Economic or Cost-effectiveness analysis

An pharmaco-economic analysis is a set of formal quantitative methods used to compare alternative strategies with respect to their resources used and their expected outcomes.

Cost–Benefit Analysis (CBA)

'A CBA is an economic evaluation in which all costs and consequences of a program are expressed in the same units, usually money. CBA is used to determine allocative efficiency; i.e., comparison of costs and benefits across programs serving different patient groups. Even if some items of resource or benefit cannot be measured in the common unit of account; i.e., money, they should not be excluded from the analysis' (15). Herman (1) identifies the challenge of CBA in that its analysis requires putting a monetary value on all health outcomes and ultimately on life. There is inherent difficulty with this type of analysis and as a result very few true CBAs have yet been performed (15).

Cost-Effectiveness Analysis (CEA)

'A CEA is an economic evaluation in which the costs and consequences of alternative interventions are expressed as costs per unit of health outcome. CEA is used to determine technical efficiency; i.e., comparison of costs and consequences of competing interventions for a given patient group within a given budget' (15). The result will be a comparison of cost per unit of improvement between examined treatments (15). Comparison of multiple outcomes is not possible with this type of analysis (1); however, the analysis does help answer urgent questions, such as how much it would cost to reduce hip fractures in osteoporotic women (1).

ELSEVIER

Nutrition 21 (2005) 1078–1086

NUTRITION

www.elsevier.com/locate/nut

Applied nutritional investigation

Hospital resources consumed for surgical morbidity: effects of preoperative arginine and ω-3 fatty acid supplementation on costs

Marco Braga, M.D.[a], Luca Gianotti, M.D., Sc.D.[b,*], Andrea Vignali, M.D.[a], Alexandra Schmid, Ph.D.[c], Luca Nespoli, M.D.[b], and Valerio Di Carlo, M.D.[a]

[a] *Department of Surgery, Vita-Salute San Raffaele University, Milan, Italy*
[b] *Department of Surgical Sciences and Intensive Care, Milano-Bicocca University, Monza, Italy*
[c] *HealthEcon AG, Basel, Switzerland*

GASTROENTEROLOGY 2002;122:1763–1770

A Randomized Controlled Trial of Preoperative Oral Supplementation With a Specialized Diet in Patients With Gastrointestinal Cancer

LUCA GIANOTTI,* MARCO BRAGA,* LUCA NESPOLI,* GIOVANNI RADAELLI,† ALDO BENEDUCE,* and VALERIO DI CARLO*

*Department of Surgery, San Raffaele University, Milan; and †Department of Informative Systems, University of Milan, Milan, Italy

Materials and Methods

ANALYSIS:

- Costs of treating complications
- Costs of clinical nutrition.
- Effectiveness* of nutrition on outcome.
- Based on the above data, cost-comparison and cost-effectiveness analysis were carried-out.

*Definition: Effectiveness is defined as the percent of complication-free patients. Thus, this parameter reflects the ability of a treatment X to prevent the occurrence of complications.

Cost-effectiveness is more favorable as more the complication rate in the control group is high and the relative difference between treated and control group is great.

Materials and Methods

- Costs of treating complications: direct medical costs during hospital stay and ambulatory follow-up.

- Indirect costs (e.g. loss of productivity) were not calculated.

Materials and Methods

Complication-related parameters:

- Diagnostic and therapeutic measures during inpatient stay (e.g. lab analysis, microbiological samples, X-ray, ultrasound, CT scan, relaparotomy, abscess drainage, etc..)
- Number of days in the ICU.
- Daily dose and duration in days of any pharmaceutical treatment.
- Prolonged LOS (to estimate the costs of board, lodging, and routine medical and nursing care)
- Ambulatory treatment after discharge.

Materials and Methods

- Diagnostic, therapeutic measures and devices to treat complications: derived from medical records of each patients who developed complications. Costs valued on the National List of Sanitary Costs by the Italian Ministry of Health and medical Diagnosis-Related-Group reimbursement rate.

- ICU stay: valued at a flat rate per day which covers average daily ICU-costs.

- Prolonged LOS: valued by comparing the average LOS of patients without complications undergoing the same type of surgery. At a daily rate which covers the cost of board, lodging, routine medical and nursing care.

Table 1. Preoperative Characteristics

	Conventional (n = 102)	Preoperative (n = 102)	Perioperative (n = 101)
Age (*yr*)	63.4 ± 11.9	62.3 ± 12.3	65.6 ± 11.5
M/F	56:46	50:52	60:41
Body weight (*kg*)	68.1 ± 11.7	69.4 ± 10.1	69.0 ± 13.3
BMI (kg/m^2)	23.8 ± 4.1	24.5 ± 4.9	24.2 ± 4.5
18–25	65	68	62
25.1–30	25	23	26
>30	12	11	13
Weight loss (%)	2.3 ± 2.7	2.4 ± 2.6	2.5 ± 2.7
Karnofsky score (%)	86 ± 11	84 ± 12	88 ± 10
Hemoglobin (*g/L*)	126 ± 13	123 ± 15	121 ± 12
Total proteins (*g/L*)	68 ± 6.1	68 ± 6.0	67 ± 7.1
Albumin (*g/L*)	40.3 ± 6.5	40.2 ± 5.6	39.9 ± 5.6
Prealbumin (*g/L*)	0.24 ± 0.07	0.26 ± 0.08	0.25 ± 0.06
Arginine ($\mu mol/L$)	65.7 ± 9.1	66.8 ± 11.3	64.2 ± 12.0
Lymphocytes ($\times 10^9/mL$)	1.68 ± 0.49	1.73 ± 0.65	1.62 ± 0.53

Table 3. Outcome Variables

	Conventional (n = 102)	Preoperative (n = 102)	Perioperative (n = 101)
Death	1	1	2
Patients with infectious complications	31	14[a]	16[b]
Patients with noninfectious complications	36	30	28
Patients with any complication	49	36	34
Length of hospital stay (*days*)	14.0 ± 7.7	11.6 ± 4.7[c]	12.2 ± 4.1[d]

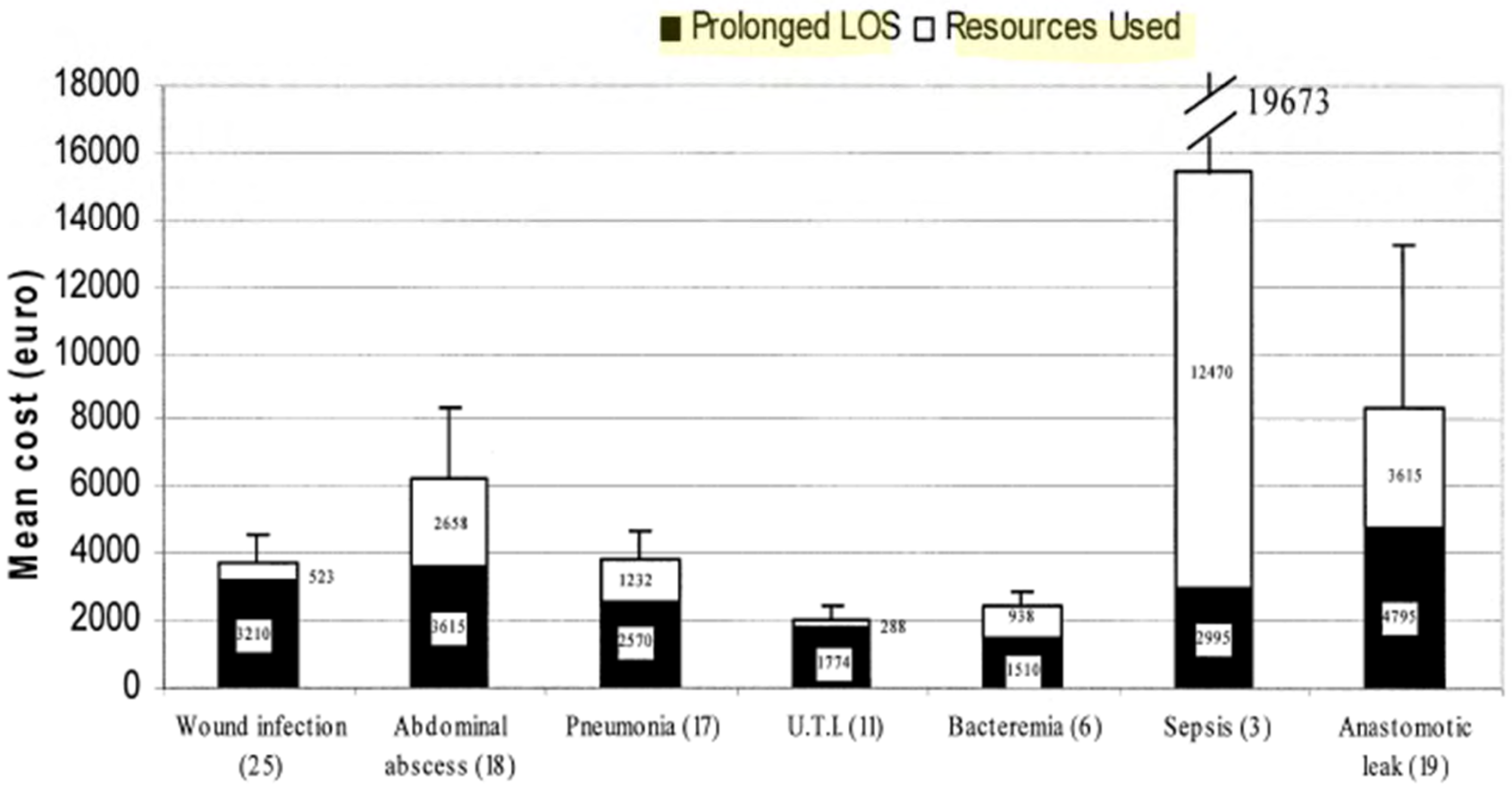
NOTE. Values are means ± SD or number of patients.

