **Oligofructose** (enzymatic partial hydrolysis of inulin) (DP_{av} 4)
<u>Large size polymers</u> (DP 10-60) $ITF_{-DPav25}$	**High molecular weight inulin** (physical purification) (DP_{av} 25) lcFOS
<u>Mixture</u> (DP 2-8) + (DP 10-60) ITF_{-MIX}	**Mixture of oligomers and large size polymers**
<u>GALACTANS</u> Mixture of $\beta(1 \rightarrow 6)$; $\beta(1 \rightarrow 3)$; $\beta(1 \rightarrow 4)$ galactosyl-galactose GOS Gal_n-Gal and/or Gal_n-Glc (DP 2-8)	**Galacto-oligosaccharides,** ***trans*-galacto-oligosaccharides** (enzymatic transgalactosylsation of lactose)
<u>MIXTURE of GALACTANS and INULIN-TYPE FRUCTANS</u> GOS−FOS	**Galacto-oligosaccharides and high molecular weight inulin** **Usually known as GOS−FOS or scGOS−lcFOS**

FIBRE SOLUBILI: PHGG, FOS INULIN, GUM etc

The soluble fiber being viscove they cannot be used in native form and not in large quantities are therofore used smaller-caliber particles or partiallly hydrolyzed the homegnization process further the caliber

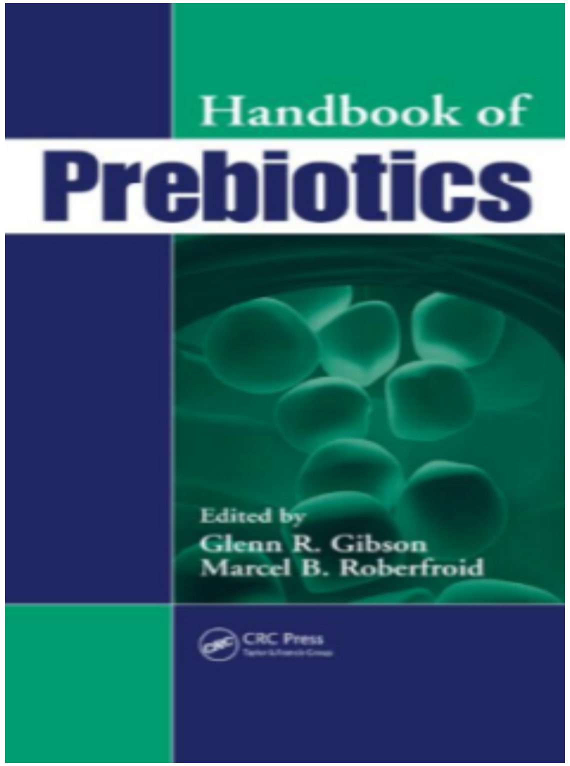
Thus begins the history of prebiotics … 1995

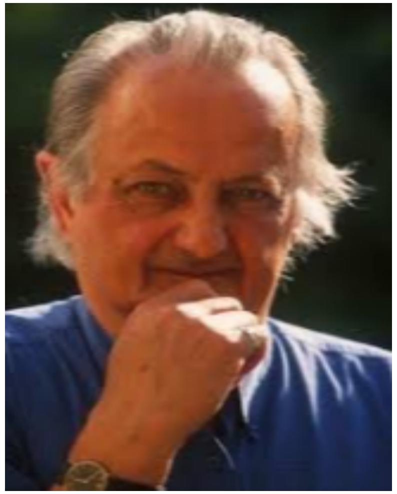
Critical Review

Dietary Modulation of the Human Colonic Microbiota: Introducing the Concept of Prebiotics

GLENN R. GIBSON AND MARCEL B. ROBERFROID[*1]

MRC Dunn Clinical Nutrition Centre, Cambridge, United Kingdom and
**Unité de Biochimie Toxicologique et Cancérologique, Départment des Sciences Pharmaceutiques, Université Catholique de Louvain, Brussels, Belgium*





Development of criteria for the classification of a food ingredient as a prebiotic

Definition	Food ingredient qualified as prebiotic
Gibson and Roberfroid (1995)[10]	
'Non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improves host health'	Fructooligosaccharides (FOS)
Gibson et al. (2004)[17]	
'A selectively fermented ingredient that allows specific changes, both in the composition and/or activity in the gastrointestinal microflora that confers benefits upon host wellbeing and health'	Inulin, fructooligosaccharides (FOS), galactooligosaccharides (GOS), lactulose
FAO Technical Meeting on Prebiotics, Rome (2008)[21]	
'Nonviable food component that confers a health benefit on the host associated with modulation of the microbiota'	Inulin, fructooligosaccharides (FOS), galactooligosaccharides (GOS), lactulose, xylooligosaccharides (XOS), resistant starch (RS), human milk oligosaccharides (HMOs), beta-glucan, other dietary fibers and non-digestible oligosaccharides Non-carbohydrate compounds, including polyphenols, minerals and vitamins?
Bindels et al. (2015)[20]	
'A non-digestible compound that, through its metabolism by micro-organisms in the gut, modulates the composition and/or activity of the gut microbiota, thus conferring a beneficial physiological effect on the host'	Inulin, fructooligosaccharides (FOS), galactooligosaccharides (GOS), lactulose, xylooligosaccharides (XOS), resistant starch (RS), human milk oligosaccharides (HMOs), beta-glucan, other dietary fibers and non-digestible oligosaccharides Non-carbohydrate compounds, including polyphenols, minerals and vitamins?

Synthesis of physiopathological effects by prebiotics, associated with the stimulation of one or more intestinal microorganisms *(Roberfroid M 2010)*

Improvement and / or stabilization of the microbiota composition.

Improvement of intestinal functions.

Increase mineral absorption

Modulation in the production of gastro-intestinal peptides (hunger / satiety, energy metabolism)

Improvement of intestinal barrier functions, reduction of endotoxemia.

Reduction of intestinal infections

Reduced risk of obesity, type 2 diabetes and metabolic syndrome, IBD and colon cancer

Use of dietary fibers in enteral nutrition of critically ill patients: a systematic review

Diarrhea in ICU (no due to: osmolality, fat content, caloric intensity)

USE OF SOLUBLE FIBER SHOULD BE CONSIDERED BENEFICIAL FOR REDUCING THE INCIDENCE OF DIARRHEA

Table 2 - Indexed articles included and their main results

Author, country	Main results
Yagmurdur et al.,[2] Turkey	The study group had less diarrhea than the control group ($p < 0.001$). The authors suggest that enteral nutrition should be initiated with fiber-enriched formulas rather than fiber-free formulas to avoid frequent feeding interruptions that cause protein energy malnutrition in intensive care unit patients
Simakachorn et al.,[3] Thailand	The enteral formula enriched with soluble fiber and probiotic was well tolerated by critically ill children; it was safe and produced an increase in fecal bacterial groups of previously reported beneficial effects
O'Keefe et al.,[6] United States	Fiber supplementation resulted in significant increases in fecal short chain fatty acids and microbial counts of specific butyrate producers, with a resolution of diarrhea in 3 of 4 patients. Thus, this supplementation has the potential to improve the microbiota mass and function, thereby reducing the risks of diarrhea as a result of dysbiosis
Caparrós et al.,[8] Spain	Patients fed a diet enriched with soluble fiber had a significantly lower catheter-related sepsis rate than patients fed a standard high-protein diet. Patients fed the study diet for > 2 days showed a trend toward decreased mortality
Spapen et al.,[9] Belgium	Enteral nutrition supplemented with soluble fiber is beneficial in reducing the incidence of diarrhea in tube-fed full-resuscitated and mechanically ventilated septic patients
Rushdi et al.,[10] Egypt	Enteral nutrition fiber supplementation was related to a decrease of diarrheal episodes in intensive care unit patients with preexisting diarrhea and a trend towards lower plasma glucose and cholesterol levels
Spindler-Vesel et al.,[11] Slovenia	The group that received soluble fiber and probiotic had significantly less combined infections ($p = 0.003$) and pneumonias ($p = 0.03$). Intestinal permeability decreased only in the symbiotic group ($p < 0.05$). Patients supplemented with symbiotic had lower intestinal permeability and fewer infections
Chittawatanarat et al.,[12] Thailand	The fiber group had a lower mean diarrhea score ($p = 0.005$) and lower global diarrhea "score on the generalized scale ($p = 0.005$). In summary, a mixed fiber diet formula can reduce the diarrhea score in surgical, critically ill septic patients who received broad spectrum antibiotics

Fiber and prebiotic supplementation in enteral nutrition: A systematic review and meta-analysis

Enteral Nutrition

World J Gastroenterol 2015 May 7; 21(17): 5372-5381
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

Review concerning fiber and prebiotic supplementation in EN relative to onset of diarrhoea, fecal microbiota and SCFA in EN

26 out of 456 studies were considered

Fiber blends are able to reduce diarrhea in stable patients receiving EN (OR = 0.31; 95% CI: 0.19-0.51; p <0.01) but not in critically ill patients (OR = 0.89; 95% CI: 0.41-1.92; p = 0.77)

The mixtures with prebiotic fibers **do not improve diarrhoea**, despite the i**ncrease in the concentration of bifidobacteria and the increase in SCFA**

The heterogeneity of the studies, the use of antibiotic therapy and the variability of dosage and type of fibers and prebiotics can explain such uncertain results

Clinical Nutrition ESPEN xxx (2018) e1–e11

Contents lists available at ScienceDirect

Clinical Nutrition ESPEN

journal homepage: http://www.clinicalnutritionespen.com

Randomized Controlled Trial

Use of standard enteral formula versus enteric formula with prebiotic content in nutrition therapy: A randomized controlled study among neuro-critical care patients

Piril Tuncay [a,*], Fatma Arpaci [b], Mutlu Doganay [c], Deniz Erdem [d], Arzu Sahna [a], Hulya Ergun [a], Dilek Atabey [a]

[a] Clinical Nutrition Unit, Ankara Numune Training and Research Hospital, Ankara, Turkey
[b] Family Economics and Nutrition Education Teaching, Gazi University Educational Science Institution, Ankara, Turkey
[c] General Surgery Clinic, Hepatobiliary Unit, Ankara Numune Training and Research Hospital, Ankara, Turkey
[d] Anesthesia and Resuscitation Clinic, Ankara Numune Training and Research Hospital, Ankara, Turkey

Production of SCFA by microbial fermentation of non-digestible carbohydrates and the growth of saccharolytic microbiota (such as bifidobacteria and lactobacilli) are the key mechanisms used by gastrointestinal microbiota to reverse abnormal water secretion in enteral nutrition and to prevent colonization of pathogenic microbiota, respectively [30,58–60].

EN with FOS-enriched formula in patients in under long term nutrition

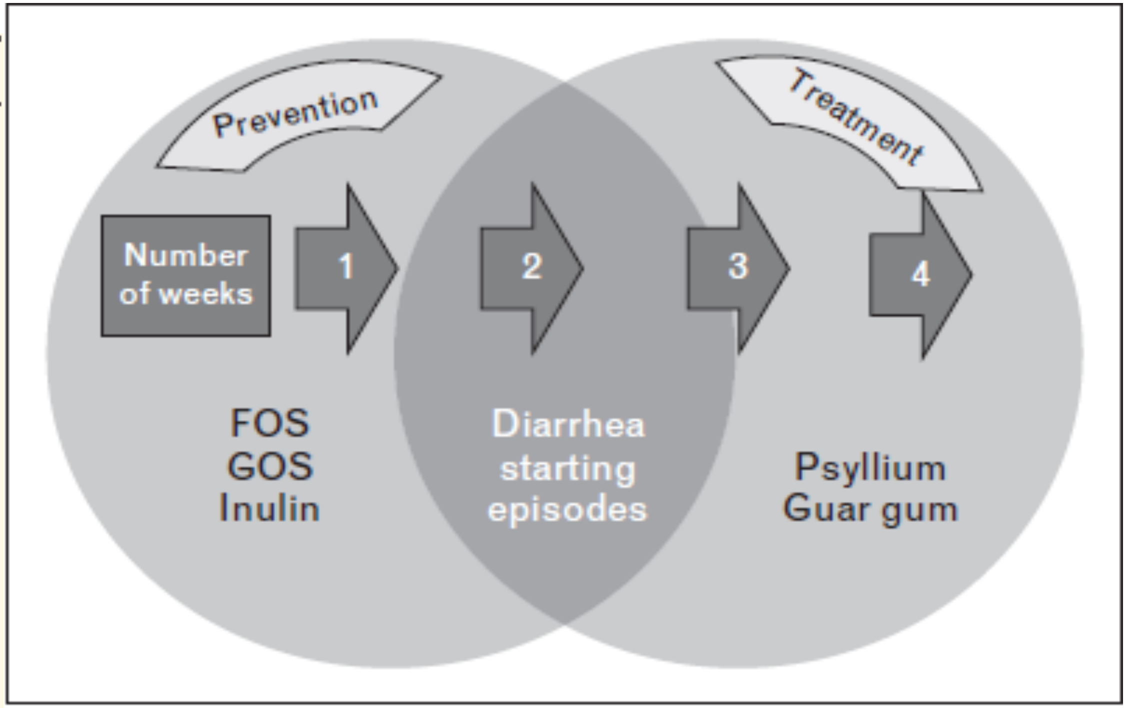
- Increase bifidobacteria
- Increase total SCFA concentrations

Neurological patients have a high risk of developing diarrhea
EN with FOS-enriched formula was associated with significantly low rate of diarrhea (8.7%vs 56.3%) in cohort of neuro-ctitical care patients

Fiber, prebiotic and diarrhea: what, why, when and how. Generoso SV - Curr Opin Clin Nutr Metab Care 2016, 19:388–393

KEY POINTS

- Fibers and prebiotics have definitions that overlap, leading to confusion in the literature over outcomes.
- There is a lack of recent methodologically sound scientific research on the adequate utilization of fiber and prebiotics in diarrhea prevention and treatment.
- Most published studies have encompassed not only prevention but also the treatment of distinct types of diarrhea, at different time points, and with patients presenting various symptoms/signs, which make it difficult to reach a consensus.
- We postulate that fiber should be used for diarrhea treatment, and prebiotics for primary and secondary prevention of diarrhea.

