Kurs 3: Intenzivno lečenje, urgentna medicina i transfuzija
Naziv teme: Parenteralna i enteralna ishrana u Jedinici intenzivnog lečenja
Datum: 10-12.03.2017.
Jezik: Srpski
Grad: Kopaonik
Zemlja: Srbija
Predavač: Doc. Dr Ivan Palibrk

Metabolički i nutritivni problemi su nešto što karakteriše kritično obolele.

- Optimalna nutritivna potpora kod kritično obolelih je još uvek nešto o čemu se debazuje.

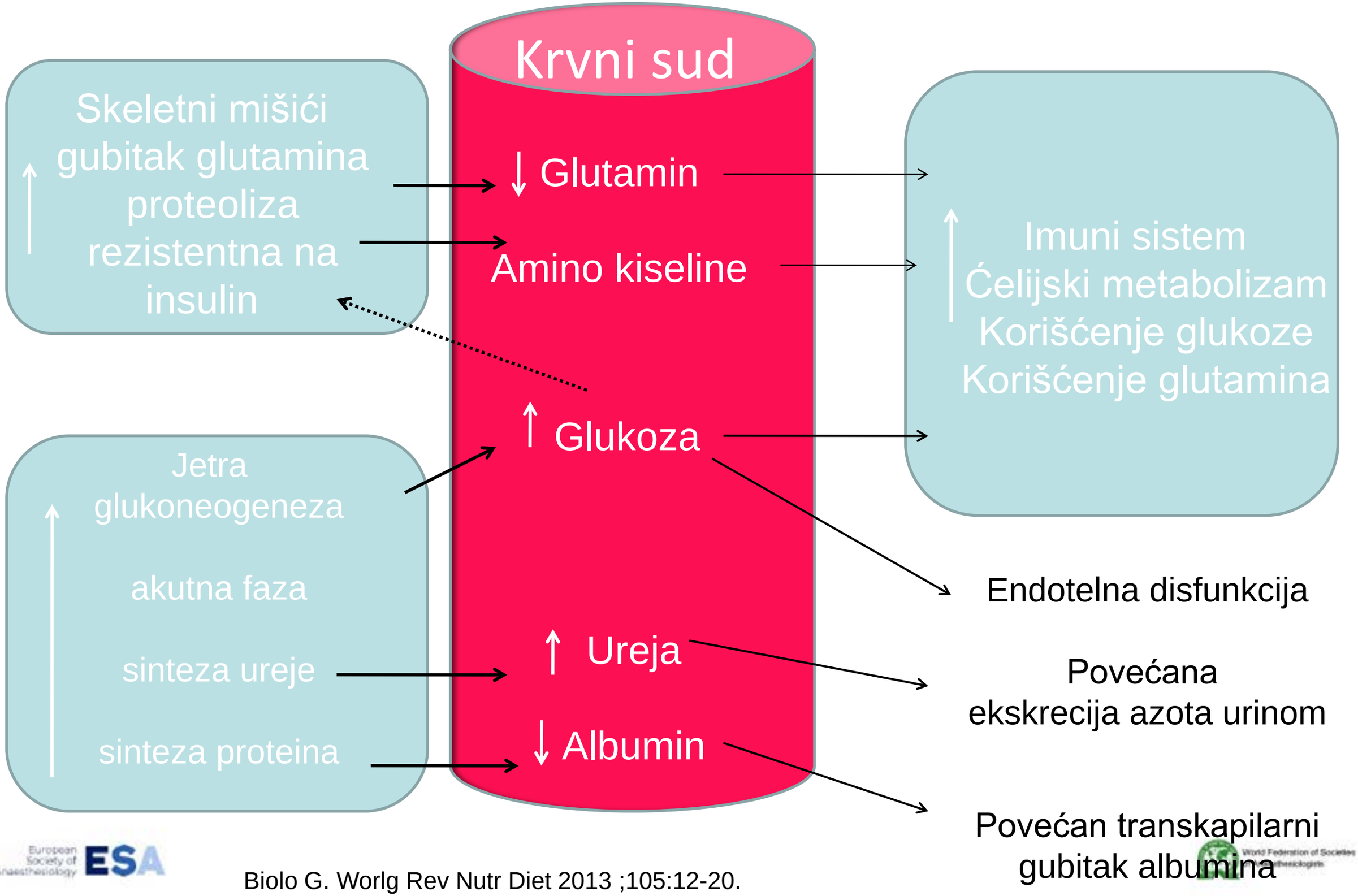
- Hipermetabolizam i katabolizam

- Akutna i hronična malnutricija

Metaboličke abnormalnosti kod kritično obolelog:

1. gubitak mišićnog tkiva
2. hiperglikemija
3. hipoalbuminemija
4. sniženje glutamina

Metaboličke abnormalnosti kod kritično obolelog



Biolo G. Worlg Rev Nutr Diet 2013 ;105:12-20.

Allingstrup JM, et al. Provision of protein and energy in relation to measured requirements in intensive care patients. Clinical Nutrition 31 (2012) 462e468

- Prospektivna observaciona kohortna studija koja obuhvata 113 JIL (mešano internističko – hirurški bolesnici).

- Inicijani energetski i proteinski ciljevi su bili

25-30 kcal/kg/dan i 1,2 – 1,5 g/kg/dan.

