The hypothesis of the project was that loss of diversity in the gut microbiome would be associated with poorer outcomes. According to Dr Wischmeyer, early data suggest an association between death and an excess of *Klebsiella* and Enterobacteriaceae on the skin. Bacteremia was associated with *Mycoplasma* in the mouth. Increased length of stay was associated with an abundance of fecal *Bilophila*. Better protein nutrition was significantly associated with an increased abundance of *Streptococcus anginosus* ($P < .05$). Greater diversity of the biome was associated with a shorter length of stay.

Dr Wischmeyer emphasized that loss of diversity in the microbiome is likely to lead to poor clinical outcomes, and the continuing analysis of these data may provide some guidance toward how to best restore microbial balance in critically ill patients in the ICU.

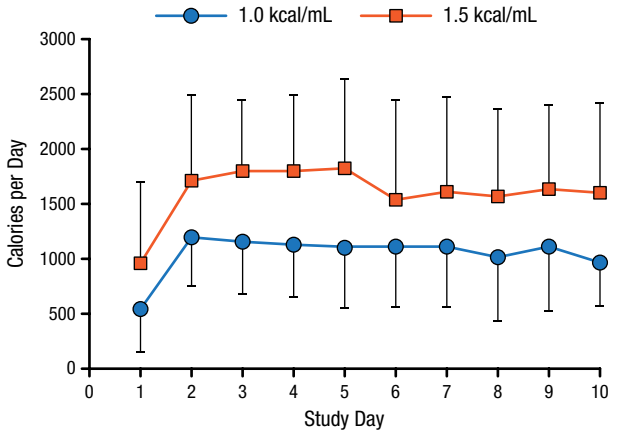
THE TARGET TRIAL

While the optimal calorie goal for critically ill patients is unclear, most guidelines suggest a goal of 25 kcal/kg/d; however, enteral feedings may deliver only half of that goal. Adam Deane, MD, PhD, University of Adelaide, Adelaide, South Australia, on behalf of the TARGET study investigators and the Australian New Zealand Intensive Care Society, discussed the TARGET trial [Peake S et al. *Am J Clin Nutr.* 2014], a feasibility study designed to test whether an energy-dense caloric enteric feeding solution would provide more calories than a standard formulation when delivered at the same rate to critically ill patients. The secondary goal was to determine if these data would inform the feasibility of conducting a multicenter double-blind randomized trial.

There were 112 patients from 5 Australian ICUs enrolled in TARGET. The mean age was 56 years, and 74% were men. All patients were mechanically ventilated and were expected to require enteral nutrition for ≥ 2 days. Patients were randomized to receive an enteral solution of 1.5 kcal/mL (n = 57) or 1.0 kcal/mL (n = 55) at a rate of 1 mL/kg of ideal body weight per hour for up to 10 days. The primary outcome measure was the number of calories delivered from enteral nutrition per day.

The 2 groups received similar mean volumes of enteral nutrition solution. The higher calorie solution was associated with a significantly higher daily caloric intake (1832 ± 381) when compared with the standard formula (1259 ± 428; $P < .001$; Figure 1). The higher energy-dense feeds were not associated with larger gastric residual volumes or diarrhea. There were fewer deaths among the patients who received the higher calorie solution 90 days after enrolling in the study, but this was not statistically significant.

Figure 1. Mean Daily Calories Provided by 2 Enteral Solutions



Peake S et al. *Am J Clin Nutr.* 2014.

Adapted from Peake SL et al. Use of a concentrated enteral nutrition solution to increase calorie delivery to critically ill patients: a randomized, double-blind, clinical trial. *Am J Clin Nutr.* 2014;100:616-625. With permission from American Society for Nutrition.

Dr Deane hypothesized that increased calorie delivery may influence outcomes in critically ill patients. He also confirmed that the ability to deliver the intervention in a blinded manner supports the development of a large multicenter double-blind RCT to determine whether critically ill patients will achieve a clinically meaningful benefit from the use of a concentrated enteral solution.

Evaluating a New Feeding Formula for Patients in the ICU Who Are Obese

Written by Jill Shuman

Increased rates of obesity in patients in the intensive care unit (ICU) reflect increased rates of obesity in the US population: recent estimates suggest that > 30% of patients in the ICU are obese [Hogue CW et al. *Intensive Care Med.* 2009], with that number likely to rise as the obesity prevalence grows in the general population. Patients in the ICU who are obese are more likely to require mechanical ventilation and to have a longer ICU stay [Akinnusi ME et al. *Crit Care Med.* 2008; Oliveros H, Villamor E. *Obesity (Silver Spring).* 2008].