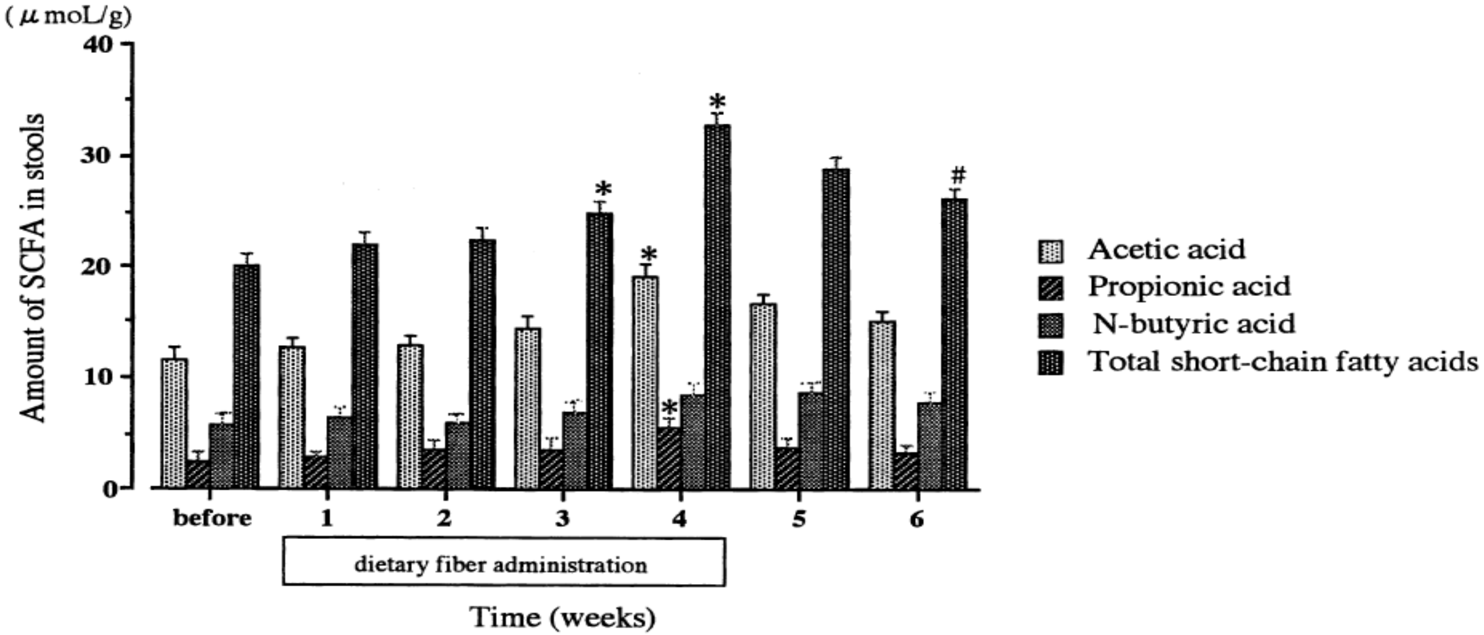


Suggested route to the use of prebiotics and fibers for diarrhea

Usefulness of Soluble Dietary Fiber for the Treatment of Diarrhea During Enteral Nutrition in Elderly Patients

Makoto Nakao, Yozo Ogura, Syousuke Satake, MD, PhD, Izumi Ito, MD, PhD, Akihisa Iguchi, MD, PhD, Kenji Takagi, PhD, and Toshitaka Nabeshima, PhD

From the Department of Neuropsychopharmacology and Hospital Pharmacy and the Department of Geriatrics, Nagoya University Graduate School of Medicine, and the Nagoya University School of Health Sciences, Nagoya, Japan



CONCLUSIONS: The administration of SDF is useful for controlling spontaneous, favorable bowel movement by improving symptoms of small intestinal mucosal atrophy and normalizing the intestinal flora.

Fructo-oligosaccharides and fibre in enteral nutrition has a beneficial influence on microbiota and gastrointestinal quality of life

NICOLETTE J. WIERDSMA[1], ADRIAAN A. VAN BODEGRAVEN[2], BERNHARD M. J. UITTDEHAAG[3], WILLY ARJAANS[1], PAUL H. M. SAVELKOUL[4], HINKE M. KRUIZENGA[1] & MARIAN A. E. VAN BOKHORST-DE VAN DER SCHUEREN[1]

Departments of [1]Nutrition and Dietetics, [2]Gastroenterology, Small-bowel Diseases Unit, [3]Clinical Epidemiology and Biostatistics, and [4]Medical Microbiology & Infection Control, VU University Medical Centre, Amsterdam, The Netherlands

Dig Dis Sci
DOI 10.1007/s10620-014-3135-1

ORIGINAL ARTICLE

Partially Hydrolyzed Guar Gum Accelerates Colonic Transit Time and Improves Symptoms in Adults with Chronic Constipation

Dimitrios Polymeros · Iosif Beintaris · Asimina Gaglia · George Karamanolis · Ioannis S. Papanikolaou · George Dimitriadis · Konstantinos Triantafyllou

Received: 11 December 2013 / Accepted: 23 March 2014

Abstract
Background and Aim Partially hydrolyzed guar gum (PHGG) is a water-soluble, non-gelling dietary fiber with a wide range of uses in clinical nutrition. The aim of this prospective study was to investigate the effect of guar gum on colonic transit time (CTT) and symptoms of chronic constipation.
Methods We enrolled patients fulfilling Rome III criteria for chronic constipation. CTT was measured before and at the end of treatment. After a 2-week run-in period, patients received 5 mg PHGG daily for 4 weeks. During study period, patients kept daily symptoms, stool and laxative usage diaries. They also recorded their symptom-related satisfaction weekly and treatment adverse events.
Results Forty-nine patients received treatment; 39 (80 %) completed the study. Treatment significantly reduced colon transit time, from 57.28 ± 39.25 to 45.63 ± 37.27 h ($p = 0.026$), a reduction more prominent in slow transit patients (from 85.50 ± 27.75 to 63.65 ± 38.11 h, $p = 0.016$). Overall, the weekly number of complete spontaneous and spontaneous bowel movements increased significantly ($p < 0.001$); the latter correlated significantly with the acceleration of CTT in the overall population and in slow transit patients ($B = 0.382$; $p = 0.016$ and $B = 0.483$; $p = 0.023$, respectively). In addition, the number of bowel movements with straining decreased ($p < 0.001$) and stool form improved ($p < 0.001$), while days with laxative intake and days with abdominal pain decreased ($p = 0.001$ and $p = 0.027$, respectively).
Conclusion Four-week PHGG use accelerates colon transit time in patients with chronic constipation, especially in those with slow transit, and improves many of their symptoms including frequency of bowel movements.

D. Polymeros (✉) · I. Beintaris · A. Gaglia · G. Karamanolis · I. S. Papanikolaou · G. Dimitriadis · K. Triantafyllou
Hepatogastroenterology Unit, Second Department of Internal

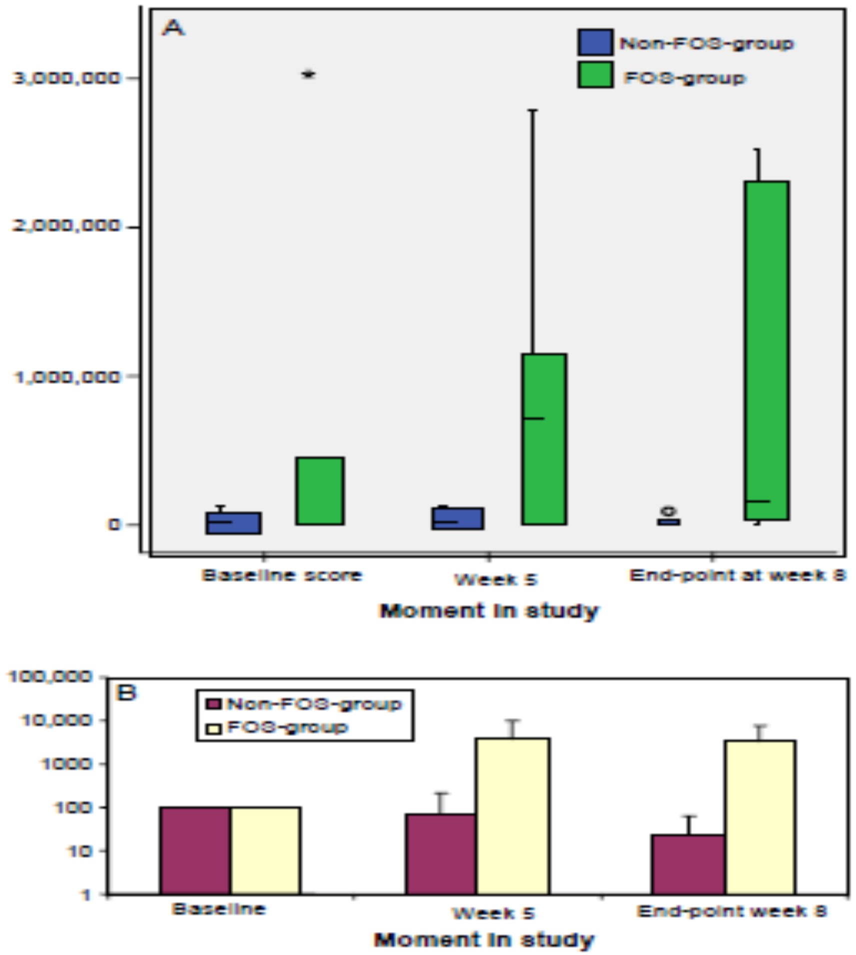


Figure 2. A. Dispersal of number of *Bifidobacteria* in units per gram faeces of enteral nutrition-dependent patients (non-FOS (fructo-oligosaccharides) group versus FOS group) at baseline, at week 5 and at end-point (week 8). Baseline scores were equal between groups. Mean number of *Bifidobacteria* decreased in the non-FOS group compared to the baseline value ($p = 0.043$). An almost significant difference was reached between the number of *Bifidobacteria* in the FOS group compared with that in the non-FOS group at end-point ($p = 0.056$). B. Number of faecal *Bifidobacteria* in enteral nutrition-dependent patients (non-FOS group versus FOS group) expressed as a percentage of baseline scores and reflected on a logarithmic scale.

Scandinavian Journal of Gastroenterology, 2009; 44: 804–812

- In long term patients the NET without fibers, determines an alteration of the microbiota, with a variation of the relationship (anaerobes /aerobes)
- Studies that have analyzed in detail some bacterial strains - while taking into account the inhomogeneity of duration, type of fiber used and basal conditions of the patients in TEN - have shown - tendency (significant or not) to: Clostridia reduction and increased ruminococcin and bifid strain
- To the only study with ICU patients, to our knowledge, switching to a fiber-free NET does not cause changes in the bacterial pattern, but causes a dramatic increase in diarrhea (+ 50%)

Review

Distant Site Effects of Ingested Prebiotics

Stephanie Collins [1] and Gregor Reid [1,2,*]

Received: 20 July 2016; Accepted: 23 August 2016; Published: 26 August 2016

- ***Densità ossea e assorbimento minerale***

Type of Trial	Prebiotic Used	Main Finding	Reference
Randomized, double-blind, placebo-controlled crossover	Inulin/oligofructose mix (Synergy1)	Improved calcium and magnesium absorption and bone turnover in postmenopausal women.	Holloway et al., 2007 [23]
Randomized, double-blind, placebo-controlled crossover	scFOS	scFOS do not improve calcium absorption in postmenopausal women.	Tahiri et al., 2003 [24]
Randomized, double-blind, placebo-controlled	Chicory fructan	Calcium absorption improved by chicory fructan administration in postmenopausal women.	Kim et al., 2004 [25]
Randomized, double-blind, placebo-controlled crossover	TOS	Calcium absorption improved by TOS administration in postmenopausal women.	van den Heuvel et al., 2000 [26]
Randomized, double-blind, placebo-controlled crossover	Lactulose	Calcium absorption improved by lactulose administration in postmenopausal women.	van den Heuvel et al., 1999 [27]
Randomized, double-blind, placebo-controlled crossover	Inulin, FOS, and GOS	Inulin, FOS, and GOS do not affect calcium or iron absorption in healthy adult men.	van den Heuvel et al., 1998 [28]
Randomized, double-blind, placebo-controlled	Inulin-type fructan	Calcium absorption and bone content/density improved by inulin-type fructan administration in teenagers.	Abrams et al., 2005 [29]
Randomized, double-blind, placebo-controlled crossover	Oligofructose and inulin/oligofructose mixture	Calcium absorption improved by inulin/oligofructose, but not oligofructose, administration in adolescent girls.	Griffin et al., 2002 [30]
Randomized, double-blind, placebo-controlled crossover	Oligofructose	Calcium absorption improved by oligofructose administration in adolescent boys.	van den Heuvel et al., 1999 [31]
Randomized, double-blind, placebo-controlled	scFOS	Bone turnover was minimized by scFOS administration in postmenopausal women. No effect on bone mineral density.	Slevin et al., 2014 [32]

Review

Distant Site Effects of Ingested Prebiotics

Stephanie Collins [1] and Gregor Reid [1,2,*]

Received: 20 July 2016; Accepted: 23 August 2016; Published: 26 August 2016

- ***Funzione immunitaria***

Type of Trial	Prebiotic Used	Main Finding	Reference
Randomized, double-blind, placebo-controlled, crossover	β2-1 fructans	β2-1 fructans increased blood IL-4, CD282+/TLR2+ myeloid dendritic cells, and a TLR2-mediated immune response in healthy adults.	Clarke et al., 2016 [89]
Randomized, double-blind, placebo-controlled	β2-1 fructans	β2-1 fructans did not affect numbers of blood immune cells or Ig, salivary IgA, or immune activity in healthy adults.	Lomax et al., 2012 [90]
Randomized, double-blind, placebo-controlled	Oligofructose/inulin mixture	Oligofructose/inulin improved antibody response to measles vaccination	Firmansyah et al., 2001 [91]
Randomized, double-blind, placebo-controlled	Oligofructose/inulin mixture	Oligofructose/inulin increased circulating influenza-specific antibodies after vaccination in healthy adults.	Lomax et al., 2015 [92]
Prospective, randomized, double-blind, placebo-controlled	Nutritional formula containing FOS	Nutritional formula with FOS improved influenza vaccine response and reduced symptomatic days in infants.	Langkamp-Henken et al., 2004 [93]
Randomized, double-blind, placebo-controlled	Oligofructose-supplemented cereal	Prebiotic cereal reduced diarrhea-associated fever and medical attention in infants.	Saavedra et al., 1999 [97]
Randomized, double-blind, placebo-controlled	Oligofructose-supplemented cereal	Prebiotic cereal reduced sick days, antibiotic use and febrile seizures in infants.	Tschernia et al., 1999 [98]

NAD: *NORMATIVA REGIONE PIEMONTE*

Nutrizione Parenterale per insufficienza intestinale	Nutrizione Enterale	Nutrizione Parenterale per pazienti oncologici
1985 LR 39 (legge sperimentale)	1988 LR 7 (legge sperimentale)	
2003 DGR 34-9745		**2000** Sperimentazione multicentrica (n 6) in collaborazione con Rete Oncologica e MMG
2007 DGR 13-7456 — Responsabilità SDNC in collaborazione La delibera individua: soggetti destinatari, compiti, responsabilità, requisiti organizzativi delle SDNC, obblighi.		
2010 DGR n. 18- 13672 RETE REGIONALE delle SDNC **2010** DGR n. 507 COMMISSIONE di COORDINAMENTO DELLA RETE delle SDNC		

PRESCRIZIONE NED

REGIONE PIEMONTE

La Legge della Regione Piemonte D.G.R. n.34-9745 del 26/06/03 disciplina compiti e procedure NED per garantire prestazioni mirate ed efficaci.

