Feeding tubes and transition to ENFit™: creating science around infinite user variables

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Some of you raised concerns, we listened.....

Do ENFit based feeding tubes:

a. Have slower flows compared to legacy devices?

b. Clog more frequently than legacy devices?

c. Require more force than legacy devices?
Our project was performed in two phases

• Phase I – commercial diets representing > 70% of tube feeders

• Phase II – home based blenderized diets representing remaining tube feeders
Phase I – Commercial diets

• 8 brands of devices
  – 4 dangling legacy brands
  – 2 dangling ENFit brands
  – 1 low profile legacy brand
  – 1 low profile ENFit brand

• 4 sizes

• 7 diets
Phase I - Commercial diets we looked at

Viscosity (centiPoise) at 100 s$^{-1}$

- Water: 1.0, Thin, watery
- Phase I: 10.0, Thick but flows under gravity

Consumer suggested:
Is flow through ENFits slower? *Gravity fed*

**Findings:**
Large diversity in data, similar flow rates in most sizes, two exceptions.
Do ENFit clogs more frequently?

Viscosity (centiPoise) at 100 s⁻¹

1.0
10.0
100

Water
Thin, watery

Legacys 2/96 clogs
ENFits 2/96 clogs

Legacys 18/60 clogs
ENFits 9/36 clogs

Findings –
1. Clogging was rare.
2. ENFits don’t necessarily clog more frequently for commercial diets.
Is more force required for ENFit devices?
Real food blend – thick commercial blenderized diet

Finding: In general ENFit devices mostly required less or equal force compared to legacy devices.
Major takeaways for commercial diets

Do ENFit based devices:

a. Have slower flows compared to all legacy-s?

Generally 20 minute feed will take 14 – 30 minutes.

i. For a subgroup of 20, 24 Fr dangling tube users 20 minute feed may take 31 – 39 minutes.

ii. For a subgroup of 14 Fr dangling tube users 20 minute feed may take 40 – 80 minutes.

b. Clog more frequently compared to all legacy-s?

Clogging was similar in Legacy and ENFit.

c. Require more force

Most often, equal or less force.
Phase II – Home based blenderized diets

- "Looks like McDonald’s shake"
- Consistency – “just look, no magic formula"
- Blendtec 3 minutes
- Ninja 1 min.
- Vitamix 2.5 mins
- Handful of blueberries
- Smooth puree
- Any fruit in season
- Yogurt Consistency

Ninja 1 min.
Phase II – Home based blenderized diets

- Diets considered
  - 1 adult gravity feed
  - 1 pediatric gravity feed
  - 3 adult syringe push feed
  - 1 pediatric syringe push feed

- Bracketed study (not all devices were considered)
Phase II – Home based diets investigated

Viscosity (centiPoise) at 100 s⁻¹

<table>
<thead>
<tr>
<th>Phase</th>
<th>Visual Description</th>
<th>Viscosity (centiPoise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Milk-juice-hemp</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(Coffee-blueberries diet)</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>(Banana-yogurt-Chicken diet)</td>
<td>300</td>
</tr>
<tr>
<td>Phase II</td>
<td>(Enchilada diet)</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td>(Sirloin steak diet)</td>
<td>3000</td>
</tr>
</tbody>
</table>

Visual Description:
- Water
- Thin pancake
- McDonald’s shake
- Malt like
Home based diet: worst case for gravity

Viscosity (cP) at 100 s$^{-1}$

<table>
<thead>
<tr>
<th>Description</th>
<th>Viscosity (cP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>1.0</td>
</tr>
<tr>
<td>Thicker than malt</td>
<td></td>
</tr>
<tr>
<td>Thin pancake</td>
<td></td>
</tr>
<tr>
<td>(Enchilada diet)</td>
<td></td>
</tr>
<tr>
<td>(Banana-yogurt)</td>
<td>300</td>
</tr>
<tr>
<td>(Coffee-blueberries diet)</td>
<td>300</td>
</tr>
<tr>
<td>(Sirloin steak diet)</td>
<td></td>
</tr>
<tr>
<td>Worst case boundary (gravity)</td>
<td>3000</td>
</tr>
</tbody>
</table>

Worst case boundary (gravity): All devices clogging beyond this point.
Worst case diet testing for gravity feed - Coffee-strawberry-blueberry-oatmeal-walnut-honey - chocolate

Ninja, 1 minute blending
Thin pancake batter consistency

- Clogging occurs in both ENFit and Legacy devices
- Better blenders can eliminate clogging
- Legacy and ENFit low profiles are most prone to clogging
An additional option for this diet – pushing the same diet with force

<table>
<thead>
<tr>
<th></th>
<th>Legacy-s (60 mL volume)</th>
<th>ENFit-s (60 mL volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Ninja 1 minute 24 Fr</td>
<td>Clog 3/3</td>
<td>Clog 3/3</td>
</tr>
<tr>
<td>24 Fr, 5 s push</td>
<td>4 lbf</td>
<td>2 lbf</td>
</tr>
</tbody>
</table>

Findings:
- Clogging can be removed by pushing the diet
- Force for Legacy and ENFit was similar
If some gravity fed diets clog

Option 1 – If particulates cause clogging, then increasing blending time with existing blender.

Option 2 – Or, pushing with some force

Option 3 – Or, using higher end blenders and increased blending time.
Consumer diets: worst case for force

- **Worst case (for force) – extremely difficult to push beyond here.**
- **Worst case (gravity)**
- **Worst case (for force)**

### Viscosity (cP) at 100 s⁻¹

- **Water** (1.0)
- **Thin pancake**
- **Coffee-blueberry diet**
- **Banana-yogurt**
- **(Chicken diet)**
- **McDonald’s shake**
- **(Sirloin steak diet)**
- **(Enchilada diet)**

- **Thicker than malt**
Enchilada-blackbeans-Mexican rice diet

Findings - ENFit devices, in general, did not require more force than legacy-s.
Consumer diets: worst case for gravity and force

Worst case (for force) – extremely difficult to push beyond here.

Viscosity (cP) at 100 s⁻¹

Worst case (gravity)

Water

Thin pancake

Description

McDonald’s shake

Worse case (for force)

Thicker than malt

Thicker than malt

(Coffee-blueberries diet)

(Banana-yogurt)

(Chicken diet)

(Sirloin steak diet)

(Enchilada diet)

Worst case (gravity)
"Yogurt like consistency."
"Recipe works great with ENFit syringes and extensions"

- Low profile ENFit user.

“Opening the container lip it should look [like] smooth puree. Should pour out about like a McDonald’s shake and pours in a smooth flow not as thick as a malt which pours in globs.”

- Vitamix 1.5 minutes, 5 s push
- 24 Fr, dangling

Findings: ENFit force equal or less, flow rates findings consistent with commercial diets.
Major takeaways from commercial and patient diets

Do ENFit based devices:

a. Have slower flows compared to all legacy-s under gravity?
   Findings with home-based diets is consistent with commercial diets. Most 20 minute feeds may take 14 – 30 minutes (two exceptions). For a 20, 24 Fr subgroup may take 31 – 39 minutes. For a 14 Fr subgroup may take 40 – 80 minutes.

b. Clog more frequently compared to all legacy-s?
   – Occurred in both ENFit and Legacy.
   – High end blenders can address clogging.
   – Dangling ENFits were found to clog less often than low profile legacy-s and low profile ENFits.

c. Require more force?
   Most often ENFit devices require equal or less force.
Thank you