- Propofol i albumini dati intravenskim putem se uključuju u izračunavanje.

- Hipoteza je da obezbeđenje proteinskog unosa poboljšava ishod.

Allingstrup JM, et al. Provision of protein and energy in relation to measured requirements in intensivecare patients. Clinical Nutrition 31 (2012) 462e468

Table 2
Data in groups according to ranked protein intake.

		Protein&AA provision group			*P*
		Low N 37	Medium N 38	High N 38	
Distribution of patients	Period 1 (N)	17	19	20	
	Period 2 (N)	20	19	18	
Diagnoses	Severe sepsis (N)	35	33	32	
	Burns (N)	2	5	6	
Anthropometrics	Age, years	59.7 ± 17.4	62.1 ± 15.4	56.7 ± 18.5	
	Height, m	1.70 ± 0.09	1.75 ± 0.07	1.77 ± 0.09	
	Body weight, kg	70.1 ± 16.1	82.2 ± 15.6	81.1 ± 16.2	L vs. M: <0.01 L vs. H: <0.05
	BMI	24.0 ± 3.9	26.7 ± 4.7	25.9 ± 5.0	
Severity scores	APACHE II score (1st 24 h in ICU)	23.2 ± 7.4	21.9 ± 5.9	22.1 ± 6.8	
	SOFA, first score	6.78 ± 3.05	6.66 ± 3.05	7.68 ± 3.05	
	SOFA, average score in ICU	6.41 ± 3.25	6.07 ± 2.45	6.70 ± 3.56	
Blood analyses	Glucose, mmol/l	9.2 ± 2.3	9.1 ± 2.3	9.1 ± 2.2	
	Urea, mmol/l	13.5 ± 9.4	14.5 ± 9.0	15.7 ± 7.9	
Nutrition	Protein&AA provision, g/kg per day	0.79 ± 0.29	1.06 ± 0.23	1.46 ± 0.29	L vs. M: <0.001 L vs. H: <0.001 M vs. H: <0.001
	N loss, $Protein_{eq}$ g/kg per day	1.40 ± 0.52	1.41 ± 0.45	1.67 ± 0.47	
	N balance, $Protein_{eq}$ g/kg per day	0.59± 0.48	0.35± 0.41	0.20± 0.58	L vs. H: <0.01
	Energy provision, kcal/kg per day	21.7 ± 6.7	24.7 ± 5.7	27.2 ± 6.7	L vs. H: <0.001
	Resting energy expenditure, kcal/kg per day	28.4 ± 6.2	28.1 ± 7.5	28.8 ± 7.2	
	Energy-balance, kcal/kg per day	6.4 ± 9.1	3.5 ± 6.3	1.5 ± 6.9	L vs. H: <0.05
	Energy in Protein&AA/Energy provision, %	15.0 ± 3.3	18.1 ± 3.3	22.4 ± 3.4	L vs. M: <0.001 L vs. H: <0.001 M vs. H: <0.001
	Energy in $Protein_{eq}$/REE, %	20.6 ± 6.7	21.2 ± 6.6	21.2 ± 6.6	
Outcome	Length of stay in ICU, d#	5 (3–9)	10 (6–14)	10 (7–15)	L vs. M: <0.01 L vs. H: <0.01
	ICU mortality, *n* (%)	10 (27)	9 (24)	6 (16)	
	Discharged alive from ICU, *n* (%)	27 (73)	29 (76)	32 (84)	

Data are presented as *N* (%), mean ± SD, or #: median (interquartile range).
P values calculated by ANOVA with Bonferroni's test for multiple comparisons (mean ± SD) or Kruskal–Wallis with Dunn's test for multiple comparisons (median, IQR). L, Low group; M, medium group; H, high group.

