

## Minimal Enteral Nutrition

**Satish Mishra, Ramesh Agarwal, M. Jeevasankar Ashok Deorari, Vinod K Paul**  
WHO Collaborating Centre for Training & Research in Newborn Care  
Division of Neonatology, Department of Pediatrics  
All India Institute of Medical Sciences  
Ansari Nagar, New Delhi –110029

**Address for correspondence:**

**Dr Ashok K Deorari**

Professor

Department of Pediatrics

All India Institute of Medical Sciences

Ansari Nagar, New Delhi 110029

Email: ashokdeorari\_56@hotmail.com

**Abstract**

Although parenteral nutrition has been used widely in the management of sick very low birth weight infants, a smooth transition to the enteral route is most desirable. Trophic feeding is the practice of feeding small volume of enteral feeds in order to stimulate the development of the immature gastrointestinal tract of the preterm infant. This practice has also been termed as minimal enteral nutrition (MEN). MEN improves gastrointestinal enzyme activity, hormone release, blood flow, motility and microbial flora. Clinical benefits include improved milk tolerance, greater postnatal growth, reduced systemic sepsis and shorter hospital stay. There is currently no evidence of any adverse effects following MEN.

MEN can be commenced in neonates on ventilation and total parenteral nutrition. A protocol of giving MEN has been presented here.

**Key words:** very low birth weight infant, minimal enteral nutrition, expressed breast milk

## **Introduction**

Because of concern that oral feedings might increase the risk of necrotizing enterocolitis (NEC), some high-risk infants have received prolonged period of total parenteral nutrition (TPN) without any enteral feedings. However, lack of enteral nutrients may diminish gastrointestinal functional and structural integrity by diminishing hormonal activity, growth of intestinal mucosa, lactase activity, nutrient absorption, or motor maturation. These problems may then compromise later feeding tolerance and growth, and thus prolong the hospital stay. The practice of providing minimal enteral nutrition (MEN) or trophic feedings (small volume feedings that provide minimal calories) for some period after birth was developed as a strategy to enhance the functional maturation of the gastrointestinal tract and to facilitate a smooth and rapid transition from parenteral to enteral nutrition .

### **Problems of delayed feeding**

In several animal species, absence of enteral nutrients is associated with diminished intestinal growth, atrophy of intestinal mucosa, delayed maturation of intestinal enzymes, and increase in permeability and bacterial translocation. A lack of enteral nutrients also affects intestinal motility, perfusion, and hormonal responses.<sup>1</sup> It is possible that a prolonged delay in starting feeds in preterm neonates may be partly responsible for the common problems of feed intolerance encountered in these newborns.

### **Minimal enteral nutrition (MEN)**

This is a practice wherein some minute volumes of feeds are given to the baby in order to stimulate the development of the immature gastrointestinal tract of the preterm infant. Studies have shown that neonates who were fed earlier with minimal feeds had

lower episodes of feeding intolerance and gained weight faster as compared to neonates who were fed late.<sup>2-4</sup>. These feeds are of small volume ranging from 10 to 15mL/Kg/day and not intended for providing adequate calories. Although MEN does not provide sufficient calories for growth, it is beneficial as it exerts a trophic effect on the gut mucosa.

### **Benefits of MEN**

Animal studies have shown a 2-3 fold increase in intestinal mucosa mass with early feeding. The trophic effect on intestinal mucosa may be mediated via various growth factors in human milk. These include insulin, epidermal growth factor and other peptides known to exert direct trophic effects. Premature infants receiving MEN had cumulative greater milk intake, which was associated with lower serum alkaline phosphatase activity.

<sup>5</sup> Intestinal motility pattern matures more rapidly in premature infants receiving early enteral feeding.<sup>4</sup> Investigators have demonstrated that trophic feeds were associated with greater absorption of calcium and phosphorus, greater lactase activity, and reduces intestinal permeability.

Besides the effect on intestinal mucosa, other beneficial responses to MEN include: (a) **motor effects:** which include better peristaltic activity and coordinated motor activity in response to feeding.