LA GESTIONE DELLA NUTRIZIONE ENTERALE DOMICILIARE (NED)
AVVIENE NELLA REGIONE PIEMONTE,
INTERAMENTE SOTTO LA RESPONSABILITÀ DELLE
STRUTTURE DI DIETETICA E NUTRIZIONE CLINICA
ACCREDITATE (DGR 13-7456/2007), SECONDO
PROCEDURE REDATTE DALLE RETE REGIONALE.

In Piemonte con DGR 18-13672 del 29.03.2010 è stata istituita la Rete regionale delle Strutture di Dietetica e Nutrizione Clinica.

Centro NED → ASL → Ditta di SERVIZIO → PAZIENTE

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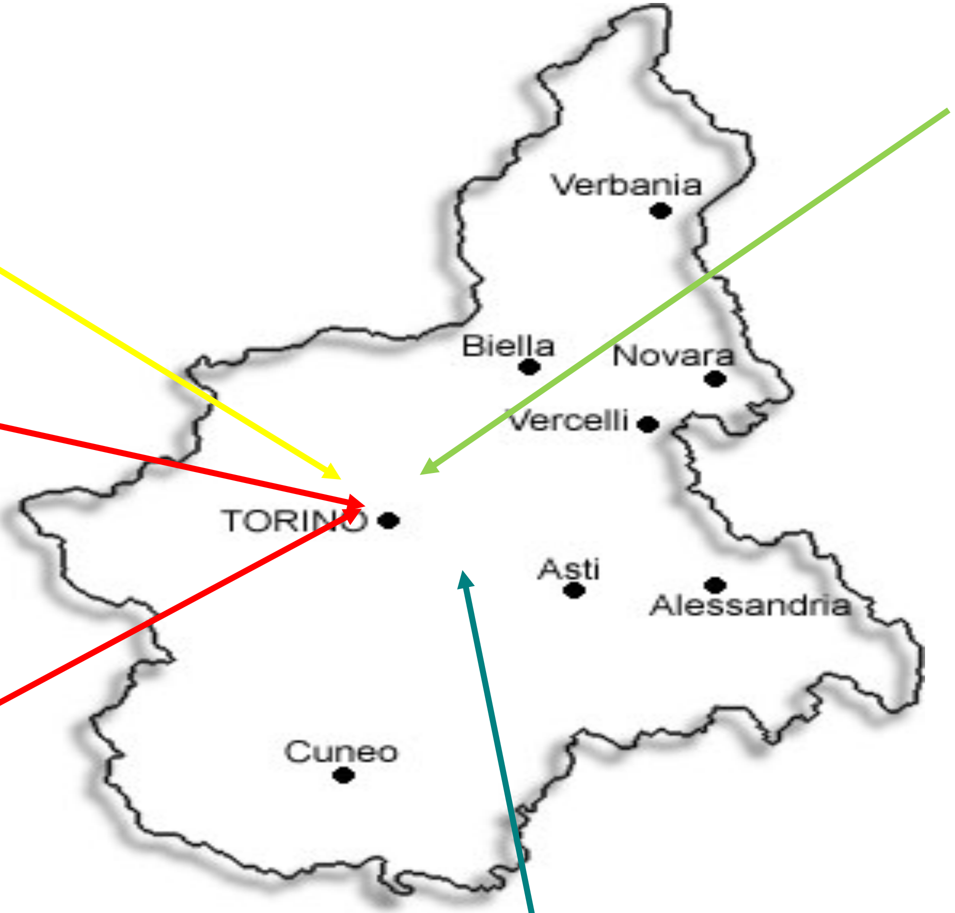
CENTRI NAD in PIEMONTE

ASL SGB
2003

ASL. M. VITTORIA 2005

ASO Mauriziano
1988

ASO Molinette
1988



ASO San Luigi Orbassano
2003

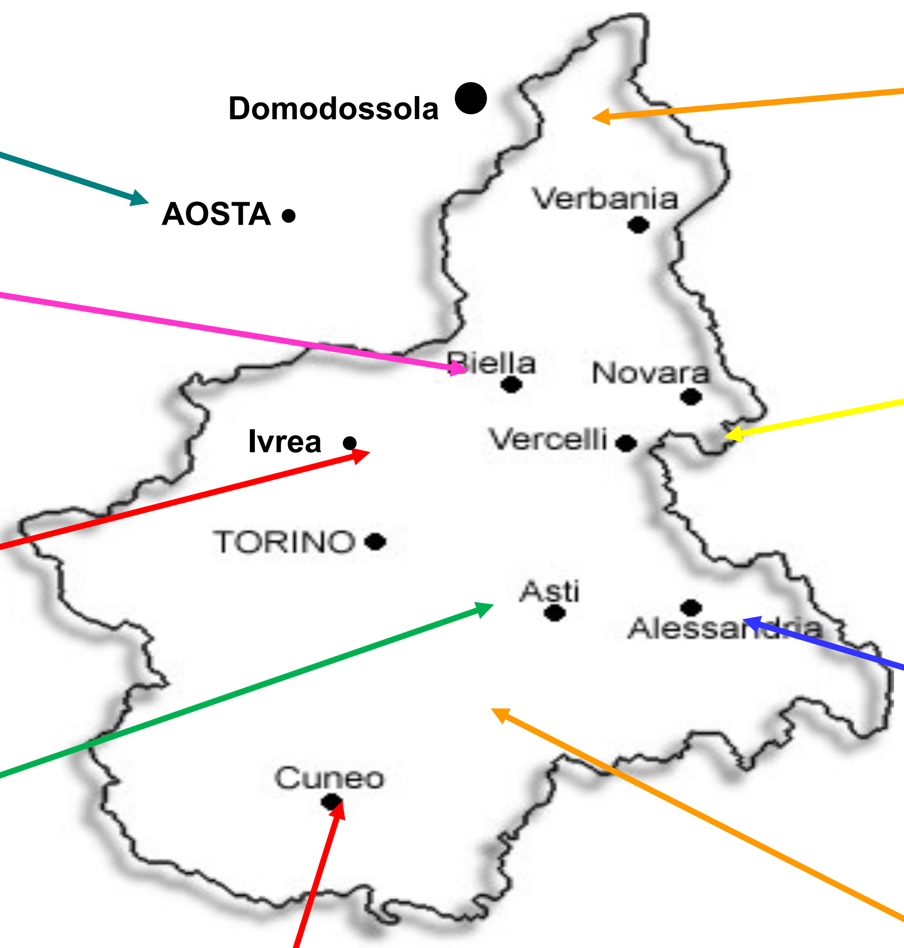
CENTRI NAD in PIEMONTE

USL Aosta
2003

ASL Biella
2004

ASL Ivrea
1988

ASL Asti
1988



ASLVCO
2000

ASO Novara
1993

AO Alessandria
2004

ASL CN 2
ALBA- 2009

ASO Cuneo 1
1988

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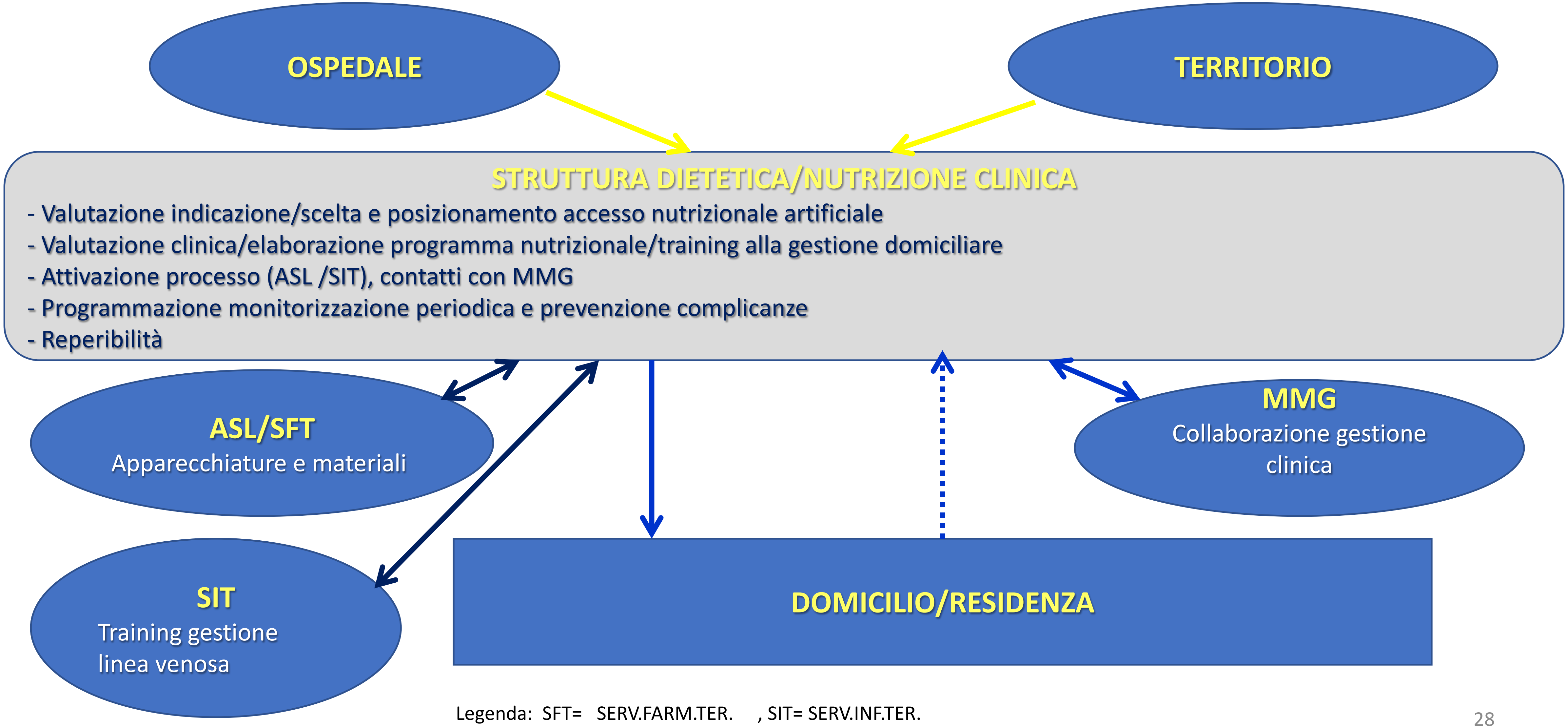
NAD :Normativa nazionale attuale

Regioni	Normativa	Anno	Criticità attuali *
Lombardia Marche Veneto Emilia-Romagna Friuli-Venezia Giulia Trentino Alto Adige Liguria	DGR DGR LR DGR DGR DGR DGR	1992 1997 1998 1995 1997 1993 1995	Carenza Strutture/Disomogeneità Id Carenza Strutture e coordinamento Disomogeneità Disomogeneità Carenza Strutture Disomogeneità/DGR inappropriata
Toscana Valle Aosta Umbria Molise Campania Abruzzo Calabria Lazio	DGR DGR DGR LR DGR PSR DGR DR	2001-2010 2002 2003-2014 2002 2005 2008 2010 2002-2013	Carenza Strutture Disomogeneità No Disomogeneità/incompleta attuaz Disomogeneità Carenza Strutture/disomogeneità Disomogeneità/incompleta attuaz
Basilicata, Sicilia Sardegna	Assenza di normativa		