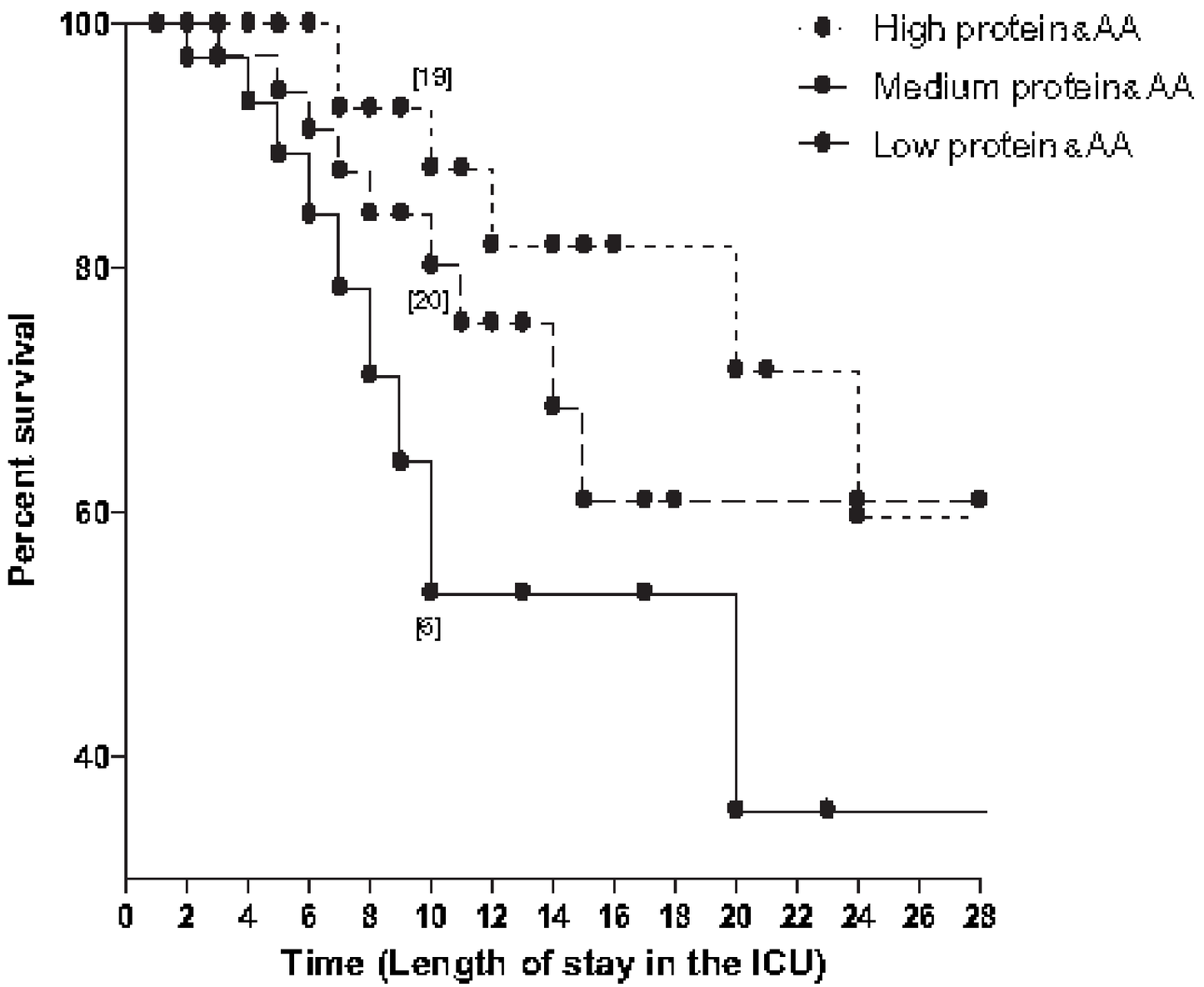
Allingstrup JM, et al. Provision of protein and energy in relation to measured requirements in intensivecare patients. Clinical Nutrition 31 (2012) 462e468

- Desetodnevni mortalitet je:

Proteini & AA obezbeđena količina (g/kg/day)	Niska (0.79 + 0.29) 37 bolesnika	Srednja (1.06 + 0.23) 38 bolesnika	Visoka (1.46 + 0.29) 38 bolesnika
Mortality (%)	8 (22%)	6 (16%)	3 (8%)

Allingstrup JM, et al. Provision of protein and energy in relation to measured requirements in intensivecare patients. Clinical Nutrition 31 (2012) 462e468

- Preživljavanje u JIL posle 28 dana



Allingstrup JM, et al. Provision of protein and energy in relation to measured requirements in intensivecare patients. Clinical Nutrition 31 (2012) 462e468

Zaključak:

- Bolji rezultati lečenja su povezani i bolje koreliraju sa većim unosom proteina i amino kiselina nego sa kalorijskim unosom.

- Rezultati sugerišu bolji ishod, ako je unos albumina od približno 1.5 g/kg na dan.

Decreases Mortality in Mechanically Ventilated, Critically Ill Patients: A Prospective Observational Cohort Study. JPEN 2012;36(1):60-68

- Mešana internističko – hirurška JIL .
- 886 bolesnika na mehaničkoj ventilaciji.
- Energetske potrebe su preračunavane Harris Benedict-ovom jednačinom uz dodavanje 20% za stres.
- Količina proteina koja im je obezbeđena je najmanje 1,2 g/kg/dan (1,2-1,5g/kg/dan)
- Analiziran je uticaj dostizanja cilja u proteinima + energiji nasuprot nedostizanja tog cilja na 28-dnevni mortalitet.

Weijs PJM, et al.Optimal Protein and Energy Nutrition Decreases Mortality in Mechanically Ventilated, Critically Ill Patients: A Prospective Observational Cohort Study. JPEN 2012;36(1):60-68

Table 2. Nutrition Therapy and Clinical Outcome[a]