[a] $P = 0.006$ vs. conventional.

[b] $P = 0.02$ vs. conventional.

[c] $P = 0.008$ vs. conventional.

[d] $P = 0.03$ vs. conventional.


Prolonged LOS
Resources Used
Mean cost (euro)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
19673
12470
3615
2658
1232
938
523
288
3210
3615
2570
1774
1510
2995
4795
Wound infection (25)
Abdominal abscess (18)
Pneumonia (17)
U.T.I. (11)
Bacteremia (6)
Sepsis (3)
Anastomotic leak (19)

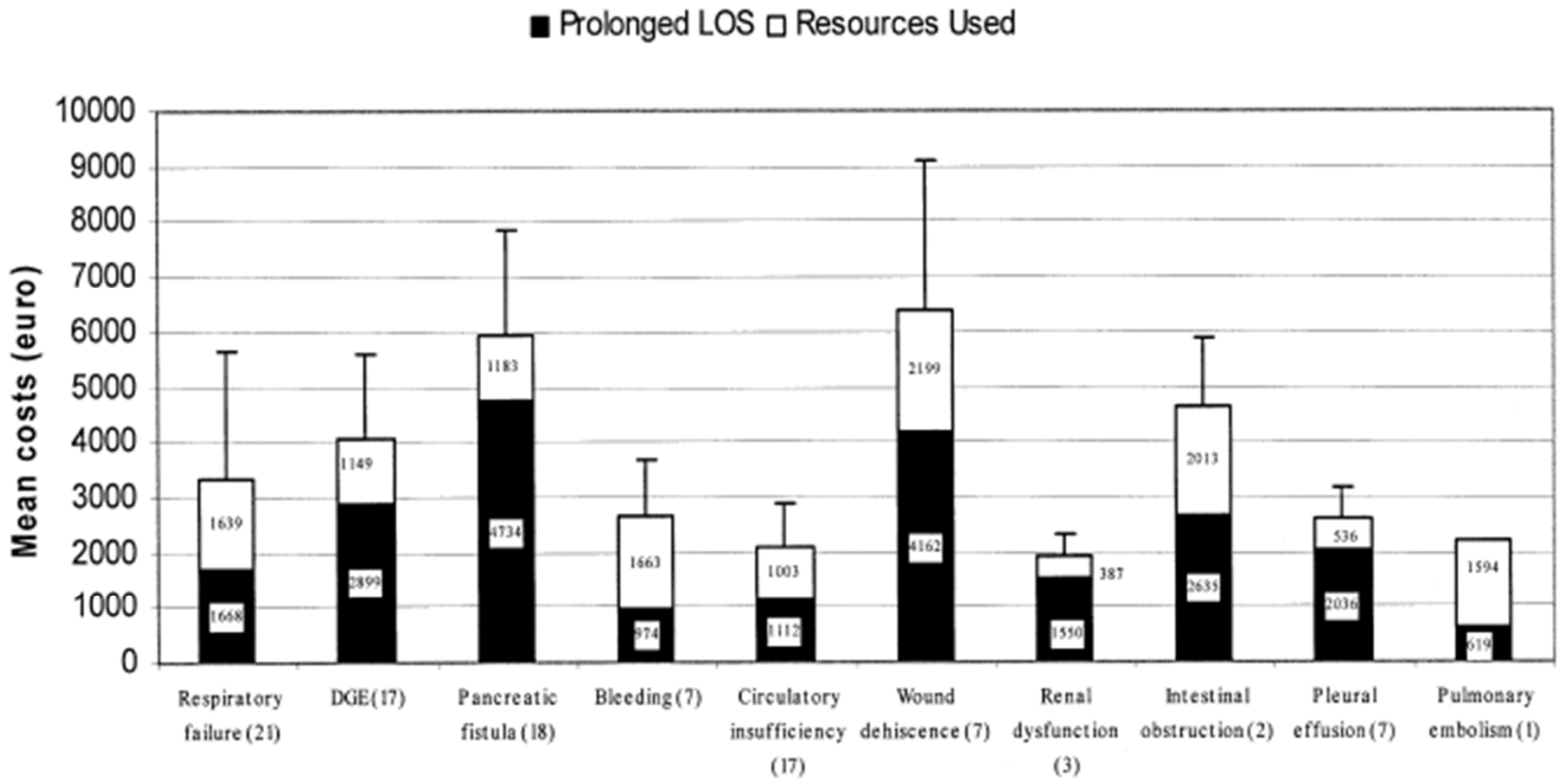


Fig. 2. Mean cost of non-infectious complications split in resources used and additional LOS. Data are reported as mean ± standard deviation. DGE, delayed gastric emptying; LOS, length of hospital stay.

Table 3
Mean costs of patients without complications*

Mean costs/patient	Conventional (n = 102)	Preoperative (n = 102)	Between-arm difference
Gastro-esophageal resection	3909 (33)	3639 (37)	+270
Pancreatic resection	5816 (3)	5334 (10)	+482
Colorectal resection	2552 (15)	2425 (17)	+127
Mean costs	3622 (51)	3581 (64)	+41

* Numbers of patients without complications are presented within parentheses.

Table 4
Mean costs of patients with complications

	Conventional	Preoperative	Between-arm difference
Mean costs of complication/patient*	6178 (1951–3 977)	4639 (1631–10 082)‡	+1539 (320–3895)
Resources used	2921 (477–6710)	1858 (411–3683)‡	+1063 (66–2847)
Additional LOS	3257 (1085–6197)	2781 (930–5671)	+476 (155–526)
Mean costs of routine care†	4316 (51)	4181 (38)	+135
Mean costs of patients with complications†	10 494 (51)	8793 (38)	+1701

LOS, length of hospital stay

* Values are reported as mean (95% confidential intervals).

† Numbers of patients with complications appear within parentheses.

‡ $P = 0.05$ versus conventional.

Table 5
Mean cost of infectious and non-infectious complications

Type of complication*	Resources used†	Additional LOS†	Total
Infectious			
Conventional (41)	2710 (930–6197)	2809 (474–6881)	5518 (1943–13 196)
Preoperative (19)	991 (254–2314)‡	2900 (1751–4028)	3891 (2087–6343)‡
Between-arm difference	+1719 (676–3883)	−91 (−1277 to 2853)	+1627 (144–6853)
Non-infectious			
Conventional (34)	1078 (188–2932)	2329 (930–5144)	3407 (1612–7261)
Preoperative (32)	1331 (448–3156)	2520 (930–5438)	3851 (1500–7445)
Between-arm difference	−253 (−260 to −222)	−191 (0 to −294)	−444 (−760 to −221)

LOS, length of hospital stay
* Numbers of complications appear within parentheses.
† Values are reported as mean (95% confidential intervals).
‡ $P < 0.001$ versus conventional.

Table 6
Total costs and DRG reimbursement rates

	Conventional*	Preoperative*	Between-arm difference
Patients without complications	184 725 (51)	229 208 (64)	−44 483
Patients with complications	535 236 (51)	334 148 (38)	+201 088
Nutrition	3407 (102)	14 729 (102)	−11 322
Total costs	723 368 (102)	578 085 (102)	+145 283
Mean total costs	7092	5668	+1424
DRG reimbursement	781 392 (102)	740 301 (102)	+41 091
Mean DRG reimbursement	7660	7257	+403
Mean gain in DRG	569	1590	−1021

DRG, diagnosis-related group

* Numbers of patients studied appear within parentheses.