** Documento presentato dal Presidente SINPE ad audizione Camera Deputati 2011*

Piemonte LR 1985 - 1988 - DGR 2003

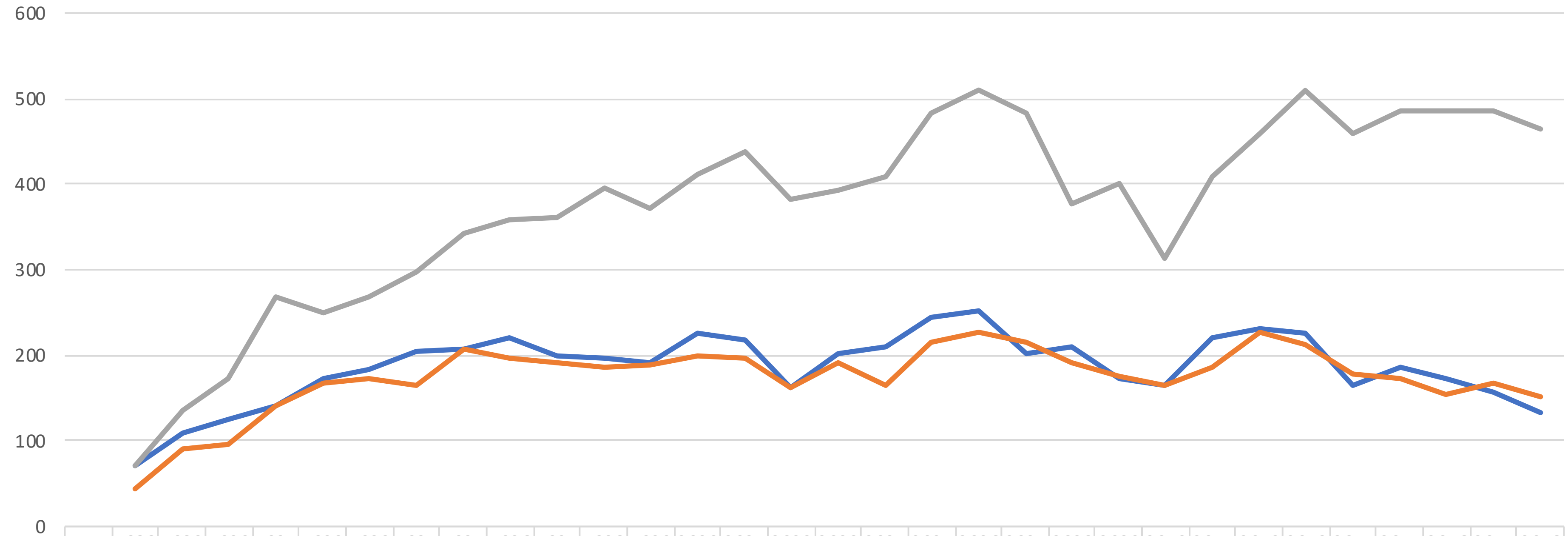
NAD in PIEMONTE
MODELLO ORGANIZZATIVO



Legenda: SFT= SERV.FARM.TER. , SIT= SERV.INF.TER.

DIETETICS AND CLINICAL NUTRITION UNIT
A.O. CITTA' DELLA SALUTE E DELLA SCIENZA
DI TORINO

HEN PATIENTS : TREND IN 30 YEARS



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
entrati	71	109	126	142	172	184	204	208	221	199	197	192	225	217	161	202	210	245	252	203	209	172	166	220	230	225	165	186	172	157	133
usciti	44	91	96	140	168	173	165	206	197	192	185	190	200	196	161	191	166	215	227	214	192	175	164	185	227	213	178	172	154	167	152
PZ./ANNO	71	136	172	268	250	267	298	342	358	362	395	372	411	438	382	393	409	482	510	482	378	402	313	408	458	509	459	486	486	485	464

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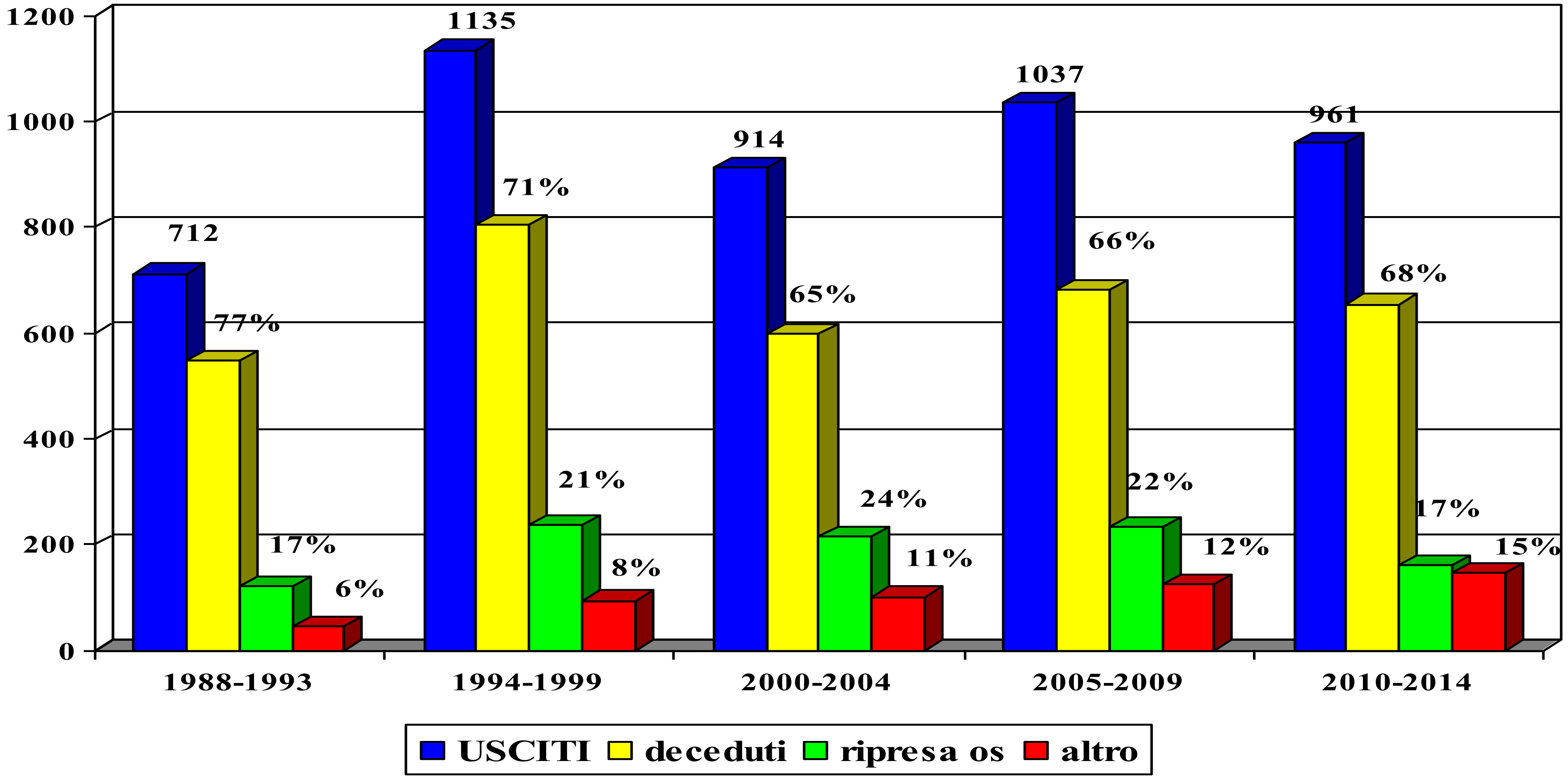
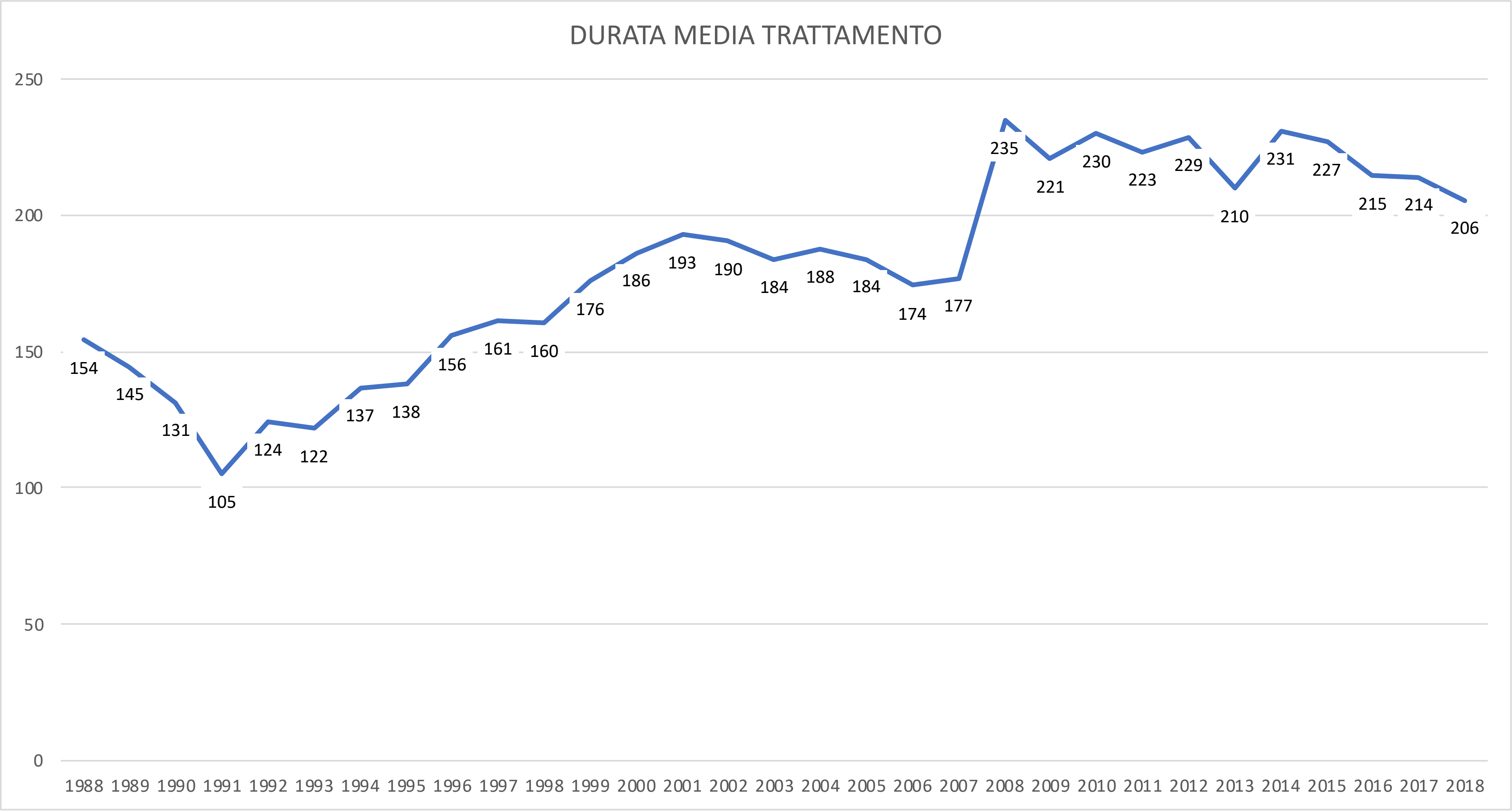
Città della Salute e della Scienza di Torino

EHN PATIENTS in 30 YEARS



DIETETIC AND CLINICAL NUTRITION UNIT
A.O. CITTA' DELLA SALUTE E DELLA SCIENZA
DI TORINO



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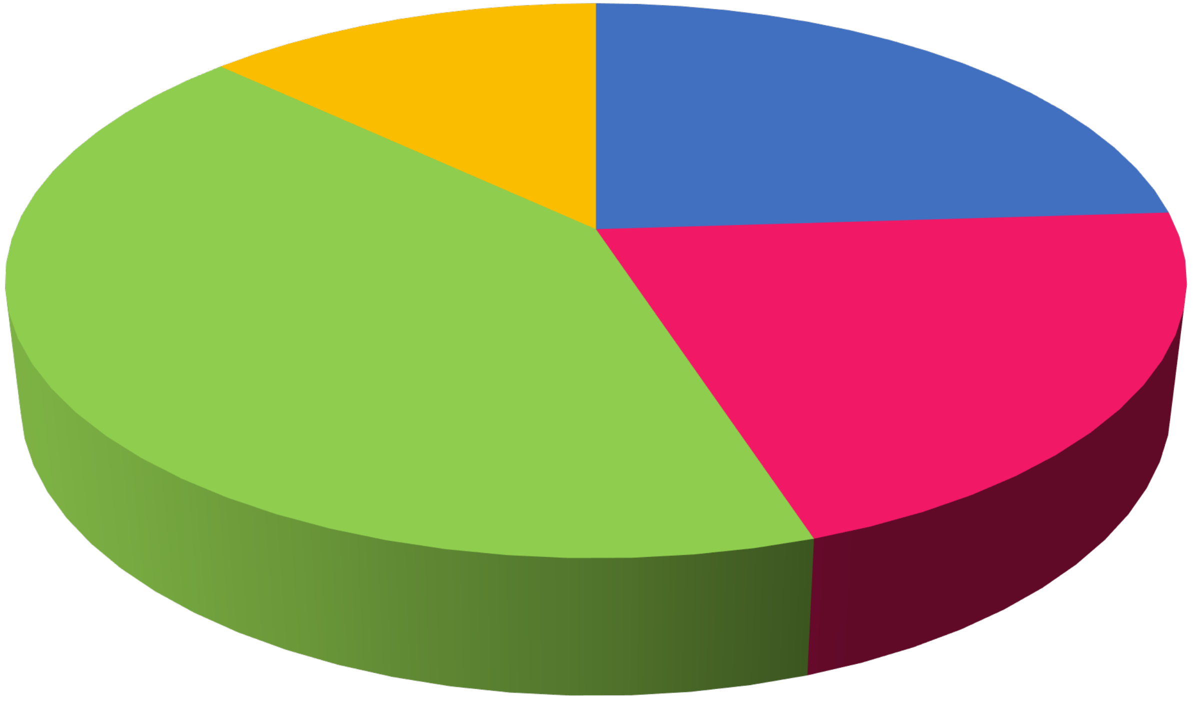
HOME ENTERAL NUTRITION: DIAGNOSIS