	No Target	Protein + Energy Target	Energy Target	Protein Target	All
No. of patients	412	245	205	24	886
Energy					
Intake, kcal/d	1572 ± 404	1897 ± 359[b]	1819 ± 333[b]	1898 ± 384	1728 ± 403[c]
Target, %	74 ± 15	99 ± 9[b]	96 ± 5[b,d]	85 ± 4	86 ± 16[c]
Protein intake					
g/d	67 ± 21	89 ± 15[b]	78 ± 15[b,d]	88 ± 19	76 ± 20[c]
g/kg/d	0.83 ± 0.23	1.31 ± 0.18[b]	1.06 ± 0.14[b,d]	1.21 ± 0.15	1.02 ± 0.28[c]
Parenteral nutrition					
% of patients	18.2	38.4	29.8	37.5	27.0[c]
mL/d	108 ± 310	297 ± 537	131 ± 301	396 ± 604	173 ± 403
Intake d1–3					
Energy, kcal/d	808 ± 379	1266 ± 545[b]	1094 ± 436[b,d]	876 ± 433	1003 ± 486
Protein, g/d	22 ± 19	47 ± 28[b]	34 ± 21[b,d]	28 ± 23	32 ± 24
Time to target, d					
Energy	3.5 ± 5.1	1.7 ± 1.5[b]	2.1 ± 2.0[b]	2.5 ± 2.3	2.7 ± 3.8[c]
Protein	3.6 ± 5.4	3.3 ± 5.0	3.9 ± 5.8	3.1 ± 4.1	3.6 ± 5.4
Length of ventilation, d					
Mean ± SD	16.4 ± 16.6	28.3 ± 17.0[b]	25.4 ± 17.9[b]	27.1 ± 24.3	22.1 ± 18.0[c]
Median (interquartile range)	12 (11)	25 (20)	20 (21)	20 (23)	17 (18)
Length of intensive care unit stay, d					
Mean ± SD	18.8 ± 18.0	31.7 ± 19.6[b]	28.0 ± 18.3[b]	28.8 ± 24.5	24.8 ± 19.5[c]
Median (interquartile range)	14 (13)	26 (22)	22 (24)	21 (22)	19 (19)
Length of hospital stay, d					
Mean ± SD	40.1 ± 35.0	65.7 ± 58.4[b]	49.9 ± 38.9[b,d]	59.1 ± 56.6	49.9 ± 45.4[c]
Median (interquartile range)	31 (36)	53 (51)	42 (40)	44 (34)	39 (40)
Mortality, %					
Intensive care unit	17.7	22.4	23.9	16.7	20.4
28 d	20.4	14.7	19.5	12.5	18.4
Hospital	31.3	39.5	36.6	20.8	34.4

Weijs PJM, et al.Optimal Protein and Energy Nutrition Decreases Mortality in Mechanically Ventilated, Critically Ill Patients: A Prospective Observational Cohort Study. JPEN 2012;36(1):60-68

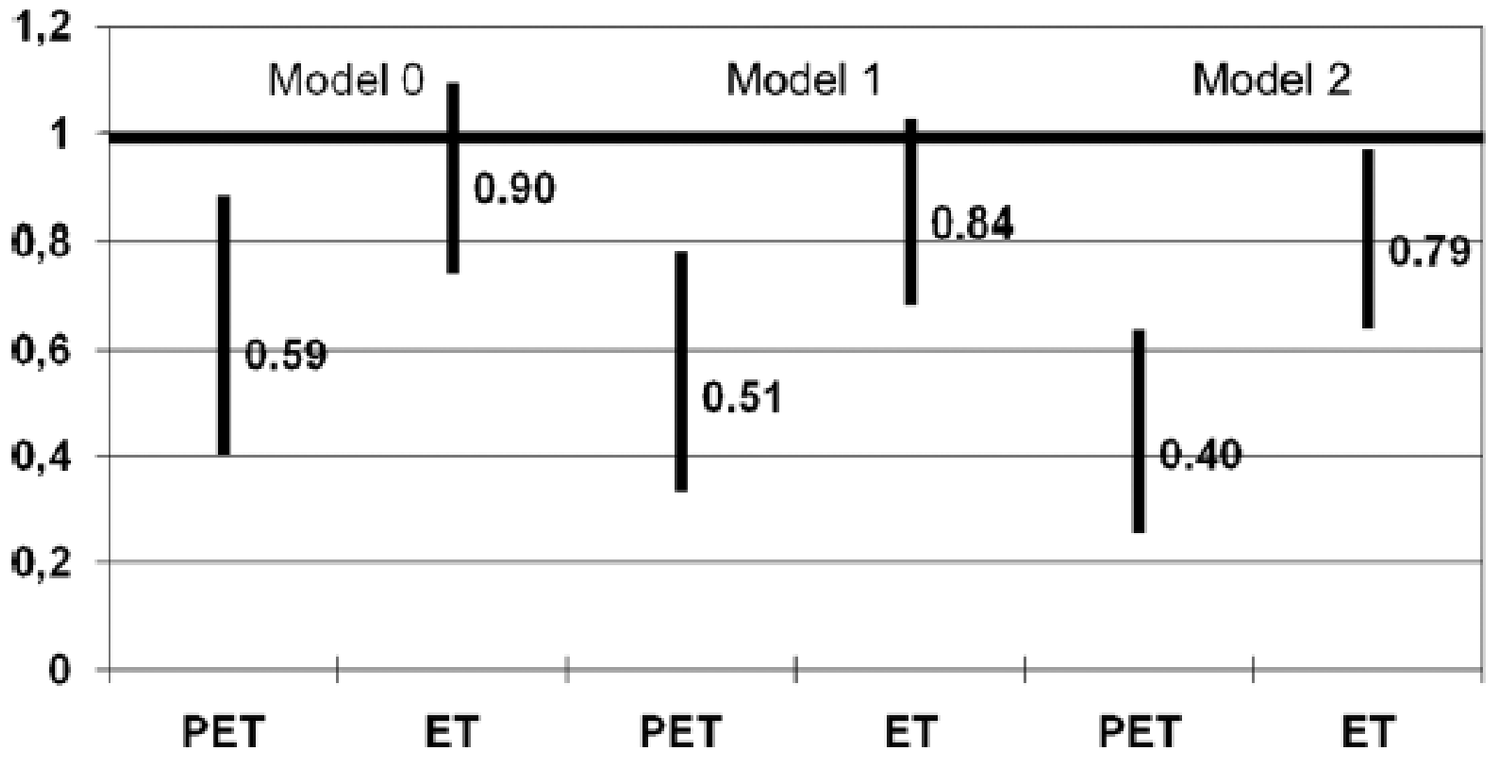


Figure 2. The 28-day mortality hazard ratio with 95% confidence interval for protein and energy target (PET) group and energy target (ET) group. Model 0 is unadjusted. Model 1 adjusted for sex, age, body mass index, diagnosis, hyperglycemic index, and Acute Physiology and Chronic Health Evaluation II score. Model 2 additionally adjusted for time to energy target and use of parenteral nutrition.