Table 7
Cost comparison and cost-effectiveness analyses

	Conventional	Preoperative	Between-arm difference
Complication cost/ randomized patient	3089	1728	+1361
Nutritional cost/patient	33	144	−111
Total cost/randomized patient	3122	1872*	+1250
Effectiveness†	50.0	62.8	−12.8

* $P = 0.04$ versus conventional.

† Percentage of complication-free patients.

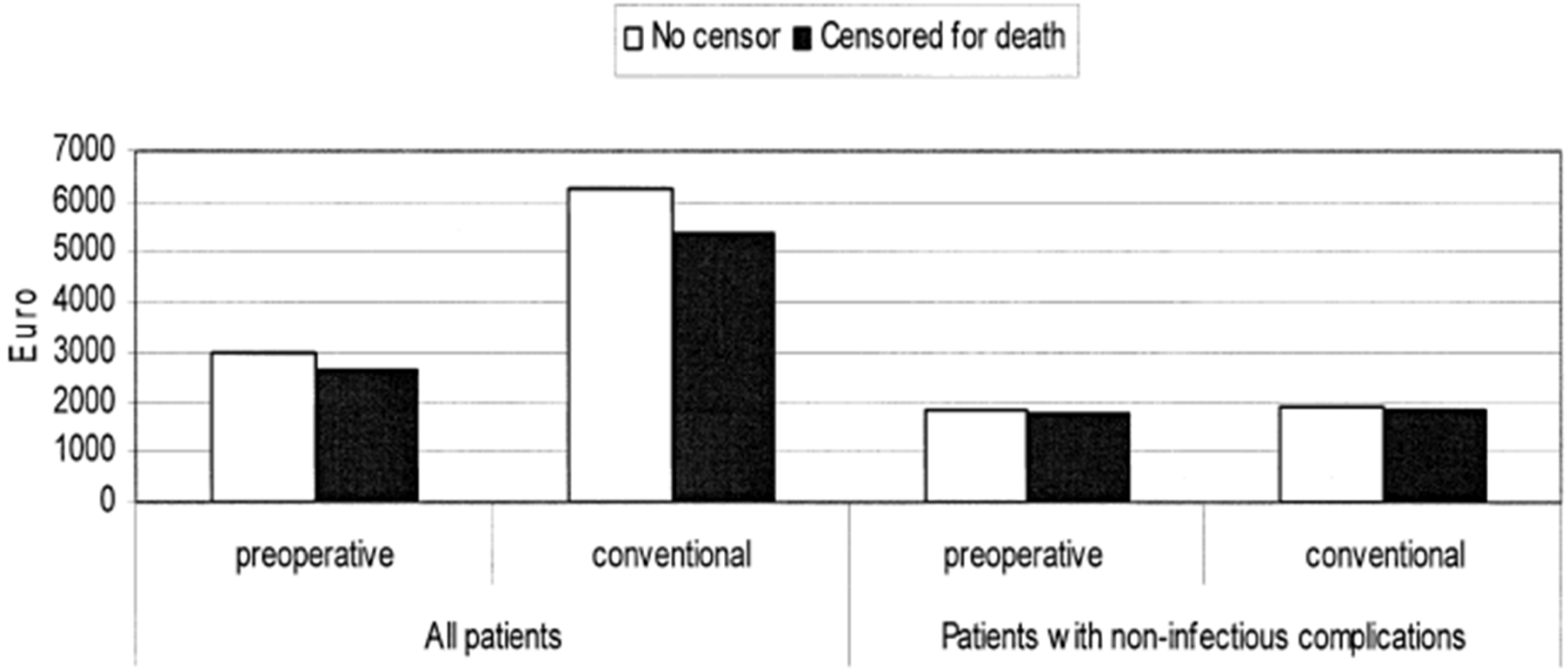


Fig. 3. Cost effectiveness with and without censoring for death.

SHOCK, Vol. 14, No. 3, pp. 325–330, 2000

HEALTH CARE RESOURCES CONSUMED TO TREAT POSTOPERATIVE INFECTIONS: COST SAVING BY PERIOPERATIVE IMMUNONUTRITION

Luca Gianotti,* Marco Braga,* Andreas Frei,† Roger Greiner,† and Valerio Di Carlo*

**Department of Surgery, Scientific Institute San Raffaele Hospital, Milan, Italy; and †HealthEcon AG, Basel, Switzerland*

ORIGINAL ARTICLE

Perioperative Immunonutrition in Patients Undergoing Cancer Surgery

Results of a Randomized Double-blind Phase 3 Trial

Marco Braga, MD; Luca Gianotti, MD, ScD; Giovanni Radaelli, PhD; Andrea Vignali, MD; Gilberto Mari, MD; Oreste Gentilini, MD; Valerio Di Carlo, MD

Arch Surg. 1999;134:428-433

TABLE 1. **Patient characteristics**

	Treatment group (n = 102)	Control group (n = 104)
Age (years)	60.8 (11.5)	61.1 (9.5)
Sex (F:M)	39:63	42:62
Karnofsky index	74 (14)	76 (15)
Weight loss (%)	5.6 (4.2)	5.2 (4.1)
Albumin (g/L)	39 (11)	38 (10)
Cancer site		
Stomach	32	31
Colon-rectum	53	55
Pancreas	17	18
Duration of surgery (min)	226 (51)	204 (68)

Table 3. Distribution of Postoperative Infections

	Intent-to-Treat Patients		Eligible Patients	
	Supplemented Group (n = 102)	**Control Group (n = 104)**	**Supplemented Group (n = 85)**	**Control Group (n = 86)**
Wound infection	4	6	3	6
Pneumonia	4	10	4	9
Urinary tract infection	3	3	2	3
Sepsis	2	5	0	2
Intra-abdominal abscess	2	4	0	2
Peritonitis	3	6	0	0
Overall infections	**18**	**34**	**9**	**22**
With any complications	14 (14%)	31 (30%)*	9 (11%)	21 (24%)†

*P = *.009* (χ^2 = *6.908) control group vs supplemented group (intent to treat).*
†P = *.02* (χ^2 = *4.801) control group vs supplemented group (eligible).*

TABLE 2. **Costs of nutrition in euros**

	Intent-to-treat analysis		Core analysis	
	Treatment group	Control group	Treatment group	Control group
Preoperative treatment (pts)	102	104	90	96
Postoperative treatment (pts)	102	104	90	96
Mean diet intake				
Preoperative (liters)	6.3	6.5	7	7
Postoperative (liters)	6.6	6.9	7.5	7.5
Preoperative costs	15,915	6,321	15,618	6,247
Postoperative costs	19,522	4,447	19,575	4,834
Total costs	35,437	10,768	35,193	11,081
Costs per patient	347	103	391	115

Pts: patients

TABLE 3. **Number and mean costs (euros) per complication**

Intent-to-treat analysis

	Treatment group (n = 102)		Control group (n = 104)	
	N°	Costs	N°	Costs
Anastomotic leak	5	6,055 (2,911)	10	15,770 (12,883)
Pneumonia	4	1,428 (1,713)	10	4,555 (6,428)
Wound infection	4	1,755 (1,936)	6	2,886 (1,218)
UTI	2	1,682 (1,101)	3	1,759 (1,030)
Sepsis	1	5,286	2	1,576 (275)
Abscess	1	6,498	2	3,756 (1,821)
Peritonitis	1	20,196	1	7,386
Mean cost per complication	18*	4,352 (4,828)**	34	7,173 (9,487)
Total costs		78,336		243,882

UTI: Urinary tract infection.
In parenthesis: standard deviation.
*P = 0.009 vs. control.
**P = 0.12 vs. control.

Core Analysis

	Treatment group (n = 90)		Control group (n = 96)	
	N°	Costs	N°	Costs
Anastomotic leak	5	6,055 (2,911)	10	15,770 (12,883)
Pneumonia	4	1,428 (1,713)	9	4,468 (6,811)
Wound infection	3	833 (722)	6	2,886 (1,218)
UTI	2	1,682 (1,101)	3	1,759 (1,030)
Sepsis	0		2	1,576 (275)
Abscess	0		2	3,756 (1,821)
Mean cost per complication	14^	2,989 (2,958)^^	32	7,224 (9,783)
Total costs		41,846		231,168

^P = 0.006 vs. control.
^^P = 0.050 vs. control.