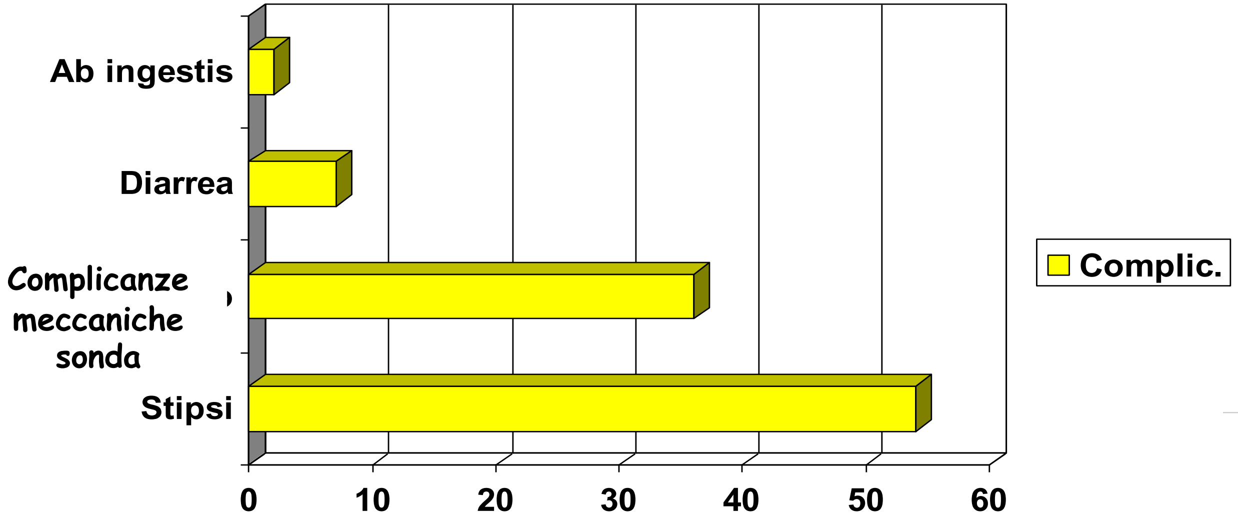
Patients in Home Enteral Nutrition followed by Dietetics and Clinical Nutrition Unit
Molinette Hospital – Turin – 2018



- Oncological pathologies 82 pt (24%)
- Vasculopathies 74 pt (21%)
- Neurological pathologies 146 pt (42%)
- Other pathologies 45 pt (13%)

HEN PATIENTS TO 31/12/2018: TOT 347

HEN COMPLICATIONS



HEN Patients followed by Dietetics and Clinical Nutritition Unit
Molinette Hospital - Turin

Invited Review

Nutrition in Clinical Practice
Volume 34 Number 2
April 2019 186–195

DOI: 10.1002/ncp.10257
wileyonlinelibrary.com
WILEY

Addressing Frequent Issues of Home Enteral Nutrition Patients

Teresa W. Johnson, DCN, RDN, FAND[1]; Sara Seegmiller RN, GIM[2];
Lisa Epp, RDN, LD, CNSC[2]; and Manpreet S. Mundi, MD[2]

Abstract

The home enteral nutrition (HEN) population is a medically diverse group whose number has increased substantially in recent decades. Although medically stable compared with acute care patients requiring nutrition support, HEN population needs are unique and require a team approach to manage nutrition. Frequently encountered issues by the HEN team include mechanical issues of the tube site, gastrointestinal and metabolic problems, and patient preferences regarding tube weaning, formula selection, and compliance. A thorough search of the published literature on how to manage these issues was conducted using scientific healthcare databases with the following inclusion criteria: English only, last 10 years, and reviews and clinical trials. Where appropriate, references from the retrieved articles were hand-searched for relevant articles older than 10 years and cited in this review. The purpose of this review is to provide the HEN team with strategies to address the top issues of home enteral feeding. (*Nutr Clin Pract*. 2019;34:186–195)

Consensus Recommendation

Journal of Parenteral and Enteral Nutrition
Volume 41 Number 1
January 2017 15–103

DOI: 10.1177/0148607116673053
jpen.sagepub.com
SAGE

ASPEN Safe Practices for Enteral Nutrition Therapy

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Tamara J. Kinn, MS, RD, LDN, CNSC[11];
Mark G. Klang, MS, RPh, BCNSP, PhD[12]; Linda Lord, NP, ACNP-BC, CNSC[13];
Karen Martin, MA, RDN, LD, FAND[14];
Cecelia Pompeii-Wolfe, RD, LDN, CNSC[15]; Jackie Sullivan, MS, RDN, CD[16];
Abby Wood, RD, LD, CNSC[17]; Ainsley Malone, MS, RD, CNSC, FASPEN[18]; and
Peggi Guenter, PhD, RN, FAAN[18]; ASPEN Safe Practices for Enteral Nutrition
Therapy Task Force, American Society for Parenteral and Enteral Nutrition

Abstract

Enteral nutrition (EN) is a valuable clinical intervention for patients of all ages in a variety of care settings. Along with its many outcome benefits come the potential for adverse effects. These safety issues are the result of clinical complications and of process-related errors. The latter can occur at any step from patient assessment, prescribing, and order review, to product selection, labeling, and administration. To maximize the benefits of EN while minimizing adverse events requires that a systematic approach of care be in place. This includes open communication, standardization, and incorporation of best practices into the EN process. This document provides recommendations based on the available evidence and expert consensus for safe practices, across each step of the process, for all those involved in caring for patients receiving EN. (*JPEN J Parenter Enteral Nutr*. 2017;41:15-103)

ENTERAL NUTRITION AND INTESTINAL MICROBIOME

- Enteral nutrition has an influence on the grow of microbiome
- In long-term HEN patients it could be present a real dysbacteriosis

Curr Opin Clin Nutr Metab Care. 2017 Mar;20(2):131-137. doi: 10.1097/MCO.0000000000000348.

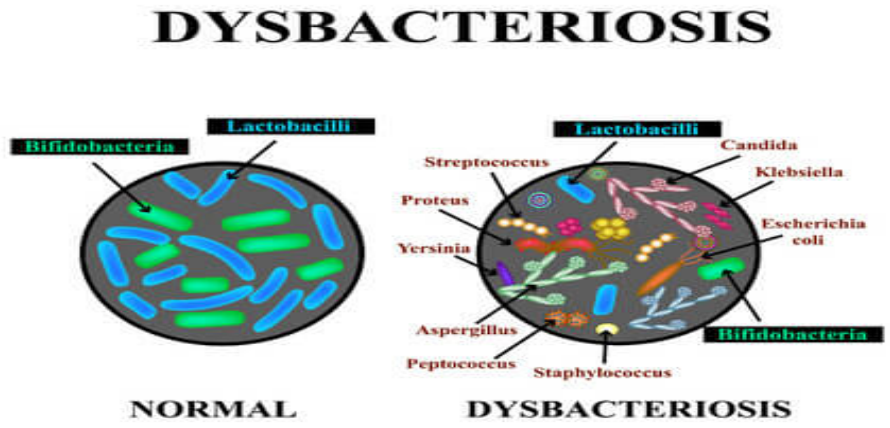
Influence of nutrition therapy on the intestinal microbiome.

Krezalek MA[1], Yeh A, Alverdy JC, Morowitz M.

Abstract

PURPOSE OF REVIEW:
This review describes the relationship between nutritional therapies and the intestinal microbiome of critically ill patients.

RECENT FINDINGS:
The intestinal microbiome of the critically ill displays a near complete loss of health-promoting microbiota with overgrowth of virulent healthcare-associated pathogens. Early enteral nutrition within 24 h of admission to the ICU has been advocated in medical and surgical patients to avoid derangements of the intestinal epithelium and the microbiome associated with starvation. Contrary to previous dogma, permissive enteral underfeeding has recently been shown to have similar outcomes to full feeding in the critically ill, whereas overfeeding has been shown to be deleterious in those patients who are not malnourished at baseline. Randomized clinical trials suggest that peripheral nutrition can be used safely either as the sole or supplemental source of nutrition even during the early phases of critical care. The use of probiotics has been associated with a significant reduction in infectious complications in the critically ill without a notable mortality benefit.



STUDY OF THE EFFECTS OF A SYMBIOTIC ON THE MICROBIOTA IN LONG-TERM HOME ENTERAL NUTRITION (HEN) PATIENTS

OUTCOME OF THE STUDY

The use of symbiotics modulates the Intestinal Microbiota (IM) through the interaction with the commensal bacteria and the regulation of the intestinal function. Furthermore, the administration of a symbiotic composed by Inulin+*Bifidobacterium Lactis* , Lactobacillus Acidophilus, Plantarum and *Lactis* appears to be synergistic with positive endosymbiotic functional effects on the IM of the host .

The present study tested the effects of a symbiotic on the modification of microbiota and intestinal function In Home Enteral Nutrition (HEN) patients

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STUDY DESIGN

- This is a randomized open-label intervention trial.
- Participants were recruited from HEN group of Dietetic and Clinical Nutrition of the "Città della Salute e della Scienza" of Turin, in the period from January 2015 to January 2017.
- Inclusion criteria were: long term enteral nutrition(≥ 2 years)
- Exclusion criteria were: active neoplastic disease, progressive neurological diseases (ALS, Multiple Sclerosis)

MATERIAL AND METHODS

Twenty long term HEN patients were randomized respectively in enteral formula plus 1 sachet/day of symbiotic for 4 months of study (intervention group, *n*=11) or enteral formula only for 4 months (control group, *n*= 9).

Diagnosis:

- 5 vascular diseases
- 11 neurological diseases
- 4 hipoxic brain

All patients received fiber-enriched tube feeding

The patients of the two groups were evaluated at baseline(T0), after 2 months (T1) and after 4 months (T2) from the baseline.

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MATERIAL AND METHODS

All participants submitted to the following assessments:

- Nutritional evaluation at T0, T1and T2
- Microbiological analysis
- Extraction of faecal DNA
- The stool samples were collected at home by patients and transferred to sterile sampling containers. The samples were immediately refrigerated at 4 ° C and within the next 2 hours stored in a refrigerator at the temperature of -80 ° C and were sent to Parassitology and Human Microbioma Unit of “Bambin Gesù” Pediatric Hospital, Rome

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MATERIAL AND METHODS

At baseline (T0), after two (T1) and four (T2) months, nutritional assessments were performed.

- At T0- T1 and T2 metabolic parameters were determined, and at T0 and T2 intestinal microbiota (IM) was analysed.
  - Collection of faecal samples at T0 and T2 to evaluate changes in the microbiota composition.
  - A fasting blood sample collection at T0 and T2, to determine the circulating concentrations of blood count with leukocyte formula, fasting glucose, total protein, transferrin, triglycerides, total and HDL cholesterol were obtained.

T0 = beginning of the study
T1= after 2 months enteral nutrition + symbiotic
T2= after 4 months enteral nutrition + symbiotic
.

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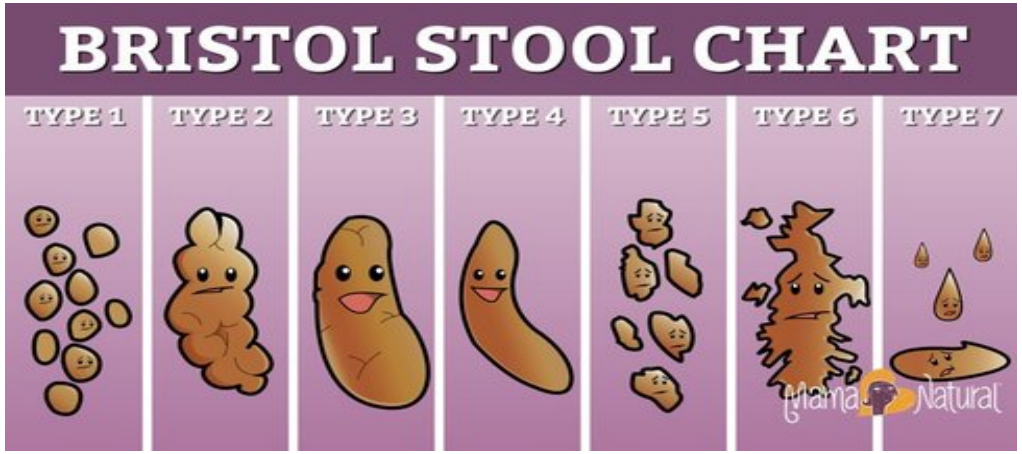
MATERIAL AND METHODS

- Constipation evaluation (T0, T1, T2) with “The Bristool Stool Chart” and “Constipation Scoring System”



T0 = beginning of the study
T1= after 2 months enteral nutrition symbiotic
T2= after 4 months enteral nutrition + symbiotic

CONSTIPATION TEST

Constipation Scoring System
(Agachan et al., 1996)

Name: ______________________ Date: ______________

Frequency of bowel movements

0	1-2 times per 1-2 days
1	2 times per week
2	Once per week
3	Less than once per week
4	Less than once per month

Difficulty: painful evacuation effort

0	Never
1	Rarely
2	Sometimes
3	Usually
4	Always

Completeness: feeling incomplete evacuation

0	Never
1	Rarely
2	Sometimes
3	Usually
4	Always

Pain: abdominal pain

0	Never
1	Rarely
2	Sometimes
3	Usually
4	Always

Time: minutes in lavatory per attempt

0	Less than 5
1	5-10
2	10-20
3	20-30
4	More than 30

Assistance: type of assistance

0	Without assistance
1	Stimulative laxatives
2	Digital assistance or enema

Failure: unsuccessful attempts for evacuation per 24 hours

0	Never
1	1-3
2	3-6
3	6-9
4	More than 9

History: duration of constipation (yr)

1	0
2	1-5
3	5-10
4	10-20
5	More than 20

TOTAL SCORE: ______________

(Minimum Score, 0; Maximum Score, 30)

SYMBIOTIC USED IN THE STUDY

INFORMAZIONI NUTRIZIONALI	Per 1 bustina (2,5 g)	Per 10,0 g
Inulina	0,375 g	1,5 g
Bifidobacterium lactis W51	≥ 333 milioni	≥ 1 milardi
Lactobacillus acidophilus W22	≥ 1 miliardo	≥ 4 milardi
Lactobacillus plantarum W21	≥ 333 milioni	≥ 1 milardi
Lactococcus lactis W19	≥ 333 milioni	≥ 1 milardi