Weijs PJM, et al.Optimal Protein and Energy Nutrition Decreases Mortality in Mechanically Ventilated, Critically Ill Patients: A Prospective Observational Cohort Study. JPEN 2012;36(1):60-68

Zaključak:

- Postizanje proteinskog (najmanje 1,2 g/kg/dan) i energetskog cilja, je povezano sa smanjenjem 28 – mortaliteta za 50%, dok postizanje samo energetskog cilja nije povezano sa smanjenjem mortaliteta.
- Imati na umu, da je kontrolna grupa (NT) imala energetski unos od skoro 1,600 kcal/dan.

Petros S. et al. Hypocaloric vs Normocaloric Nutrition in Critically Ill Patients: A Prospective Randomized Pilot Trial. JPEN 2016;40(2):242–249

- Prospektivna randomizovana pilot studija
- Normokalorična grupa (19,7±5,7 kcal/kg/dan): 54 pac
  vs.
- Hipokalorijska grupa (11,3±3,1 kcal/kg/dan): 46 pac

p= 0,0001

Srednja dnevna potrošnja merena je indirektnom kalorimetrijom,
ako to nije moguće, koristimo,Ireton-Jones jednačinu za izračunavanje eneregetskih potreba.

Enteralni unos ima prednost!

Petros S. et al. Hypocaloric vs Normocaloric Nutrition in Critically Ill Patients: A Prospective Randomized Pilot Trial. JPEN 2016;40(2):242–249

Proteini

Energija

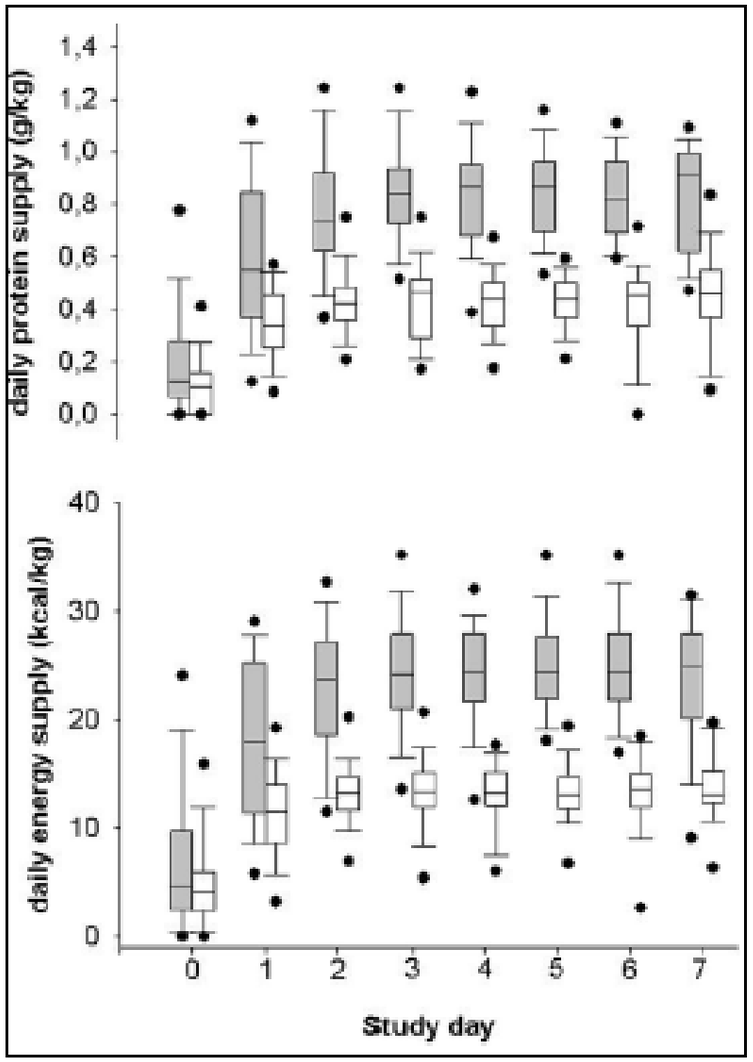


Figure 3. Median energy (lower panel) and protein (upper panel) supplies calculated for the ideal body weight in the normocaloric group (gray boxes) and hypocaloric group (white boxes). Except for day 0, the differences were significant throughout the study period ($P < .0001$). The dots at the lower and upper ends of the whiskers represent 5th and 95th percentiles, respectively.