TABLE 4. **Cost comparison and cost effectiveness analyses (cost are in euros)**

Intent-to-treat analysis

	Treatment group (n = 102)	Control group (n = 104)
Nutrition costs/patient	347	103
Complication costs/patient	768 (2,589)	2,345 (6,346)
Total costs/patient	1,115*	2,447
Total costs	113,778	254,450
Effectiveness (%)	83.3	68.3
Cost-effectiveness	1,339	3,725

In parenthesis: standard deviation.
*$P = 0.038$ vs. control.

Core analysis

	Treatment group (n = 90)	Control group (n = 96)
Nutrition costs/patient	391	115
Complication costs/patient	465 (1,570)	2,408 (6,554)
Total costs/patient	856^	2,523
Total costs	76,988	242,248
Effectiveness (%)	84.4	67.7
Cost-effectiveness	1,013	3,727

^$P = 0.027$ vs. control.

Analysis without anastomotic leak

	Treatment group (n = 97)	Control group (n = 94)
Nutrition costs/patient	362	112
Complication costs/patient	471 (2,431)	829 (2,569)
Total costs/patient	833	941
Total costs	80,801	88,454
Effectiveness (%)	88.2	77.9
Cost-effectiveness	916	1,135

Review

Cost Effectiveness of Natural Health Products: A Systematic Review of Randomized Clinical Trials

Deborah A. Kennedy[1], Jason Hart[1] and Dugald Seely[1,2]

[1]Department of Research and Clinical Epidemiology, The Canadian College of Naturopathic Medicine and [2]Institute of Medical Science, University of Toronto

The pooled searches unveiled nine articles that fit the inclusion/exclusion criteria. The conditions assessed by the studies included three on postoperative complications, two on cardiovascular disease, two on gastrointestinal disorders, one on critically ill patients and one on urinary tract infections. Heterogeneity between the studies was too great to allow for meta-analysis of the results. The use of NHPs shows evidence of cost effectiveness in relation to postoperative surgery but not with respect to the other conditions assessed. In conclusion, NHPs may be of use in preventing complications associated with surgery. The cost effectiveness of some NHPs is encouraging in certain areas but needs confirmation from further research.

Conclusions

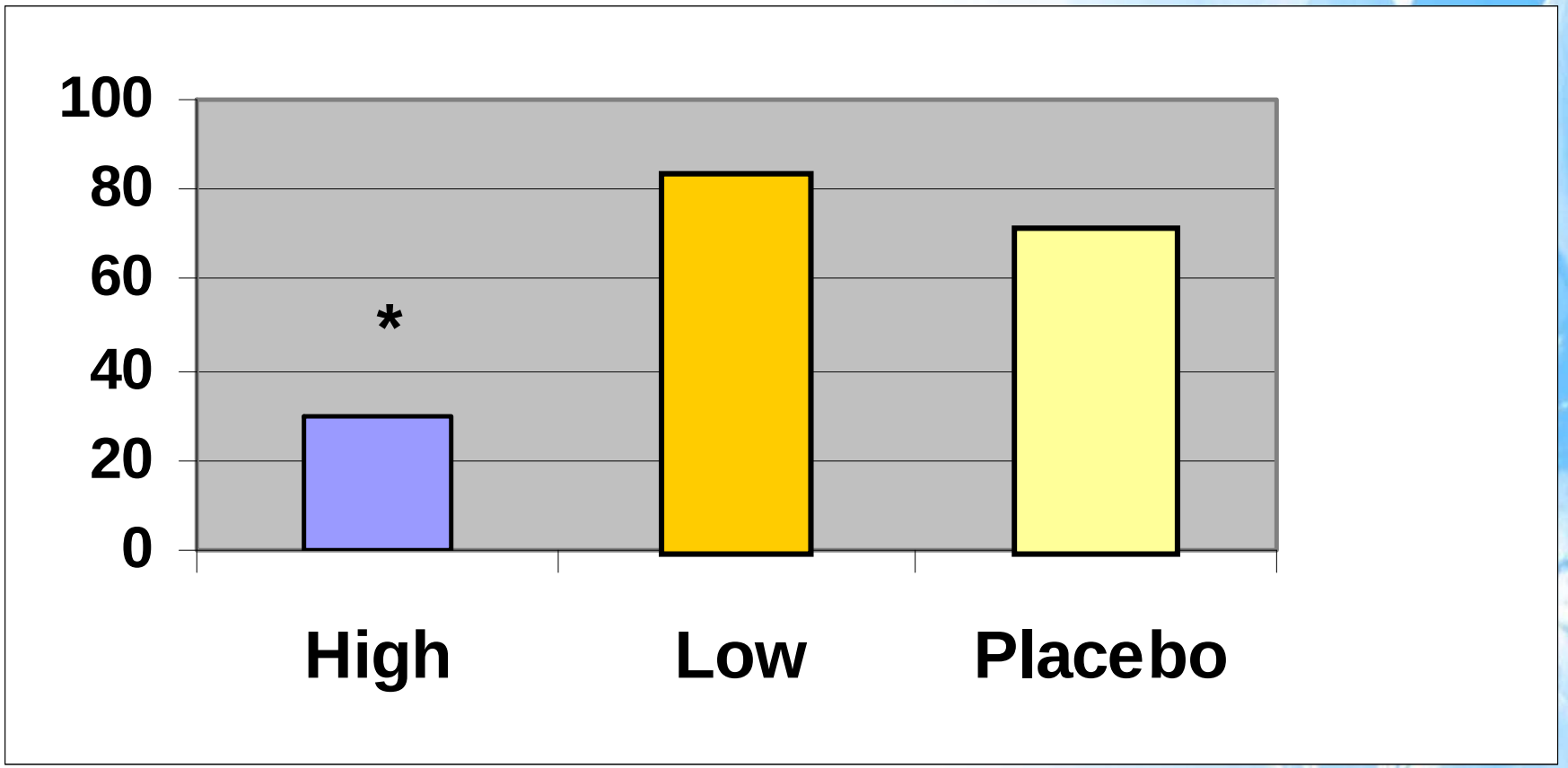
The results of the present economic analysis support that preoperative administration of the specialized diet could be the dominant nutritional strategy in well-nourished patients who are candidates for major GI surgery for cancer. Preoperative treatment resulted in a positive cost-effectiveness ratio with a net saving of €3260 per treated patient compared with conventional treatment. Moreover, the mean cost of treating a complication was significantly lower in the preoperative group, and this trend was also observed when the complication costs were split by the type of surgery performed.

Looking in detail, this overall net saving in cost effectiveness is largely due to the differences observed for infectious complications, whereas no effect was observed for non-infectious complications or anastomotic leaks. This reflects the decrease in postoperative infection rate in the treatment group as consistently reported by others [6,7,10,11], whereas no significant decrease was found in non-infectious complications. The lower costs of complica-