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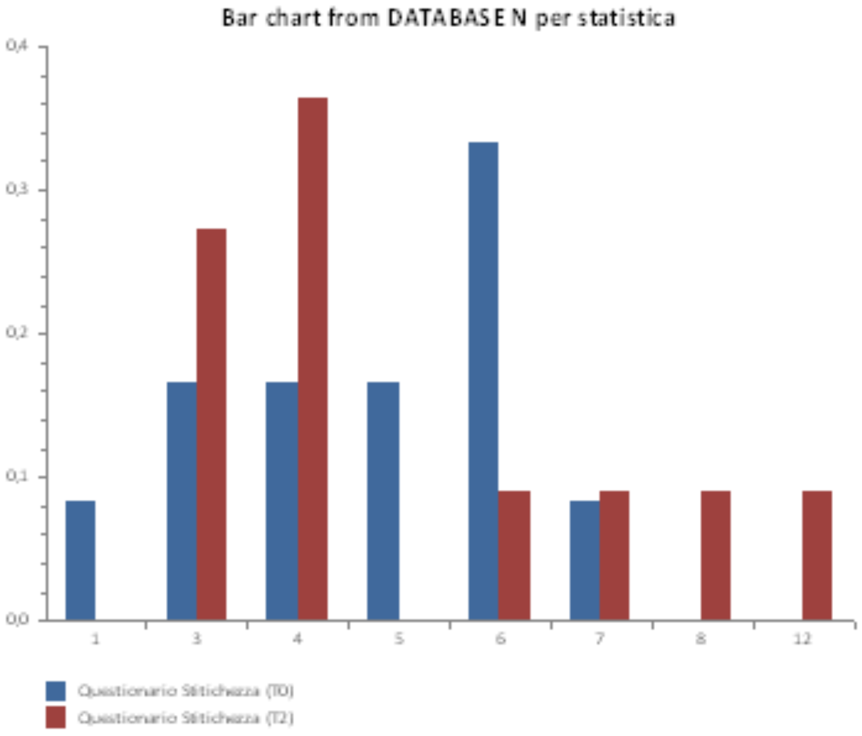
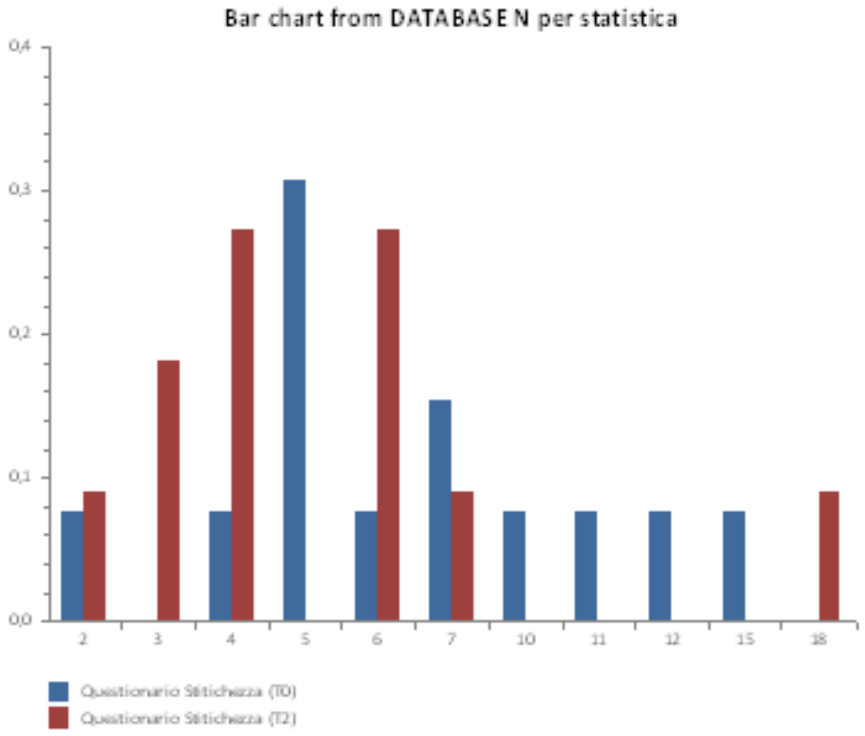
- # ANTHROPOMETRIC AND BLOOD VARIABLES

Anthropometric and blood variables	T 0	T2
Age (y)	74 ± 28	74 ± 28
glycemia (g/dl)	81 ± 30	81 ± 30
Total Protein (g/dl)	6,7 ± 0,8	6,6 ± 0,6
Transferrin (g/dl)	220 ± 32	216 ± 28
Food intakes		
Protein (g)	61 ± 17	61 ± 17
Lipid (g)	59 ± 14	59 ± 14
Carbohydrate (g)	182 ± 37	182 ± 37
Energy (kcal)	1489 ± 212	1489 ± 212
Fibers	18	18

RESULTS (1)

Significant reduction of constipation in Group 1 (with symbiotic) (p < 0,0001), between T1 e T2.

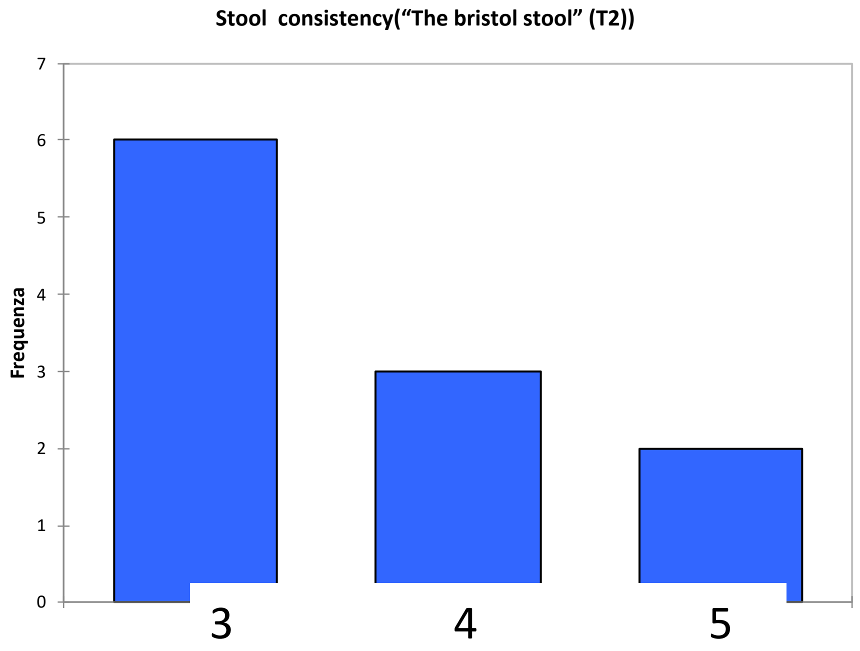




Comparison between item of constipation test in T1 e T2, in symbiotic group and control group

RESULTS (2)

Significant change of stool consistency in symbiotic group between time T1 - T2. (p = 0,0001)



Comparison between item of “The Bristol Stool” T1 e T2, in symbiotic group”.

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Analysis of intestinal mycrobiota

Parassitology and Human Microbioma Unit of "Bambin Gesù" Pediatric Hospital, Rome

Composition of intestinal microbiota was analysed at baseline (T0) and after four months of intervention (T2) in all patients

- 11 patients enteral nutrition + symbiotic (*group 1*)
- 9 patients only enteral nutrition (*group 2*)

Group 1: 3 pts with **significant increase in bacterial diversity** (**«UP»**).

Group 2: 9 pts with reduction in bacterial diversity(**«Down»**).

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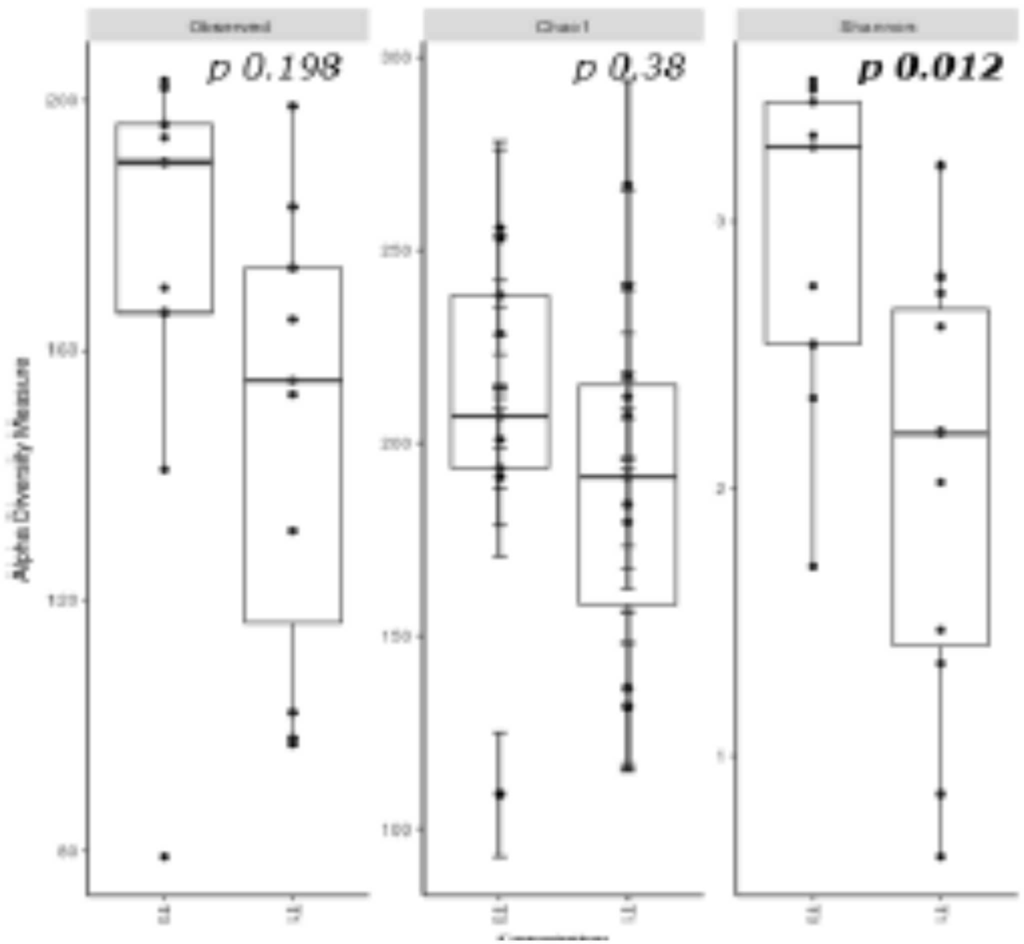
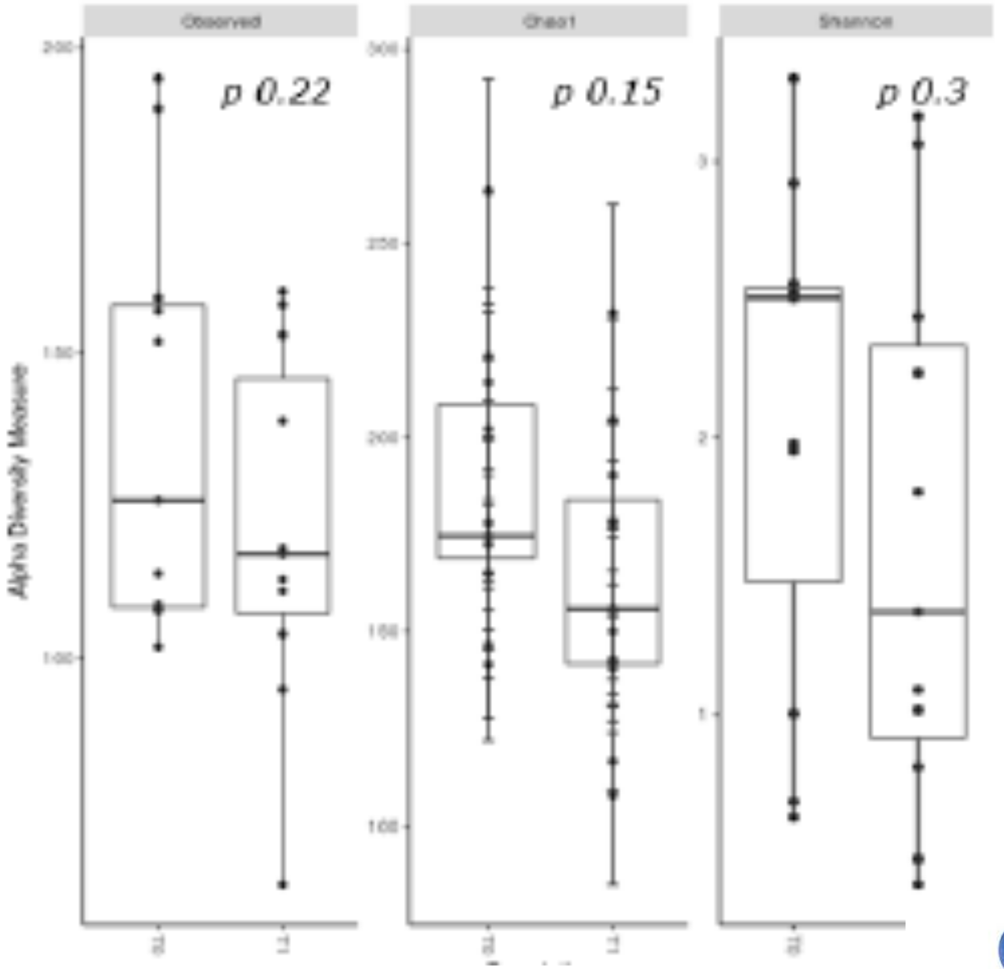
Analysis of intestinal mycrobiota

Parassitology and Human Microbioma Unit of “Bambin Gesù” Pediatric Hospital, Rome

