

4.2(a) Composition of Enteral Nutrition: (Carbohydrate/fat): High fat/low CHO

January 31st, 2009

Recommendation:

There are insufficient data to recommend high fat/low CHO diets for critically ill patients.

Discussion: The committee noted that with respect to ventilator days, the evidence from two small studies showed only a small treatment effect and wide confidence intervals and the presence of heterogeneity between the two studies. The significant improvement in a surrogate endpoint i.e. glycemic control in the group receiving the higher fat/lower CHO formula in one study was noted. Concerns were expressed about the safety of high fat diets and the committee noted the higher cost of high fat formulas compared to standard. The feasibility was not felt to be a great concern

Values	Definition	Score: 0, 1, 2, 3
Effect size	Magnitude of the absolute risk reduction attributable to the intervention listed--a higher score indicates a larger effect size	1
Confidence interval	95% confidence interval around the point estimate of the absolute risk reduction, or the pooled estimate (if more than one trial)--a higher score indicates a smaller confidence interval	1
Validity	Refers to internal validity of the study (or studies) as measured by the presence of concealed randomization, blinded outcome adjudication, an intention to treat analysis, and an explicit definition of outcomes--a higher score indicates presence of more of these features in the trials appraised	2
Homogeneity or Reproducibility	Similar direction of findings among trials--a higher score indicates greater similarity of direction of findings among trials	1
Adequacy of control group	Extent to which the control group represented standard of care (large dissimilarities = 1, minor dissimilarities=2, usual care=3)	3
Biological plausibility	Consistent with understanding of mechanistic and previous clinical work (large inconsistencies =1, minimal inconsistencies =2, very consistent =3)	2
Generalizability	Likelihood of trial findings being replicated in other settings (low likelihood i.e. single centre =1, moderate likelihood i.e. multicentre with limited patient population or practice setting =2, high likelihood i.e. multicentre, heterogeneous patients, diverse practice settings =3.	1
Cost	Estimated cost of implementing the intervention listed--a higher score indicates a lower cost to implement the intervention in an average ICU	2
Feasible	Ease of implementing the intervention listed--a higher score indicates greater ease of implementing the intervention in an average ICU	2
Safety	Estimated probability of avoiding any significant harm that may be associated with the intervention listed--a higher score indicates a lower probability of harm	2

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Question: Does a high fat/low CHO enteral formula affect outcomes in the critically ill adult patient?

Summary of evidence: There were three level 2 studies that compared a high fat, low CHO formula to a standard formula. Two studies compared Pulmocare (55% fat, 28 % CHO) and one compared Novasource Diabetic Plus (40% fat, 40 % CHO) to standard formula (29-30 % fat, 49-53% CHO).

Mortality: Two studies reported on mortality and found no differences between the groups (Al Saady 1994, Mesejo 2003).

Infections: One study reported infectious complications and found no differences between the two groups (Mesejo 2003)

LOS: Only one study reported on ICU length of stay and found no differences between the two groups (Mesejo 2003)

Ventilator days: Were significantly lower in the high fat group in one study (Al Saady 1994 $p < 0.001$), no difference found in the van de Berg 1994 study or the Mesejo 2003 study.

Other complications: In the one study that reported on glycemic control, glucose levels and the dose of insulin needed were significantly lower in the group receiving the higher fat, lower CHO formula.

Conclusions:

- 1) A high fat, low CHO enteral formula may be associated with a reduction in ventilated days in medical ICU patients with respiratory failure and better glycemic control in critically ill patients with hyperglycemia.
- 2) No difference in mortality, infections or LOS found between the critically ill patients receiving high fat/low CHO formula or standard.

Level 1 study: if all of the following are fulfilled: concealed randomization, blinded outcome adjudication and an intention to treat analysis.

Level 2 study: If any one of the above characteristics are unfulfilled

Table 1. Randomized Studies Evaluating High Fat/Low CHO Enteral Nutrition In Critically ill Patients