According to Stephen McClave, MD, University of Louisville, Louisville, Kentucky, USA, critically ill patients who are obese have different metabolic patterns than do their nonobese counterparts in that they mobilize more protein and less fat. This process can make it difficult for

Table 1. Formula Composition

Overall Design	
Caloric density	1.0 kcal/mL
NPC:N ratio	43:1
Osmolality	345 mOsm/kg water
Macronutrient composition	
Protein	37% kcal
Whey peptides	100%
Carbohydrate	31%
Soluble fiber	4.4 g/L (FOS, inulin)
Fat	32%
MCT:LCT ratio	50:50
EPA + DHA	2.0 g/L

DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; FOS, fructo-oligosaccharides; LCT, long-chain triglycerides; MCT, medium-chain triglycerides; NPC:N, nonprotein kcalorie to nitrogen.

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Table 2. Comparing Protein Adequacy Among Formula Types[a]

	Standard			25% High Protein	37% High Protein
Formula	1.0 kcal/mL	1.5 kcal/mL	2.0 kcal/mL	1.0 kcal/mL	Bariatric
mL/h	72	48	36	72	72
Total calories	1728	1728	1728	1728	1728
Total protein, g	69	69	69	108	161
Protein balance, g	−93	−93	−93	−52	+1
Protein modular scoops (6 g) needed	16	16	16	9	0

[a]Female patient scenario: height, 5 feet 8 inches; weight, 397 lb (180 kg); body mass index, 60; ideal body weight, 136 lb (65 kg); calculated needs, 1750 kcal/d (ideal body weight, 25 kcal/kg); protein per day, 162 g (ideal body weight: protein, 2.5 g/kg).

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these patients to meet their protein needs unless they consume excess calories and carbohydrates, which can lead to hyperglycemia.

Dr McClave described the development of an industry-funded prospective observational study designed to evaluate the tolerance and safety of a liquid enteral formula developed especially for critically ill patients who are obese. The formula included 1.0 kcal/mL—37% calories from protein (as 100% whey hydrolysate) and 31% calories from carbohydrate—with the addition of medium-chain triglycerides, fish oil, and prebiotic fiber (Table 1). It was designed to meet previously established protein requirements for critically ill patients who are obese [McClave SA et al. *JPEN J Parenter Enteral Nutr.* 2009].

Twenty-nine patients from ICUs at 2 Kentucky hospitals were recruited for the study. Inclusion criteria were a body mass index (BMI) ≥ 30 and a need for enteral nutrition over at least 3 days. Because 13 patients were deemed ineligible, the analysis was completed on 16 patients. These 16 patients were split evenly between men and women, with a mean age of 50.9 years, a mean BMI of 38.8, and a mean Acute Physiology and Chronic Health Evaluation II score of 17.3. Of the 16 patients included in the analysis, 15 were ventilator dependent at the inception of the trial.

The patients received study formula for up to 10 days; by day 3, all patients had received 80% of their goal calories and 86% of their protein needs. Daily intake, tolerance, and safety data were collected and analyzed. Mean laboratory values were as follows: blood glucose, 142.8 mg/dL, with no episodes of hypoglycemia; blood urea nitrogen, 29.07 mg/dL; creatinine, 0.96 mg/dL; and ketones, 0.0 mg/dL.

Four patients experienced ≥ 3 liquid stools per day for partial duration of the study. No subjects had a gastric residual volume > 400 mL, and there were no episodes of vomiting. Only nitrogen balance results were conflicting and therefore discouraging, said Dr McClave; results could not be obtained for all patients, but positive nitrogen balance was recorded in 7 of the 16 patients and negative nitrogen balance in 3 of them.

Dr McClave presented data comparing this new formula with other enteral products currently available (Table 2) based on the nutrient needs for a female patient with a BMI of 60 and an ideal body weight of 136 lb. He concluded that this unique enteral formula was safe and well tolerated in critically ill patients with obesity. The design of this formula may facilitate improved glucose control and allow patients to achieve nitrogen balance without receiving excess calories.