Glukoza

Insulin

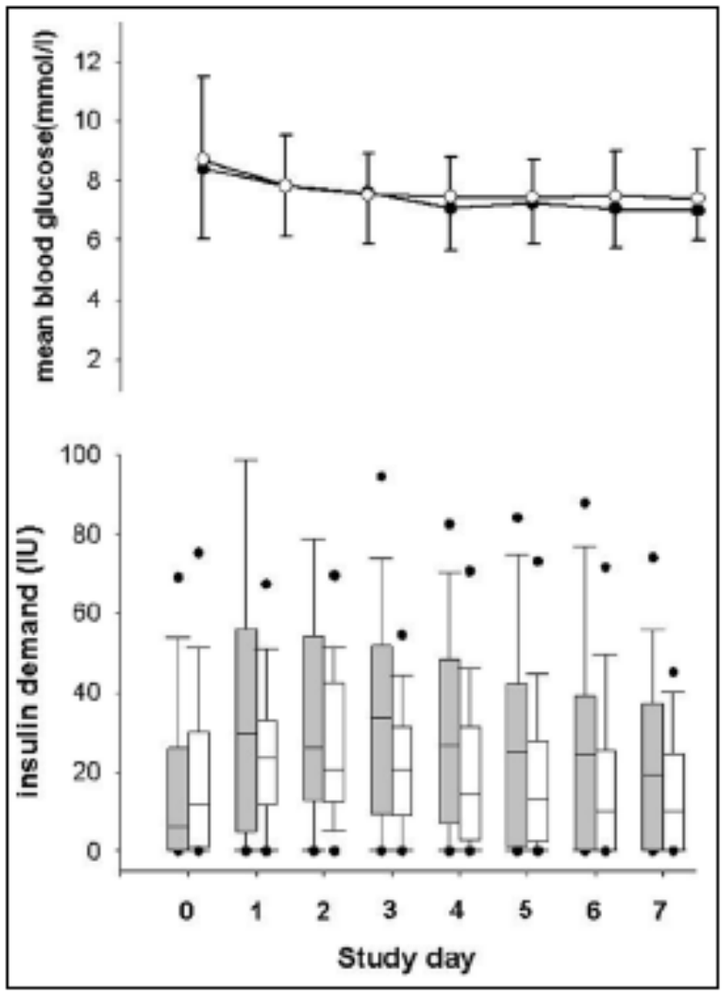


Figure 5. Daily blood glucose level (upper panel) and insulin demand (lower panel) in the study population. Blood glucose (normocaloric group = closed circles; hypocaloric group = open circles) is presented as mean ± standard deviation. The insulin requirement is given in U/m^2 of the body surface area (normocaloric group = gray boxes; hypocaloric group = white boxes). The dots at the lower and upper ends of the whiskers represent 5th and 95th percentiles, respectively. The insulin demand was significantly different ($P < .05$) between the 2 groups on days 3, 4, 5, and 6.

Petros S. et al. Hypocaloric vs Normocaloric Nutrition in Critically Ill Patients: A Prospective Randomized Pilot Trial. JPEN 2016;40(2):242–249

	Normokalorijska grupa	Hipokalorijska grupa	P
Nosokomijalne infekcije	11,1%	26,1%	0,046
Srednje trajanje mehaničke ventilacije Xsr (min – max)	178,5 sati (69,5-403,3)	254,5 sati (115,5-686,3)	NS
Srednje trajanje vazopresora Xsr (min - max)	53,5 sati (23,5 – 111,8)	73,5 sati (30,9 – 145,1)	NS
ICU mortalitet	22.5%	21,7%	NS
Bolnički mortalitet	31,5%	37,0%	NS
Mortalitet posle 28 dana	33,3%	39,1%	NS

Petros S. et al. Hypocaloric vs Normocaloric Nutrition in Critically Ill Patients: A Prospective Randomized Pilot Trial. JPEN 2016;40(2):242–249

- Zaključak:
- Hipokalorijska ishrana tokom prvih 7 dana je povezana sa češćima nosokomijalnim infekcijama.

- Nije bilo klinički značajne razlike u kliničkom ishodu između grupa sa dva različita načina ishrane.

Zusman O, et al.Resting energy expenditure, calorie and protein consumption in critically ill patients: a retrospective cohort study. Critical Care 2016; 20:367.

- Reroespektivna observacina studija
- Internističko/hirurška ICU, na mehaničkoj ventilaciji
- 5053 bolesnika je primilo nutritivnu potporu (EN i/ili PN)
- 1171 komplet podaci
- 60 dana preživelo 846 bolesnika
- Nutritivna potpora započeta 4 sata po prijemu u ICU
- Energetske potrebe u miru (REE) su merene indirektnom kalorimetrijom

- Meren je odnos datih kalorija (AdCal) prema REE
- Minimalna REE je 800 kcal a maksimalna 4540 kcal

Zusman O, et al.Resting energy expenditure, calorie and protein consumption in critically ill patients:
a retrospective cohort study. Critical Care 2016; 20:367.