Study	Population	Methods (score)	Intervention	Mortality # (%)		RR (CI)**	Infections # (%)		RR (CI)**
				High fat/low CHO	Standard		High fat/low CHO	Standard	
van den Berg 1994	Medical ICU patients with COPD Chronically ventilated N= 32	C.Random: not sure ITT: yes Blinding: no (5)	55% fat, 28 % CHO (Pulmocare) vs 30 % fat, 53 % CHO (standard, Ensure Plus)	NR	NR	NR	NR	NR	NR
Al Saady 1994	Ventilated patients Acute respiratory failure N = 40	C.Random: not sure ITT: no Blinding: double (9)	55% fat, 28 % CHO (Pulmocare) vs 30 % fat, 53 % CHO (standard, Ensure Plus)	3/9 (33)	3/11 (27)	1.22 (0.32-4.65)	NR	NR	NR
Mesejo 2003	Critically ill pts with Diabetes or hyperglycemia from 2 different centers N = 50	C.Random: not sure ITT: yes Blinding: single (9)	40% fat, 40 % CHO (Novasource Diab Plus) vs. 29 % fat, 49 % CHO (Standard, Isosource Protein)	8/26 (31)	7/24 (29)	1.05 (0.45, 2.47)	10/26 (38.5)	8/24 (33)	1.15 (0.55, 2.43)

Study	LOS days		Ventilator days		Cost		Other	
	High fat/low CHO	Standard	High fat/low CHO	Standard	High fat/low CHO	Standard	High fat/low CHO	Standard
van den Berg 1994	NR	NR	4 (median)	6 (median)	NR	NR	High fat/low CHO Gastric retention 1/15 (7)	Standard 1/17 (6)
Al Saady 1994	NR	NR	3.6 ± 0.7	6.2 ± 1.5	NR	NR	Diarrhea 3/9 (33)	3/11 (27)
Mesejo 2003	ICU 14.8 ± 9.4	ICU 14.8 ± 8.8	8.7 ± 6.2	9.4 ± 6.0	NR	NR	Plasma Glucose Levels (mmol/L) 9.8 ± 2.4	12.4 ± 2.6

C.Random: concealed randomization
ITT: intent to treat
NR: Not reported

± : Mean ± Standard deviation
** RR= relative risk, CI= Confidence intervals

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Article inclusion log

Criteria for study selection

Type of study: RCT or Meta-analysis
Population: critically ill, ventilated patients (no elective surgery patients)
Intervention: TPN and /or EN
Outcomes: mortality, LOS, QOL, functional recovery, complications, cost. Exclude studies with only biochemical, metabolic or nutritional outcomes.

	Author	Journal	I	E	Why Rejected
1	Schneeweiss	Metabolism 1992		√	No clinical outcomes
2	Diboune	JPEN J Parenter Enteral Nutr 1992		√	No clinical outcomes
3	Adams	JPEN J Parenter Enteral Nutr 1993		√	No clinical outcomes
4	Van den Berg	Intensive Care Med 1994	√		
5	Al Saady	Intensive Care Med 1994	√		
6	Tappy	JPEN J Parenter Enteral Nutr 1999		√	No clinical outcomes
7	Mesejo	Clin Nutr 2003	√		
8	Pohl	Euro J Clin Nutr 2005		√	Not ICU pts

I = included, E = excluded

References

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2. Diboune M, Ferard G, Ingenbleek Y, Tulasne PA, Calon B, Hasselmann M, Sauder P, Spielmann D, Metais P. Composition of phospholipid fatty acids in red blood cell membranes of patients in intensive care units: effects of different intakes of soybean oil, medium-chain triglycerides, and black-currant seed oil. *JPEN J Parenter Enteral Nutr* 1992 Mar-Apr; 16(2): 136-41.
3. Adams S, Yeh YY, Jensen GL. Changes in plasma and erythrocyte fatty acids in patients fed enteral formulas containing different fats. *JPEN J Parenter Enteral Nutr*. 1993 Jan-Feb; 17(1): 30-
4. Van den Berg B, Bogaard JM, Hop WC. High fat, low carbohydrate, enteral feeding in patients weaning from the ventilator. *Intensive Care Med*. 1994 Aug; 20(7): 470-5.
5. al Saady NM, Blackmore CM, Bennett ED. High fat, low carbohydrate, enteral feeding lowers PaCO₂ and reduces the period of ventilation in artificially ventilated patients. *Intensive Care Med* 1989;15:290-5.B
6. Tappy L, Berger M, Schwarz JM, McCamish M, Revelly JP, Schneiter P, Jequier E, Chiolero R. Hepatic and peripheral glucose metabolism in intensive care patients receiving continuous high- or low-carbohydrate enteral nutrition. *JPEN* 1999 Sep-Oct; 23(5): 260-7; discussion 267-8.
7. Mesejo A, Acosta JA, Ortega C, Vila J, Fernandez M, Ferreres J, Sanchis JC, Lopez F. Comparison of a high-protein disease-specific enteral formula with a high-protein enteral formula in hyperglycemic critically ill patients. *Clin Nutr*. 2003 Jun; 22(3): 295-305.
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