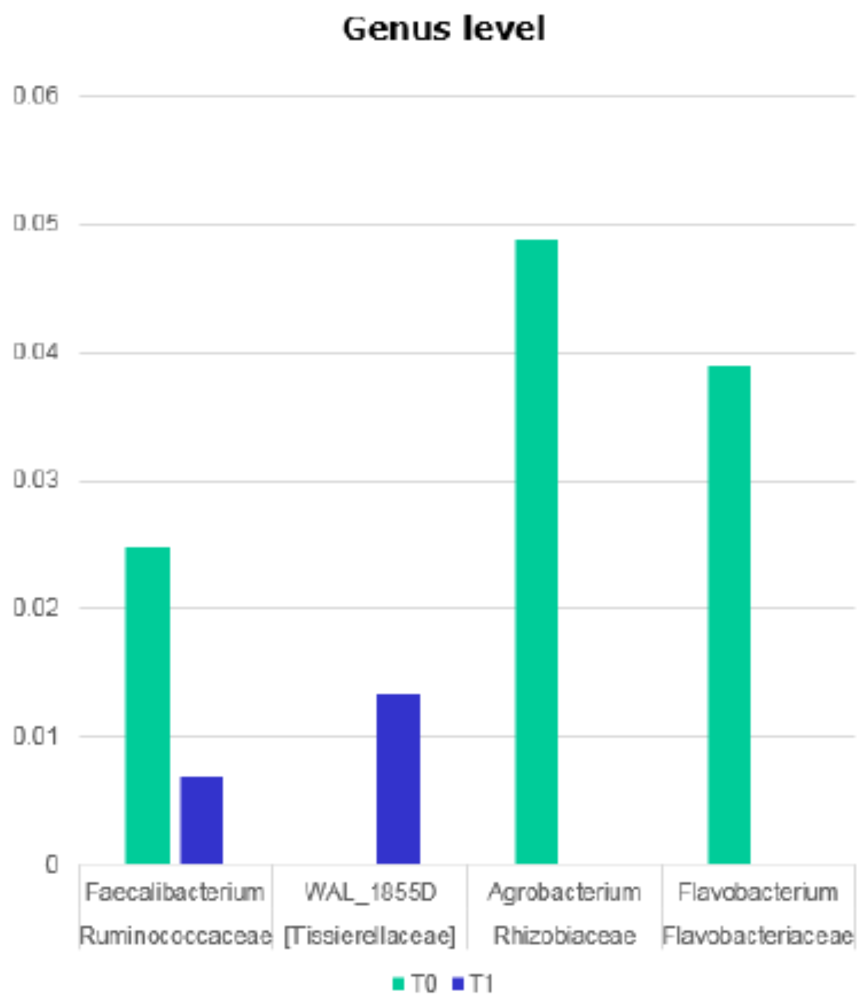




Alpha-diversity for group 1 and not for group 2

Analysis of intestinal mycrobiota

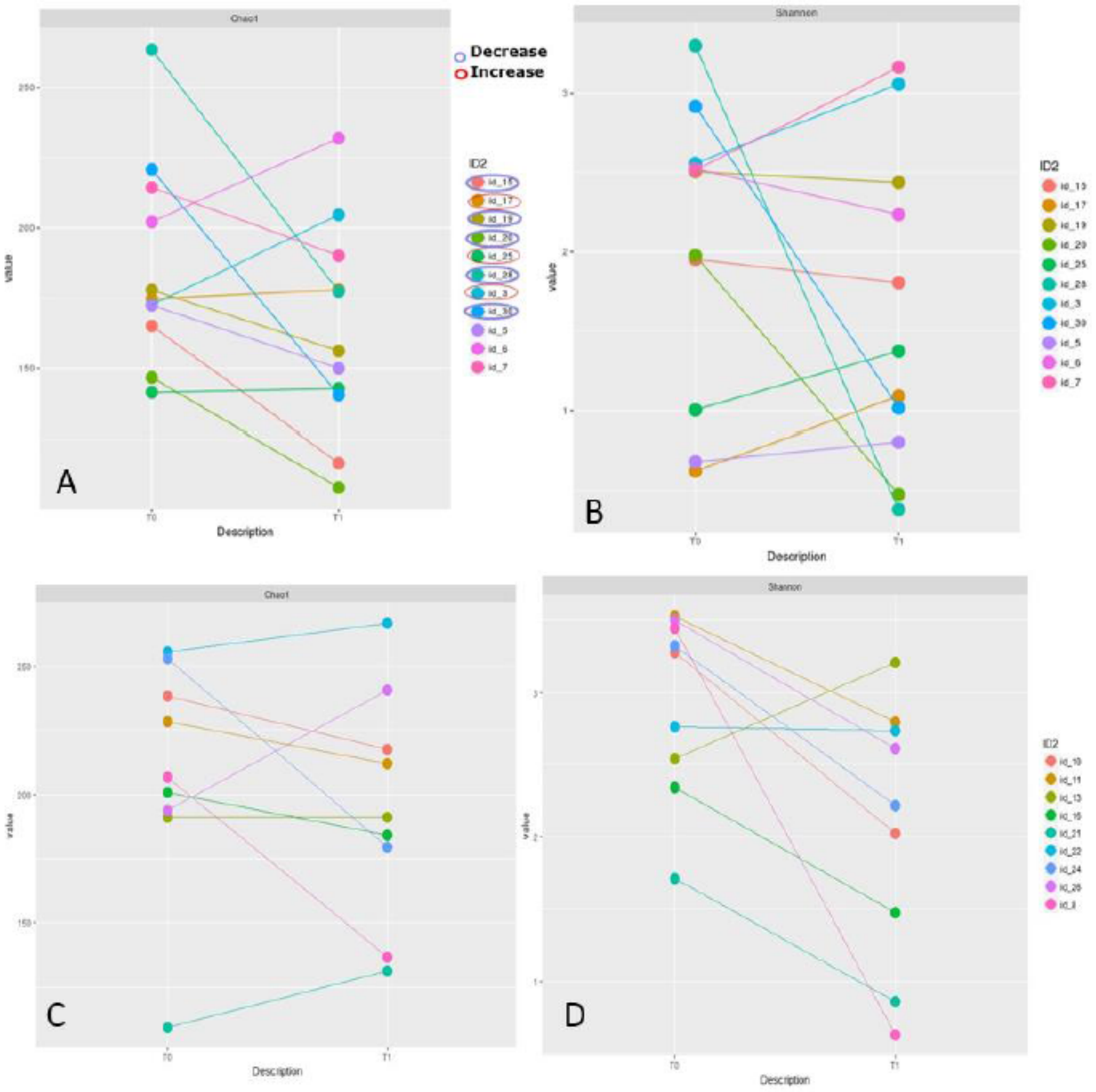
Unità di Parassitologia e Unità di Microbioma Umano
Ospedale Pediatrico Bambino Gesù di Roma



In group 2 a significant reduction in bacterial diversity
Some OTUs are completely disappeared at T2.

Analysis of intestinal mycrobiota

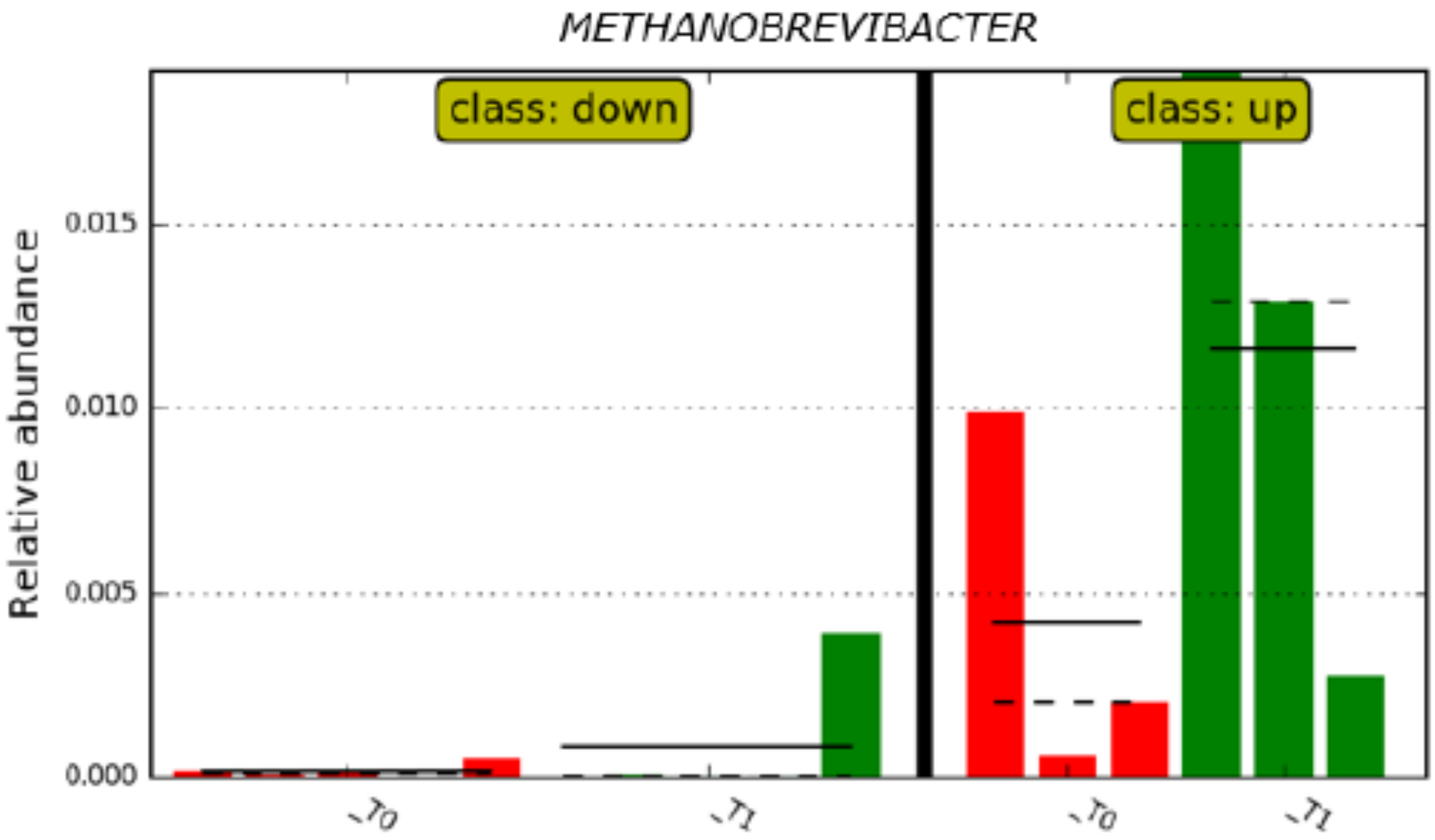
Parassitology and Human Microbioma Unit of “Bambin Gesù” Pediatric Hospital, Rome



Alpha-diversity index in group 1 (A and B) and in group 2 (C and D)

Analysis of intestinal mycrobiota

Parassitology and Human Microbioma Unit of “Bambin Gesù” Pediatric Hospital, Rome



Comparison of the abudance of *Methanobrevibacter* , marker in group1 with increased biodiversity (up) and group 2 (down)

DISCUSSION

- Patients in enteral nutrition with symbiotic added (group 1) present increased biodiversity compared to other group (group 2)
- This result wasn’t seemed linked to a specific patology.

- Methanobrevibacter was present at the beginning of the study and it is linked to more biodiversity of group 1 (symbiotic group).

In group «up» (group 1) there was an high concentration of Prevotella

- In literature a study highlights that in obese mouse methanobrevibacter associated with Prevotella is associated to increased bacterial diversity and a more production of SCFAs.

PRELIMINARY STUDY ON THE EFFECTS OF A PREBIOTIC (PHGG) ADDED IN LONG-TERM HOME ENTERAL NUTRITION (NED) PATIENTS

AIM OF THE STUDY

Fibers (prebiotics) lead to specific changes in the composition and activity of gut microbiota

Useful to study the alteration of microbiota in long term HEN, and the modification of microbiota using fiber and/or prebiotics in minimizing constipation.

The aim of this pilot study is to assess the utility of PHGG added in patients in HEN home enteral nutrition

SUBJECTS AND METHODS

- Study population

A total of 12 patients in Home Enteral Nutrition
(7 men and 5 women), mean age 71 ± 5 y)
All patients have functioning gastrointestinal tract and access via gastric route

Diagnosis:

- vascular diseases
- neurological diseases
- hipoxic brain

All patients received fiber-enriched tube feeding and a soluble fiber **(PHGG)** was added to all patients: 2 measuring cups/die (8.6 g soluble fiber) added to water