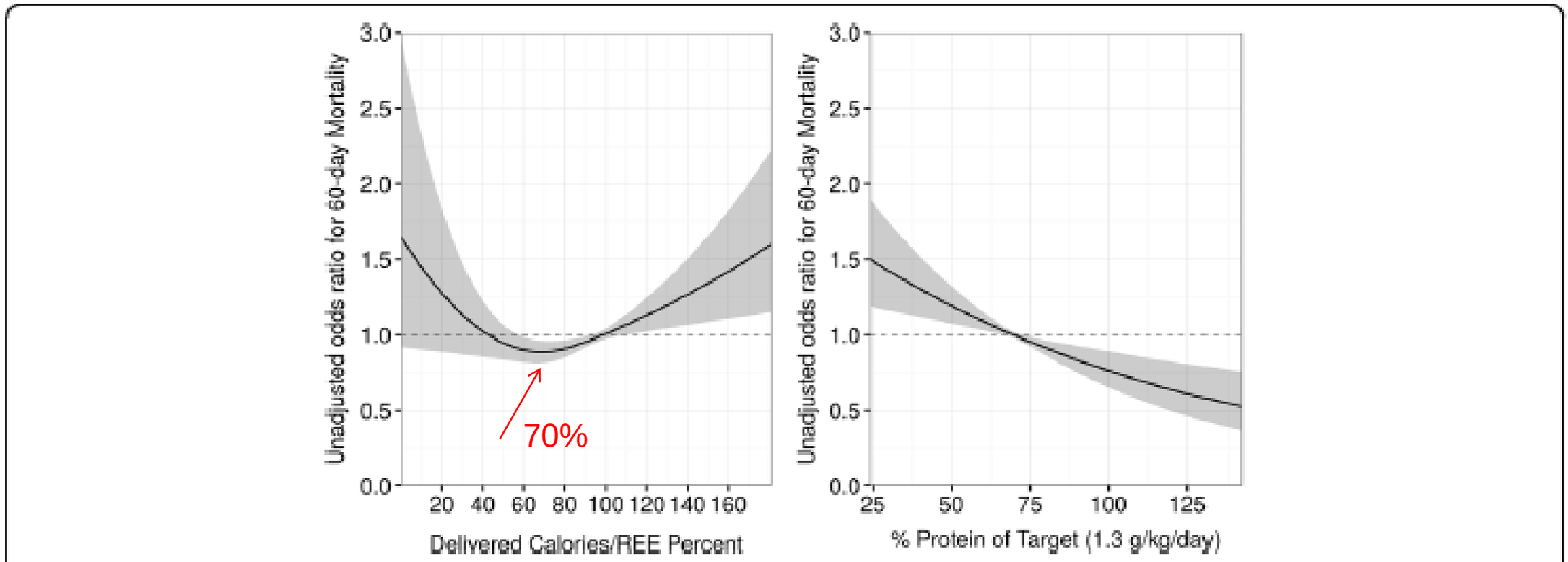


Fig. 2 Association of administered calories/resting energy expenditure (Adcal/REE) percent with 60-day mortality (*left*), and protein intake by daily requirement (1.3 g/kg/d) with 60-day mortality (*right*) by odds ratio. *REE* resting energy expenditure

Nema linearne povezanosti izmedju Adcal/REE

i 60 dnevnog mortaliteta kritično obolelih mehenički ventiliranih bolesnika.

Postoji linearna povezanost izmedju date količine proteina i smanjenja rizika od umiranjau istoj grupi bolesnika.

Zusman O, et al.Resting energy expenditure, calorie and protein consumption in critically ill patients:
a retrospective cohort study. Critical Care 2016; 20:367.