(b) **vascular effects:** which include post-prandial decrease in splanchnic vascular resistance. This decrease would be associated with an increase in intestinal blood flow and oxygen uptake in response to feeding. (c) **endocrine: effects** which include the significant increases in plasma concentrations of enteroglucagon, gastrin, and gastric-inhibiting polypeptide in preterm infants after milk feedings of as little as 12 mL/kg per

day. Similar surges in the trophic hormones were not seen in intravenously nourished infants.<sup>6</sup>

### **Clinical benefits of MEN**

Cochrane meta-analysis on studies evaluating the clinical effects of MEN done by Tyson et al has showed that, among infants given trophic feedings, there was an overall reduction in mean days to full feeding (weighted mean difference [WMD] = -2.6 days; number of days that feeding was withheld (WMD = -3.1 days; and total hospital stay (WMD = -11.4 days) compared to infants given no enteral nutrient intake<sup>7</sup>. There was no significant increase in the risk of necrotizing enterocolitis (relative risk = 1.16 [0.75, 1.79]). McClure et al have shown a reduction in episodes of culture confirmed sepsis and faster weight gain in babies receiving minimal enteral nutrition<sup>8</sup>. However, conclusive evidence in favor of MEN is not yet available due to the small size and number of studies on this issue. Nonetheless, due to obvious beneficial effects (Table 1), MEN has become a widely used practice in neonatal intensive care units.

### **Adverse effects of MEN**

There is currently no evidence of any adverse effects following MEN.<sup>9</sup>

### **Indications for MEN**

All preterm infants especially  $\leq 32$  weeks of gestation, in whom enteral feeding has not yet been started due to underlying illness, should be commenced on MEN..

### **Contraindications**

MEN should be avoided in infants with severe hemodynamic instability, suspected or confirmed NEC, evidence of intestinal obstruction/perforation or paralytic ileus.

Mechanical ventilation and/or use of umbilical catheters are not contraindications to using MEN.

### **Protocol for MEN**

MEN should be commenced after ensuring hemodynamic stability in preterm neonates. This is usually possible by day 2-3 in sick preterm neonates. However MEN may be started on the first day itself in hemodynamically stable neonates if no contraindications to feeding exist. *Expressed human breast milk is the preferred milk for MEN.* Commercial formulas are best avoided for MEN.<sup>10</sup> Recommended volume is 10-15 mL/kg/day. This should be divided into equal aliquots and administered by gavage feeding in a 3-6 hourly schedule. In preterm very low birth weight infants born with antenatal diagnosis of altered in umbilical arterial blood flow (reversed or absent end diastolic flow), MEN can possibly be delayed for 2 to 3 days. Advancement of feeds should also be slow and carefully monitored in these infants.

### **Monitoring**

The infant should be monitored for any evidence of feed intolerance including abdominal girth, gastric residuals or clinical signs of NEC. If the abdominal girth has increased by 2 cm, gastric residual volume (GRV) should be checked. Feeding should be stopped in the presence of significant aspirate (>25% of feed or >3mL whichever is more) and/ or bilious or blood stained aspirates.

**Progression to full feeds** As baby gains clinical stability, feeds are advanced at the rate of 20-30 mL/kg/day. Baby is monitored as mentioned above and volume of feeds increased gradually to full enteral feeds.

In view of profound clinical benefits routine practice of minimal enteral nutrition should be encouraged in developing countries using expressed breast milk for VLBW infants.

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**Table 1: Advantages of gastrointestinal priming with MEN<sup>1</sup>**

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1. Shortens time to regain birth weight
  2. Improves feeding tolerance
  3. Enhances enzyme maturation
  4. Improves gastrointestinal motility
  5. Improves mineral absorption, mineralization
  6. Lowers incidence of cholestasis

**Table 2: Protocol on minimal enteral nutrition (MEN)\***

***For whom***

All preterm infants especially those less than  $\leq 32$  weeks gestation, who are hemodynamically stable but cannot be given enteral feeds

***What to feed***

Preferably expressed breast milk (EBM)

***How much to feed***

EBM 8-12 mL/kg/day divided into 4-8 feeds given by gavage feeding

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***For < 1000g:*** 1-2mL every 4-6 hour; ***for > 1000 g:*** 2-3 ml every 2-4 hour;

\*Can be started while baby is on ventilator and /or receiving total parenteral nutrition

\*In severe birth asphyxia, MEN should be started after 48-72 hours

\*VLBW infants born with antenatal diagnosis of altered umbilical arterial blood flow (reversed or absent end diastolic flow), MEN can possibly be delayed for 2 to 3 days.