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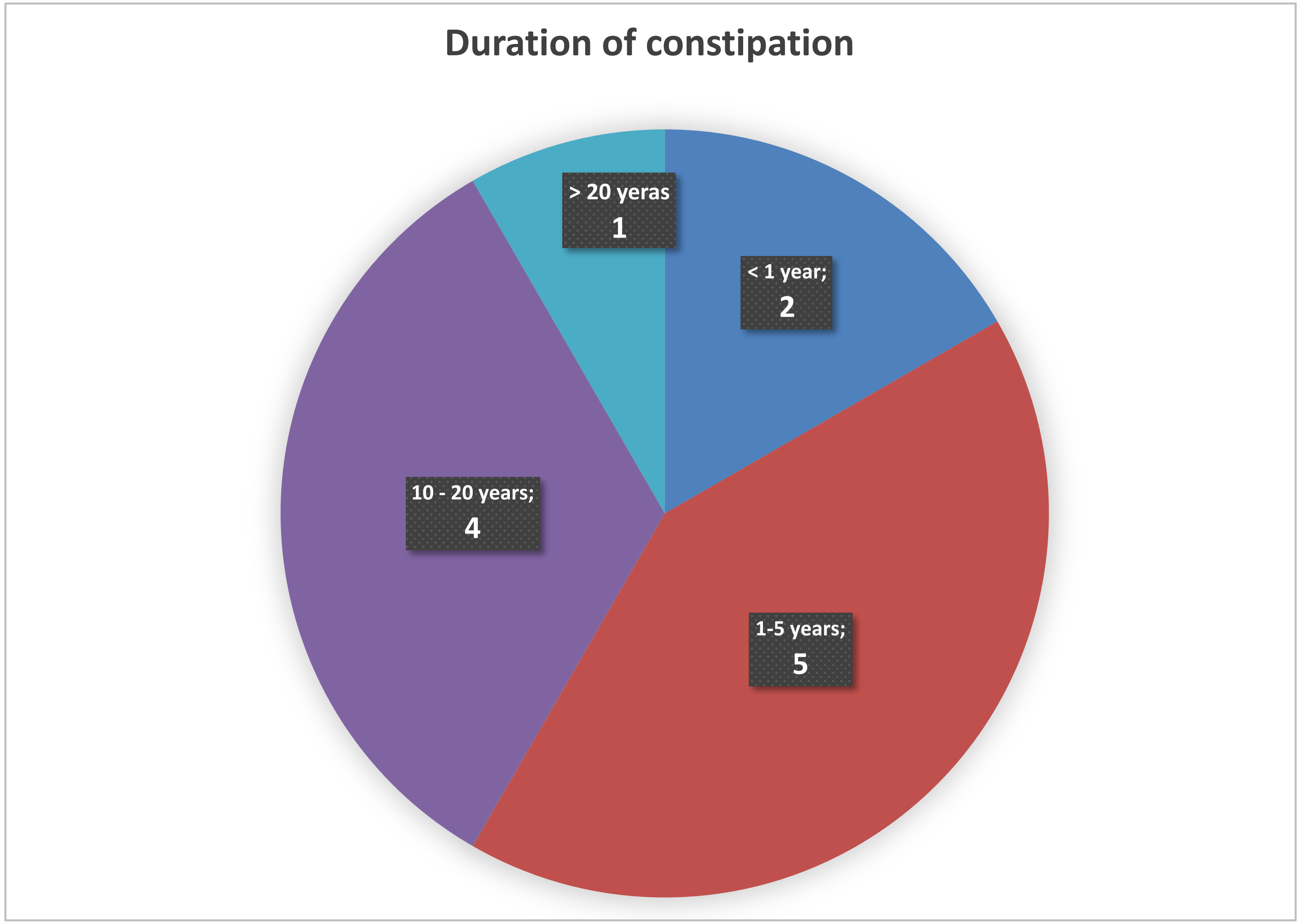
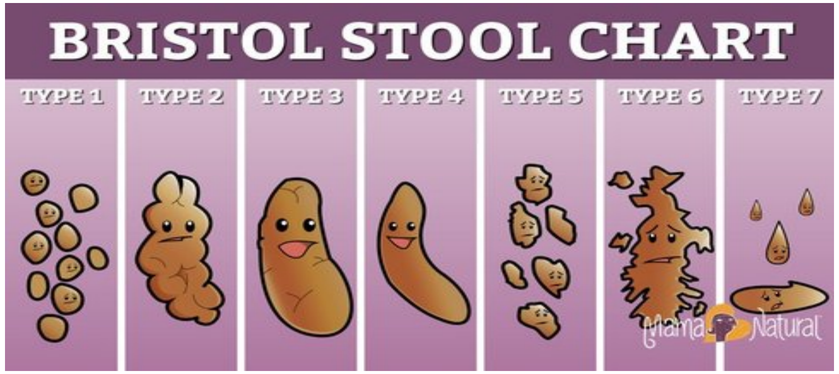
Città della Salute e della Scienza di Torino

HEN Patients and duration of constipation



METHODS

- Costipation valutation (T0, T1, T2)
  with "The Bristool Stool Chart"
  and "Constipation Scoring System"



T0 = beginning of the study
T1= after 2 months enteral nutrition + symbiotic
T2= after 4 months enteral nutrition + symbiotic

Constipation Scoring System
(Agachan et al., 1996)

Name: ______________________ Date: ________________

Frequency of bowel movements

0	1-2 times per 1-2 days
1	2 times per week
2	Once per week
3	Less than once per week
4	Less than once per month

Difficulty: painful evacuation effort

0	Never
1	Rarely
2	Sometimes
3	Usually
4	Always

Completeness: feeling incomplete evacuation

0	Never
1	Rarely
2	Sometimes
3	Usually
4	Always

Pain: abdominal pain

0	Never
1	Rarely
2	Sometimes
3	Usually
4	Always

Time: minutes in lavatory per attempt

0	Less than 5
1	5-10
2	10-20
3	20-30
4	More than 30

Assistance: type of assistance

0	Without assistance
1	Stimulative laxatives
2	Digital assistance or enema

Failure: unsuccessful attempts for evacuation per 24 hours

0	Never
1	1-3
2	3-6
3	6-9
4	More than 9

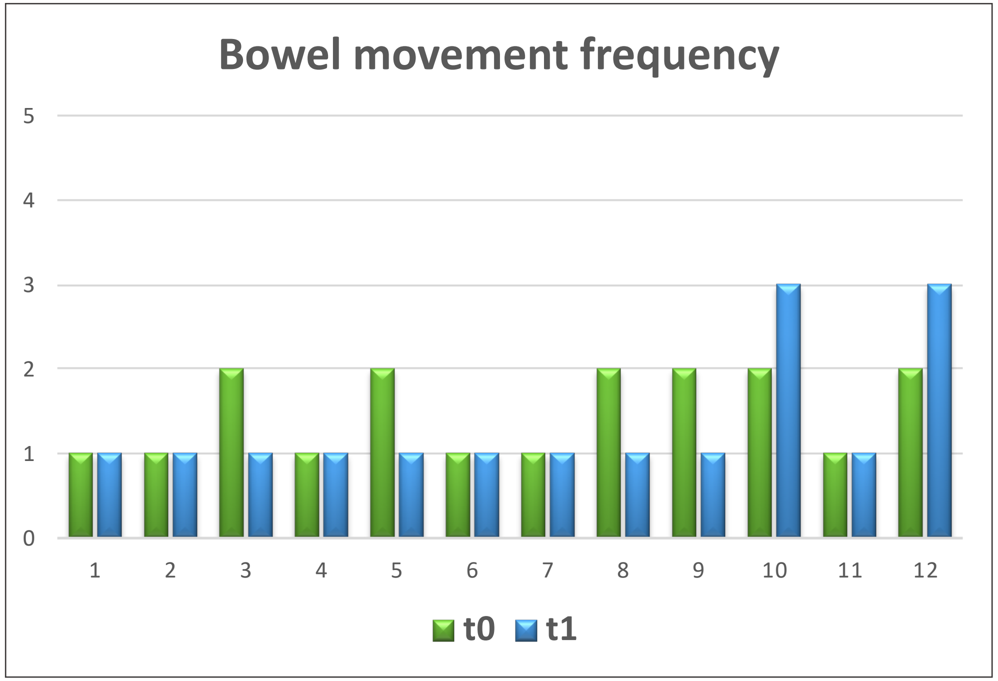
History: duration of constipation (yr)

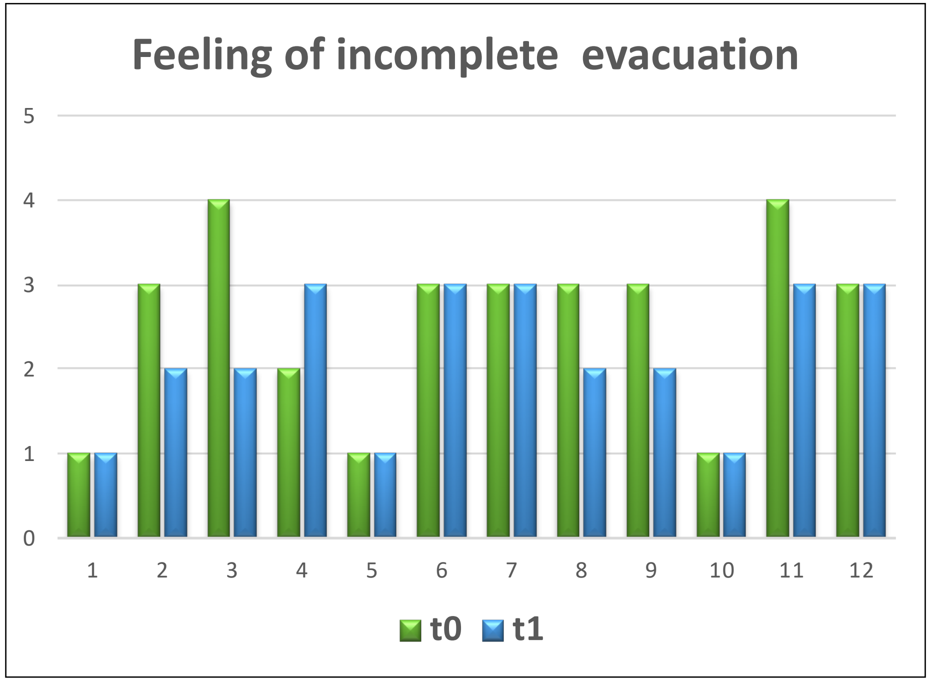
1	0
2	1-5
3	5-10
4	10-20
5	More than 20

TOTAL SCORE: ________________

(Minimum Score, 0; Maximum Score, 30)

CONSTIPATION TEST





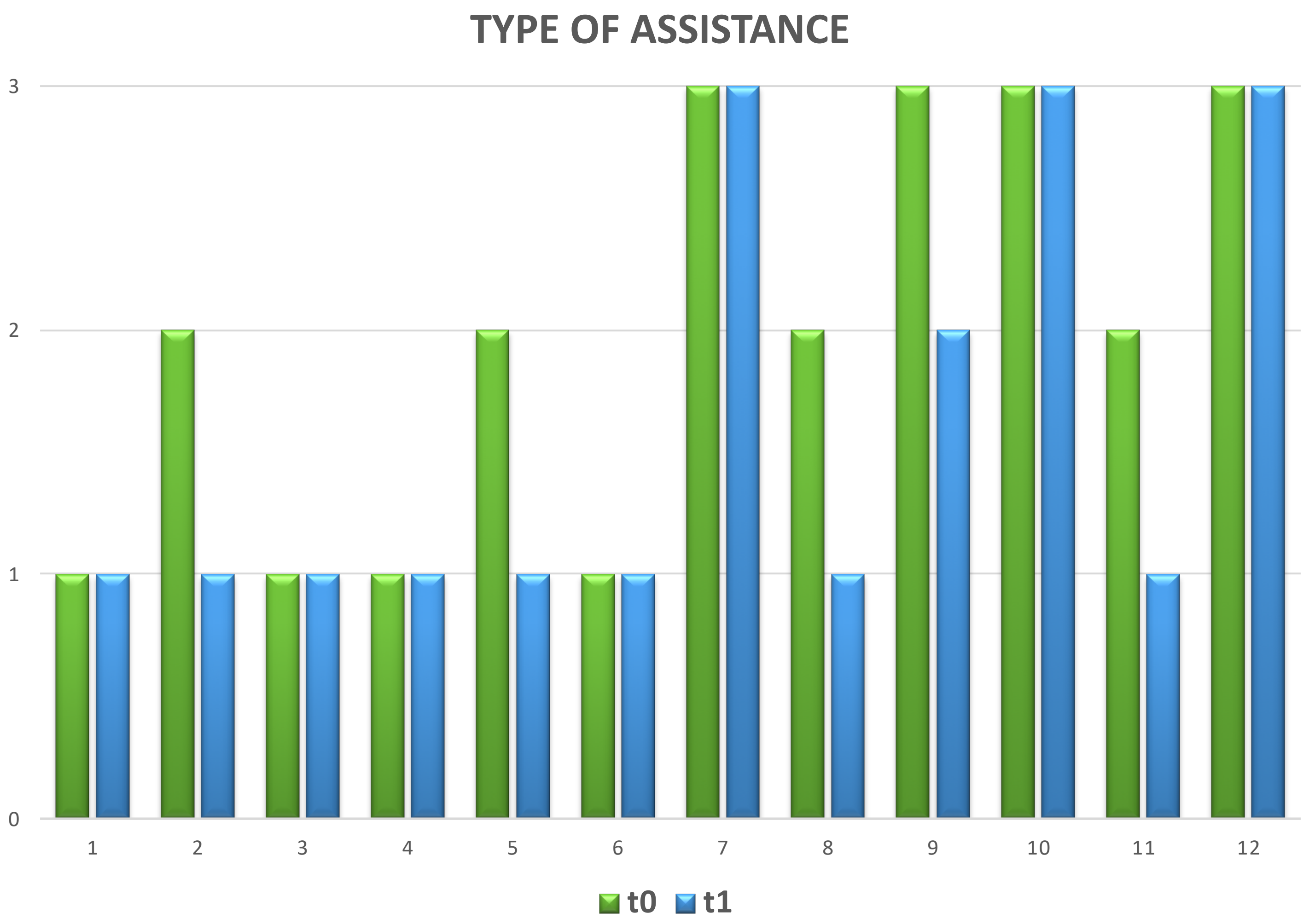
Frequency of bowel movement

1 1-2 times per 1-2 days
2 2 times per week
3 Once per week
4 Less than one per week
5 Less tham once per month

Completeness: feeling incomplete evacuation

1 Never
2 Rarely
3 Sometimes
4 Usually
5 Always

CONSTIPATION TEST



Assistance: type of assistance

0	Without assistance
1	Stimulative laxatives
2	Digital assistance or enema

DISCUSSION 1

- Diarrhea and constipation, representing the two extremes of bowel function, continue to be the most common problems associated with enteral tube feeding.

- Constipation can lead to modify quality of life, and need for nursing and pharmaceutical interventions, Although in both cases the causes are multiple and often poorly understood, the absence of fibres in enteral feeds has been implicated as a cause for these impairments in bowel function.

  Fibre in enteral formulae is well tolerated and has clinical benefits in patients, most pronounced in diarrhoea but with trends in constipation, and in terms of acute and chronic healthcare settings.

- Demonstrates significant clinical benefits of fibre supplemented enteral feeds in patients suffering with constipation. The findings were relevant in a prevalent chronic healthcare settings and across all age ranges;

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DISCUSSION 2

- Although constipation is a common problem in long-term care, but there are insufficient data to properly evaluate the effect of fibre supplementation.

- Examination of the associated underlying mechanisms for constipation, potentially requiring clinical, biochemical and bacteriological investigations

- Focus of research in shifting toward strategies that augment the intestinal environment to facilitate growth of beneficial microorganisms, strengthen colonization resistance and maintain immune homeostasis.

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