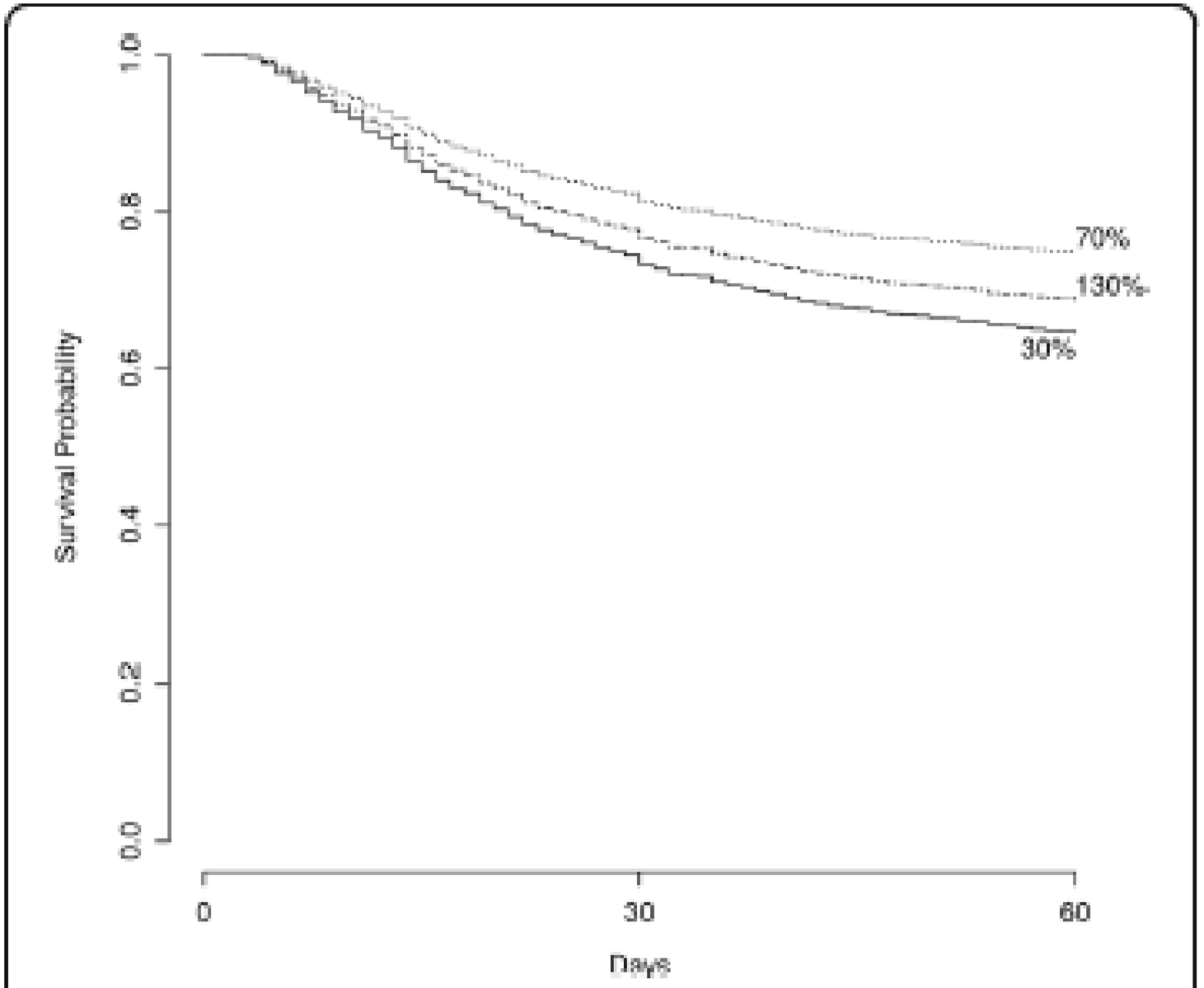


Fig. 3 Association between administered calories/resting energy expenditure (Adcal/REE) percent and 60-day survival. *Labels* correspond to Adcal/REE percent

Zusman O, et al.Resting energy expenditure, calorie and protein consumption in critically ill patients:
a retrospective cohort study. Critical Care 2016; 20:367.

Adcal/REE	< 70%	70 – 100%	> 100%	p
Dužina boravka u bolnici (dani)	12	15	16,5	< 0.001
Dužina mehaničke ventilacije (dani)	10	13	14	< 0.001

Zaključak:
Realnost isključuje energetski cilj od 100% kao idealan.

Indirektna kalorimetrija idealna
za procenu energetskih potreba bolesnika.

Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) Journal of Parenteral and Enteral Nutrition Volume 40 Number 2 February 2016 159–211

A3b. Based on expert consensus, in the absence of IC, we suggest that a published predictive equation or a simplistic weight-based equation (25–30 kcal/kg/d) be used to determine energy requirements. (See section Q for obesity recommendations.)

Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) Journal of Parenteral and Enteral Nutrition Volume 40 Number 2 February 2016 159–211

C4. We suggest that sufficient (high-dose) protein should be provided. Protein requirements are expected to be in the range of 1.2–2.0 g/kg actual body weight per day and may likely be even higher in burn or multitrauma patients.

- Potrošnja pojedinačnih boca amino kiselina i “All in one” u 2015, Prva hirurška klinika

	All in one	Hepasol 8%	Aminosol 10%	Aminosol 15%	Aminosol 10%E
Jedinica	567 kesa	630 boca	820 boca	870 boca	180 boca
	567 kesa		2500 boca		
Grama a.k.	29580	25200	41000	65250	9000
	29580		140450		

Primena parenteralne nutritivne potpore: pojedinačne boce – all in one

- Prednosti primene “all in one” u odnosu na pojedinačne boce:

a) Smanjena je mogućnost za nastanak kontaminacije (nema potrebe za višestrukim punkcijama).
b) Koristi se samo jedna venska linija.
c) Optimalan odnos makro i mikro elemenata.
d) Manje metaboličkih komplikacija.
e) Bolji azotni balans.
f) Nema potrebe za čestim zamenama boca.
g) Nije potrebno posebno proračunavanje protoka pojedinih nutricijenata.
h) Smanjena mogućnost nastanka greške.
i) Manji utoršak vremena.

Mühlebach S, Franken C, Stanga Z. Practical handling of AIO admixtures – Guidelines on Parenteral Nutrition, Chapter 10. GMS German Medical Science 2009;7:18

PRIMER

Amino kiselina -1,5g/ kg

TT (kg)	60	70	80	90
Amino kiselina	90 gr/24h	105 gr/24h	120 gr/24h	135 gr/24h

TT- 80 kg potrebno je: 120 gr/24h

Kesa “all in one” sadrži 33 gr a.k./l

Boca 10% a.k.sadrži: 100 gr a.k./l

Boca 15% a.k. Sadrži: 150 gr a.k./l

Dipeptiven: 20 gr glutamina i alanina/ 100 ml rastvora.

Preparat za enteralnu ishranu: 45 gr/l

Zaključak:

Tri važna koraka u nutritivnoj potpori kritično obolelih:

a) Odrediti individualne ciljeve u energiji (Izbeći overfeeding i underfeeding) i proteinskom unosu (optimalna ishrana).
b) Omogućiti dostizanje ovih ciljeva.
c) Pokazati da dosezanje ovih ciljeva ima uticaja na ishod.