Limitations

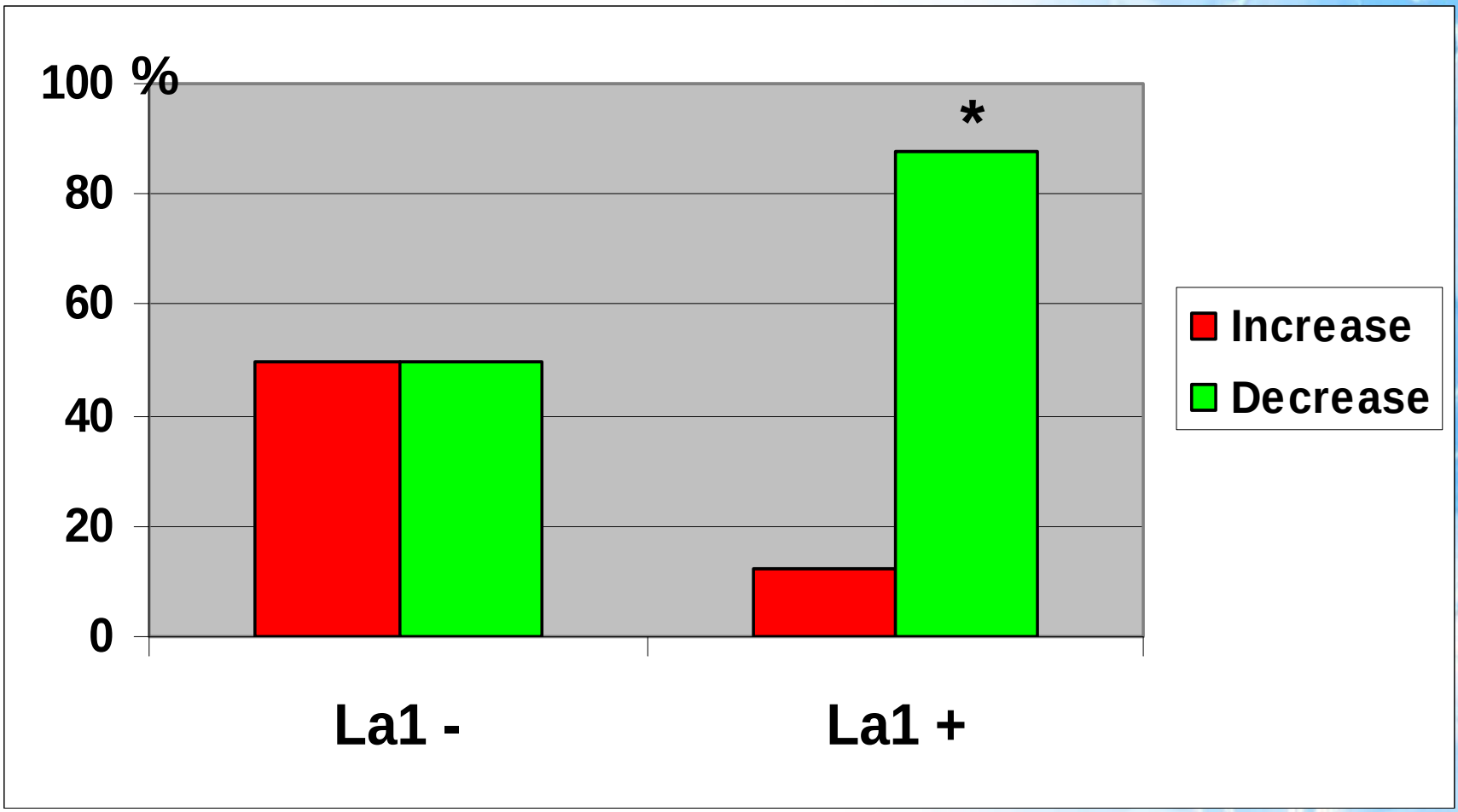
Some general limitations of economic analyses should be noted on the transferability of the present clinical and economic data, which may also influence their reproducibility. Comparable cost saving by the routine preoperative use of the specialized diet might be achieved in hospitals where the same types of operations are performed on a similar scale and complication rate. The economic parameters that we used for the present analysis may differ from country to country based on the type of health care system and reimbursement rates. The present analysis is based only on calculation of hospital resources spent. The assessment of community-associated costs, including sick leave, rehabilitation, and full recovery of physical and social performance would probably magnify our findings even more.

Rate of mucosa samples colonized by enterobacteriacae at D0

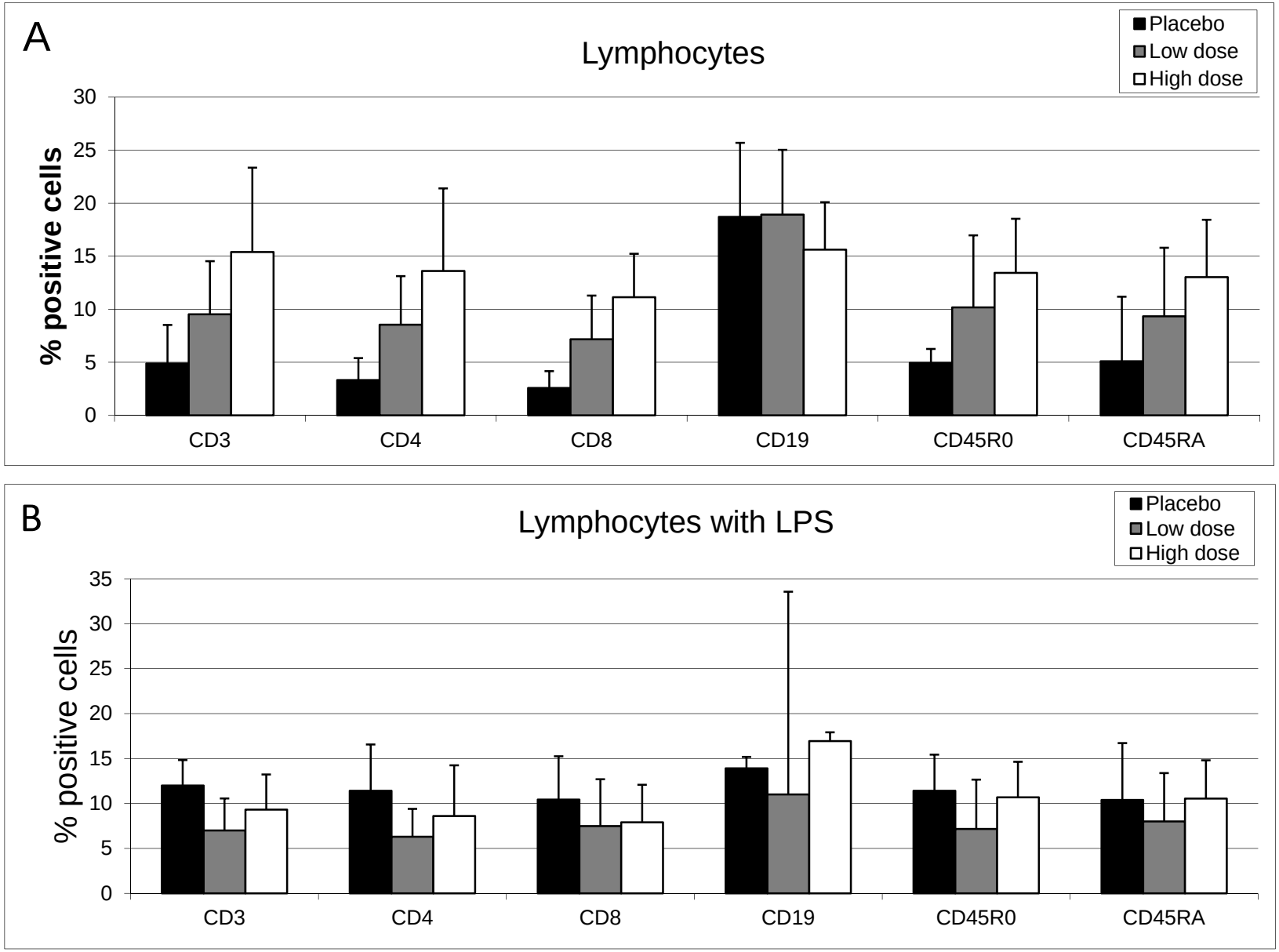


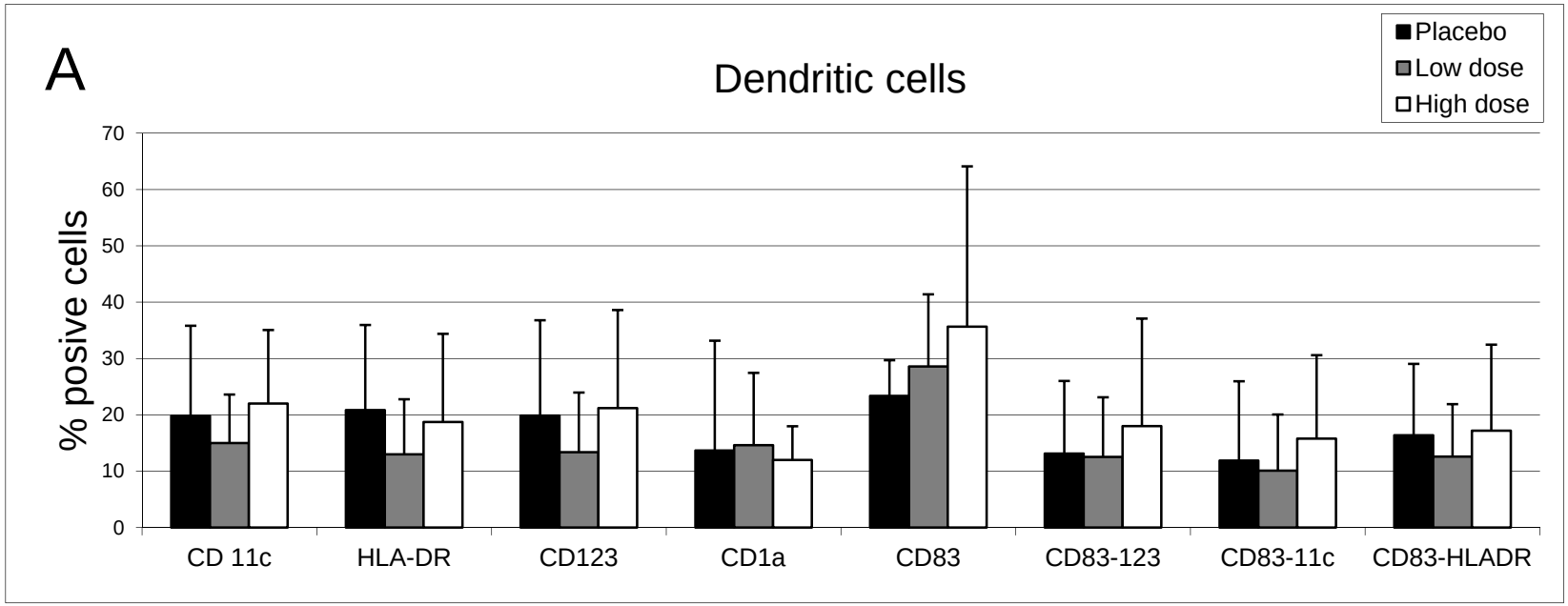
P = 0.03 vs. Low and placebo

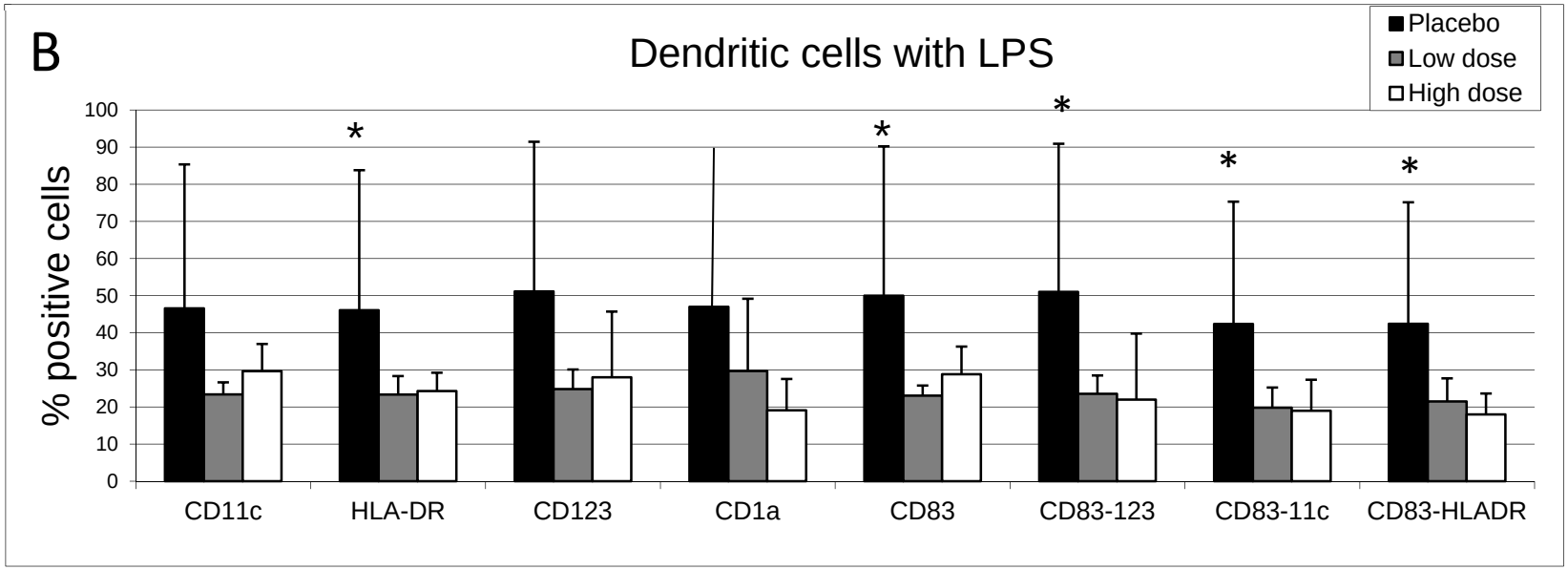
Variation of enterococci (1 log) between D - 4 and D 0



P = 0.02 vs. increase


A
Lymphocytes
Placebo
Low dose
High dose
% positive cells
30
25
20
15
10
5
0
CD3
CD4
CD8
CD19
CD45R0
CD45RA
B
Lymphocytes with LPS
Placebo
Low dose
High dose
% positive cells
35
30
25
20
15
10
5
0
CD3
CD4
CD8
CD19
CD45R0
CD45RA


A
Dendritic cells
Placebo
Low dose
High dose
% posive cells
70
60
50
40
30
20
10
0
CD 11c
HLA-DR
CD123
CD1a
CD83
CD83-123
CD83-11c
CD83-HLADR


B
Dendritic cells with LPS
Placebo
Low dose
High dose
% positive cells
100
90
80
70
60
50
40
30
20
10
0
*
*
*
*
*
CD11c
HLA-DR
CD123
CD1a
CD83
CD83-123
CD83-11c
CD83-HLADR

Original Communication

A Meta-Analysis of Probiotic and Synbiotic Use in Elective Surgery: Does Nutrition Modulation of the Gut Microbiome Improve Clinical Outcome?

James Macalister Kinross, PhD[1]; Sheraz Markar, MRCS[2]; Alan Karthikesalingam, MRCS[3]; Andre Chow, MRCS[1]; Nicholas Penney, MRCS[4]; David Silk, MD[1]; and Ara Darzi, KBE HonFrEng FmedSci[1]

Journal of Parenteral and Enteral Nutrition
Volume XX Number X
Month 2012 1-11

DOI: 10.1177/0148607112452306
http://jpen.sagepub.com
hosted at
http://online.sagepub.com

Nutrients **2012**, *4*, 91-111; doi:10.3390/nu4020091

OPEN ACCESS
nutrients
ISSN 2072-6643
www.mdpi.com/journal/nutrients

Review

Pro- and Synbiotics to Prevent Sepsis in Major Surgery and Severe Emergencies

Stig Bengmark [1,2]

Eur J Clin Pharmacol (2009) 65:561–570
DOI 10.1007/s00228-009-0642-7

PHARMACODYNAMICS

Does the use of probiotics/synbiotics prevent postoperative infections in patients undergoing abdominal surgery? A meta-analysis of randomized controlled trials

Eleni Pitsouni · Vangelis Alexiou · Vasilis Saridakis · George Peppas · Matthew E. Falagas

Nutrients **2011**, *3*, 604-612; doi:10.3390/nu3050604

OPEN ACCESS
nutrients
ISSN 2072-6643
www.mdpi.com/journal/nutrients

Review

Use of Probiotics as Prophylaxis for Postoperative Infections

Bengt Jeppsson *, Peter Mangell and Henrik Thorlacius

Department of Surgery, Lund University and Skane University Hospital, Malmo, SE 205 02, Sweden; E-Mails: peter.mangell@med.lu.se (P.M.); henrik.thorlacius@med.lu.se (H.T.)

Review Article

Digestive Surgery

Dig Surg 2012;29:426–438
DOI: 10.1159/000345580

Received: July 2, 2012
Accepted after revision: October 22, 2012
Published online: December 14, 2012

Probiotics, Prebiotics, Synbiotics: Is There Enough Evidence to Support Their Use in Colorectal Cancer Surgery?

Kiriaki Peitsidou Theodoros Karantanos George E. Theodoropoulos

Colorectal Unit, 1st Department of Propaedeutic Surgery, Athens Medical School, Athens, Greece

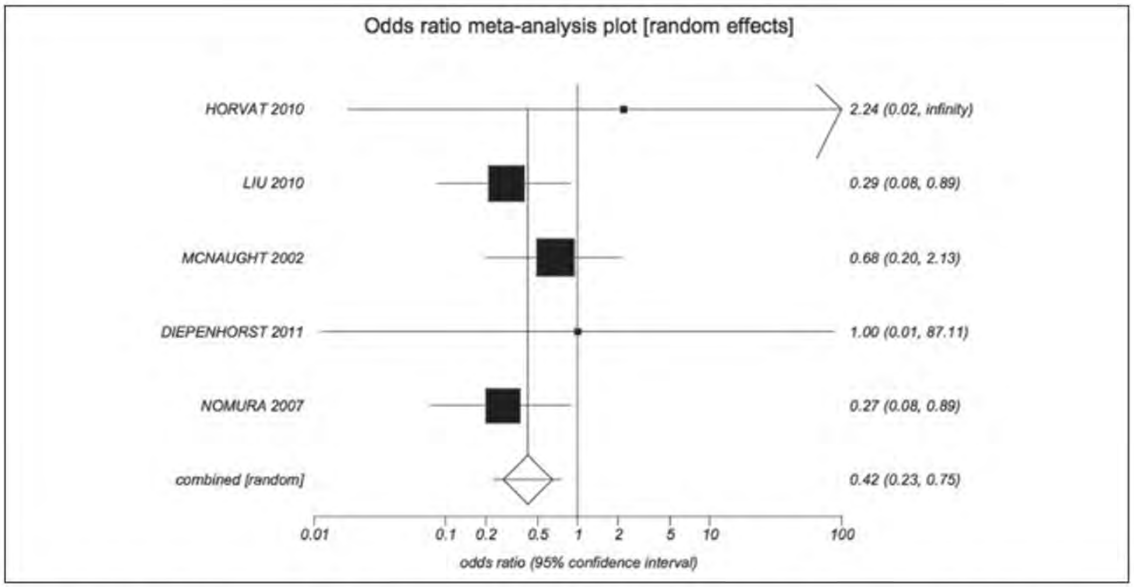


Figure 2. Forest plot of data reported by 5 randomized controlled trials (RCTs) of perioperative probiotic therapies for the reduction of sepsis after elective surgery (pooled odds ratio = 0.42; 95% confidence interval, 0.23–0.75; $P = .003$).

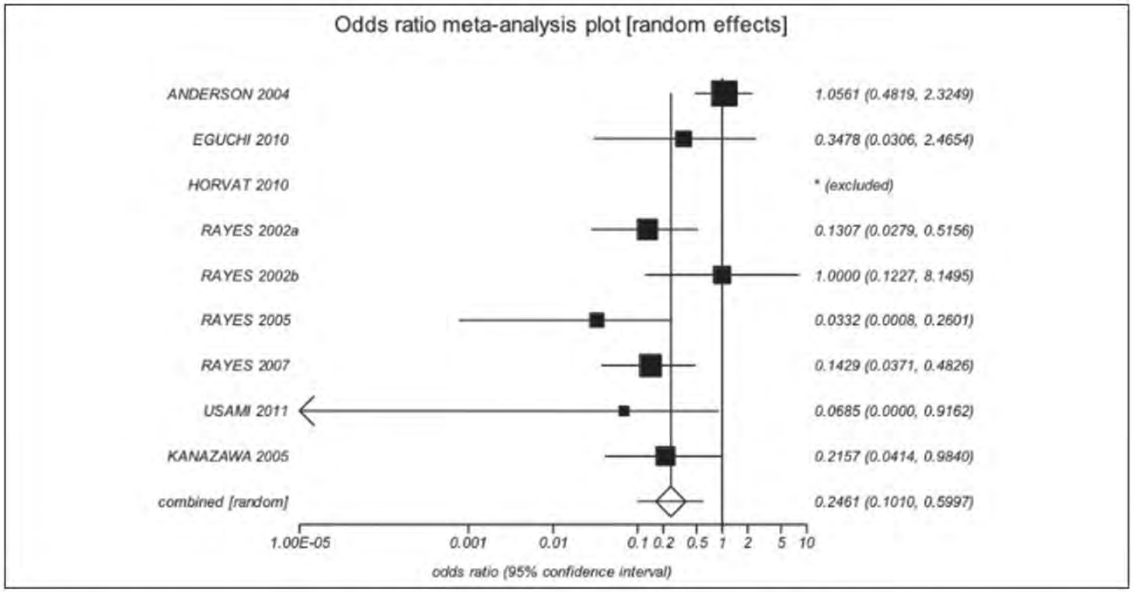


Figure 3. Forest plot of data reported by 8 randomized controlled trials (RCTs) of synbiotic therapies for the reduction of sepsis after elective surgery (pooled odds ratio = 0.25; 95% confidence interval, 0.1–0.6; $P = .002$).

Table 1. Overview of Study Designs

Author	Trial	Groups	Surgery	Outcomes	n	Probiotic	Prebiotic	Route	Pre operative Dose, d	Post operative Dose, d	Bowel Prep
Rayes et al (2002)[45]	PRCT	2, 3, 4	A, B	In, Ab, SI	95	LP	OAF	NJ	0	5	Not stated
Rayes et al (2002)[46]	PRCT	2, 3, 5	B	In, Ab, LOS, ICU	90	LP	OAF	NJ	0	12	Not stated
McNaught et al (2002)[42]	PRCT	1, 4	A	BT, GC, SI, In	129	LP	—	PO	7–12	0	Not stated
Anderson et al (2004)[39]	RDBT	3, 4	A, E	BT, GC, SI, In	137	LA, LB, BL, ST	OF	PO	7–14	Until discharge	Not stated
Rayes et al (2005)[43]	RDBT	2, 3	B	In, Ab, LOS, SI	66	PP, LM, LPA, LP2	BG, I, P, RS	NJ	0	8	Not stated
Kanazawa et al (2005)[40]	PRCT	3, 4	C	In, SI, LOS, ICU, LM, FC, FA	54	LC, BB	GO	Jejunostomy	0	1–14	Not stated
Rayes et al (2007)[44]	RDBT	2, 3	D	In, Ab, LOS, ICU	80	PP, LM, LPA, LP2	BG, I, P, RS	NJ	0	8	Not stated
Nomura et al (2007)[25]	PRCT	1, 4	D	In, LOS	64	EF, CB, BM	—	Not stated	3–15	Pod 2 until discharge	Yes
Horvat et al (2010)[38],[a]	RDBT	1, 3, 4	A	In, SI, LOS	76	PP, LM, LPA, LP2	BG, I, P, RS	PO	3	0	Control only
Liu et al (2011)[41]	PRCT	1, 4	A	BT, FC, FA, SI, In, LOS	100	LP, LA, BL	—	PO	6	10	Yes
Diepenhorst et al (2011)[37]	PRCT	1, 4, 5	D	BT, In	30	LA, LC, LS, LL, BB2, BL	—	PO/NJ	7	7	Not stated
Eguchi et al (2011)[36]	PRCT	2, 3, 4	B	FC, In, LOS, ICU	50	LC, BB	GO	PO, jejunostomy	2	14	Not stated
Usami et al (2011)[27]	PRCT	3, 4	C	In, SI, LOS, FC, FA	61	LC, BB	GO	PO	14	3–14	Yes

Trial design: PRCT, prospective randomized controlled trial; RDBT, prospective randomized double-blinded trial. Comparison groups: 1, probiotic; 2, prebiotic; 3, synbiotic; 4, placebo; 5, selective bowel decontamination. Surgical groups: A, bowel resection; B, liver transplantation; C, partial hepatectomy; D, pancreatoduodenectomy; E, aortic aneurysm repair. Outcome measures: Ab, length of antibiotic usage; BT, bacterial translocation measured by cultures of mesenteric lymph nodes or serosal scrapings; FA, fecal organic acid concentration; FC, fecal culture; GC, gastric colonization; ICU, length of intensive care unit stay; In, postoperative infective complications; LM, lactulose/mannitol ratio; LOS, hospital length of stay; SI, markers of systemic inflammation, including serum C-reactive protein, interleukin-6. Probiotic type: BB, *Bifidobacterium breve;* BB2, *Bifidobacterium bifidum;* BI, *Bifidobacterium infantis;* BL, *Bifidobacterium lactis* Bb-12; BM, *Bacillus mesentericus;* CB, *Clostridium butyricum;* EF, *Enterococcus faecium;* LA, *Lactobacillus acidophilus* La5; LB, *Lactobacillus bulgaricus;* LC, *Lactobacillus casei;* LL, *Lactococcus lactis;* LM, *Leuconostoc mesenteroides;* LP, *Lactobacillus plantarum* 299v; LPA, *Lactobacillus paracasei;* LP2, *Lactobacillus plantarum* 2362; LS, *Lactobacillus salivarius;* PP, *Pediococcus pentosaceus;* ST, *Streptococcus thermophilus*. Prebiotic type: BG, β-glucan; GO, galacto-oligosaccharides: Oligmate 55; I, inulin; P, pectin; OF, oligofructose; OAF, oat fiber; Pod, postoperative day; RS, resistant starch. Route: NJ, nasojejunal feeding tube; PO, per oral. Dashes represent that there are no data for probiotic or synbiotic data respectively as the data table expresses outcome data from each intervention group.

[a]Agents given either postoperatively or pre- and postoperatively.

From these data, it is not possible to determine which specific strains of probiotics are the most beneficial, but we would advocate a preference for pro- or prebiotics that enhance gut populations of *Bifidobacteria*. Strain-specific benefits and optimization of the dosing strategy must now be addressed by future studies. This requires the standardization of both the experimental methodology and the reporting of data in surgical gut microbial modulation studies if the significant potential of these nutrition in the surgical setting is to be maximized.

Table 1 Characteristics of studies included in meta-analysis on glutamine dipeptide for abdominal surgery

Authors	Journals	Year	Study design	Jadad score	Reference	Operation	Patients (Gln/Con)	Gln dipeptide (g/kg)	Days of Gln dipeptide (d) admininistration
Stehle P	Lancet	1989	RCT	3	5	Elective resection of carcinoma of colon or rectum	12 (6/6)	0.28	5 (postoperative 1-5)
O'Riordain	Annals of Surgery	1994	RCT	3	6	Colorectal Resection	22 (11/11)	0.18	5 (postoperative 1-5)
Morlion BJ	Ann Surg	1998	Double-blind RCT	4	7	Major abdominal surgery	28 (13/15)	0.3	5 (postoperative 1-5)
Metes	Clinical Nutrition	2000	RCT	4	8	Major abdominal surgery	30 (15/15)	0.5	5 (postoperative 1-5)
Jiang Z	Zhong guo Yi Xue Ke Xue Yuan Xue Bao	2000	Prospective double-blind RCT	5	9	Gastrointestinal operations	120 (60/60)	0.36	6 (postoperative 1-6)
Neri	Nutrition	2001	Multiple centers prospective double-blind RCT	3	10	Major abdominal surgery	33 (16/17)	0.18	5 (postoperative 1-5)
Fan YP	Zhonghua Wai Ke Za Zhi	2005	RCT	3	11	Abdominal surgery	40 (20/20)	0.16	7 (postoperative 1-7)
Lin MT	World J Gastroenterol	2005	RCT	4	12	Abdominal surgery	48 (25/23)	0.417	6 (postoperative 1-6)
Yao GX	Clin Nutr	2005	RCT	3	13	Gastrointestinal operations	40 (20/20)	0.5	5 (preoperative 1-postoperative 3)

Original Communication

Journal of Parenteral and Enteral Nutrition
Volume 34 Number 4
July 2010 378-386

10.1177/0148607110362692
http://jpen.sagepub.com
hosted at
http://online.sagepub.com

Immunonutrition in High-Risk Surgical Patients: A Systematic Review and Analysis of the Literature

Paul E. Marik, MD, FCCM[1]; and Gary P. Zaloga, MD, FCCM, FACN[2]

Odd ratio

Total (95% CI)	974	944	100.0%	0.49 [0.39, 0.62]	
Total events	167	271			

Heterogeneity: Chi² = 16.47, df = 20 (P = 0.69); I² = 0%
Test for overall effect: Z = 6.21 (P < 0.00001)
Test for subgroup differences: Not applicable

Conclusions: An immunomodulating enteral diet containing increased amounts of both arginine and fish oil should be considered in all high-risk patients undergoing major surgery. Although the optimal timing cannot be determined from this study, it is suggested that immunonutrition be initiated preoperatively when feasible. (*JPEN J Parenter Enteral Nutr.* 2010;34:378-386)

FeSIN
Federazione delle Società Italiane di Nutrizione

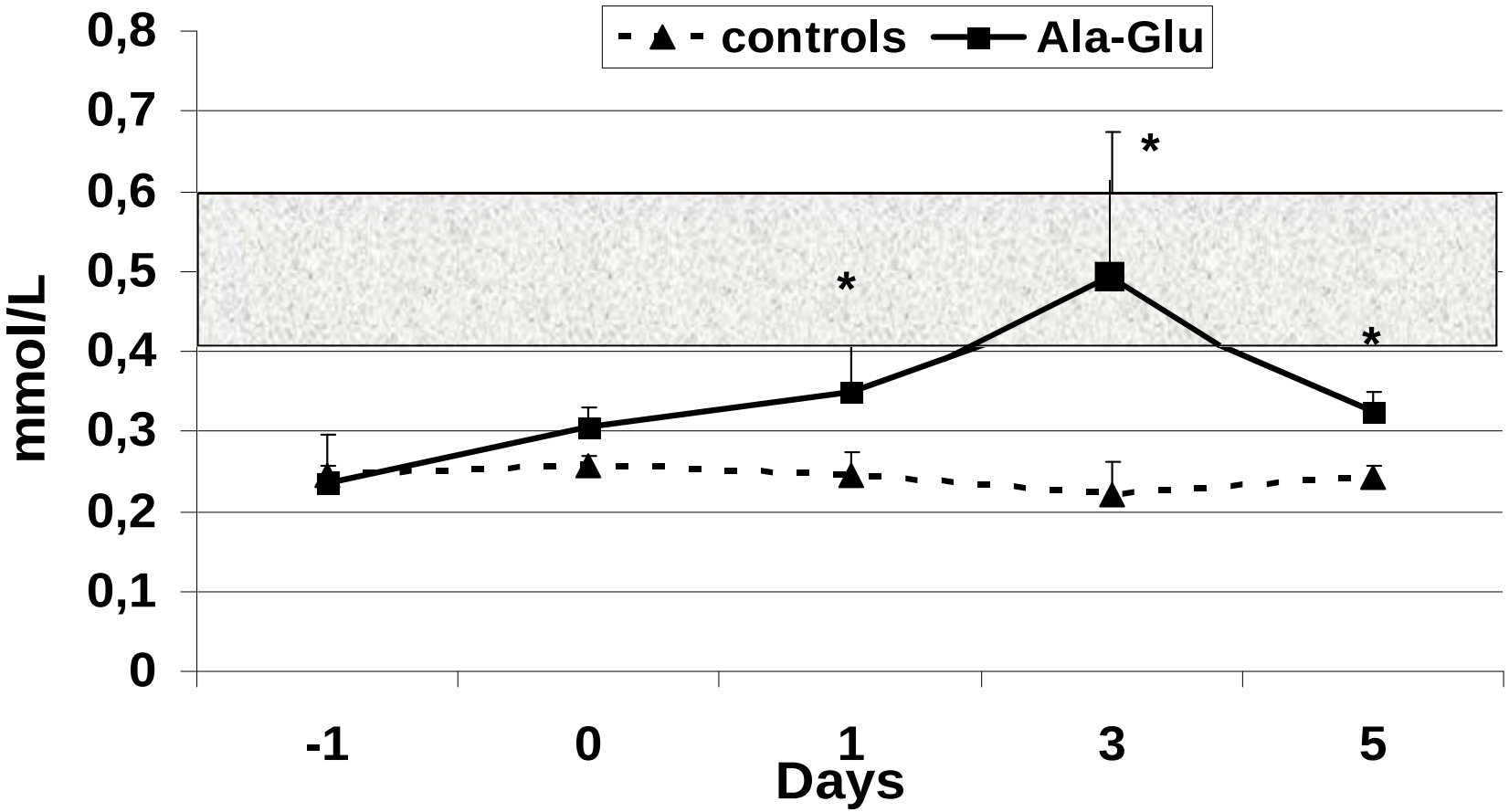
ALIMENTAZIONE E NUTRIZIONE IN PAROLE

GLOSSARIO DI ALIMENTAZIONE E NUTRIZIONE UMANA

FARMACONUTRIZIONE

pharmaco-nutrition

Prescrizione a fini preventivi o terapeutici di nutrienti e di altre sostanze di interesse nutrizionale con effetti metabolicamente documentati, in quantità note e controllate, e con modalità farmacologiche.


controls
Ala-Glu
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
mmol/L
*
*
*
-1
0
1
3
5
Days

Online Submissions: http://www.wjgnet.com/1007-9327office
wjg@wjgnet.com
doi:10.3748/wjg.v16.i2.152

World J Gastroenterol 2010 January 14; 16(2): 152-160
ISSN 1007-9327 (print)

ORIGINAL ARTICLE

A randomized double-blind trial on perioperative administration of probiotics in colorectal cancer patients

Luca Gianotti, Lorenzo Morelli, Francesca Galbiati, Simona Rocchetti, Sara Coppola, Aldo Beneduce, Cristina Gilardini, Daniela Zonenschain, Angelo Nespoli, Marco Braga