Dysglycaemia In Acute Patients With Nutritional Therapy

Diabetes-Specific Feeds

M. Karipidou (GR)
Dysglycaemia in acute patients with nutritional therapy

Diabetes specific feeds

Melina S. Karipidou, MSc
Clinical Dietitian Nutritionist
Harokopio University of Athens, Greece
School of Health Science & Education
Department of Nutrition & Dietetics

mkaripidou@nutridiet.gr
I have no relevant conflict of interest to disclose
To understand:
- the characteristics of diabetes specific formulas (DFs) and their differences with standard formulas (SF)
- the indications and benefits of their use
- the evidence behind this
- how to choose the most appropriate formula for the patient
Standard Formulas VS Diabetes formulas
## Standard Vs Diabetes Formulas

<table>
<thead>
<tr>
<th>Composition</th>
<th>Standard Formula</th>
<th>Diabetes Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of carbohydrate</td>
<td>Higher (&gt;50% TE*)</td>
<td>Lower (&lt;50% TE)</td>
</tr>
<tr>
<td>Type of carbohydrate</td>
<td>Simple</td>
<td>Complex slowly digestible blend</td>
</tr>
<tr>
<td>Glycemic load/index</td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Amount of fat</td>
<td>Lower (~30% TE)</td>
<td>Higher (&gt;30% TE)</td>
</tr>
<tr>
<td>Type of fat</td>
<td>LCT</td>
<td>MUFA, n-3</td>
</tr>
<tr>
<td>Amount of fiber</td>
<td>Low or no</td>
<td>Higher</td>
</tr>
<tr>
<td>Type of fiber</td>
<td>-</td>
<td>Soluble, prebiotic</td>
</tr>
<tr>
<td>Amount of protein</td>
<td>15-20%</td>
<td>15-25%</td>
</tr>
<tr>
<td>Type of protein</td>
<td>Milk</td>
<td>Soy</td>
</tr>
</tbody>
</table>

*TE: Total Energy
**Type of CHO**
SFs: Corn maltodextrin, corn syrup solids, short-chain fructo-oligosaccharides
DFs: Complex slowly digestible CHO blend: Non-hydrolyzed starches, modified maltodextrins, fructose, polyols (maltitol), slowly digested carbohydrates (isomaltulose, sucromalt)

**Type of fiber**
DFs contain high or exclusive proportion of fermentable (soluble) fibers, prebiotic, soy & oat fiber.
Controversial: the effect of the use of high fiber formulas in postprandial glycemic response

32nd ESPEN Congress in Nice

www.espen.org
Fructose
Controversial issue
+ Low GI (~19)
+ Sweetening power
- ↑ triglycerides
- ↑ LDL cholesterol

★ Some DFs contain ~20% of the total CHO intake
★ Other formulas do not contain fructose (recent formulas)

Elia et al. Diabetes Care 2005 Sep;28(9):2267

www.espen.org
Randomized, double blinded, crossover study
12 products
14 healthy volunteers
DFs had significant ($P=0.004$) lower GI (average ± SEM: 19.4±1.8) than standard formulas (42.1 ± 5.9)

Hofman et al.
Asia Pac J Clin Nutr, 2006; 15(3): 412
Increased percentage of MUFAs to the detriment of CHO
- ↓ postprandial glycemic response
- ↓ blood glucose levels & variability
- MUFA + n-3: + cardiovascular effects
- - Delayed gastric emptying
- - Greater volumes of formula

- DFs primarily contain soy protein vs milk casein
  Improve insulin sensitivity & fasting glucose concentrations

Shao et al. JPEN 2018 Jul; 42(5): 926
Recommendations
Based on this available evidence, the ESPEN expert group endorses the utilization of DFs for nutritional support of people with conditions such as diabetes, obesity or metabolic stress resulting from critical illness or surgery.

DFs have many of the following ingredients in common:

i. lower CHO content than SFs
ii. higher proportion of complex carbohydrates that are slowly digestible to reduce blood glucose spiking
iii. modified maltodextrin, starch, fructose, isomaltulose, and sucromalt, rather than the maltodextrin, starch, and sucrose found in SFs
iv. fat content enriched in unsaturated fatty acids, especially monounsaturated fatty acids, in higher proportion than in SFs
v. fiber content higher than in SFs
Additional randomized controlled studies are desirable to identify optimal formula composition.

Further studies should address the potential metabolic impact of higher utilization of lipid substrates for energy provision.
Evidence-based recommendations and expert consensus on enteral nutrition in the adult patient with DM or hyperglycemia

8 specialists in endocrinology, nutrition, dietetics
Spanish Society of Endocrinology and Nutrition (SEEN)
Spanish Society on Enteral & Parenteral Nutrition (SENPE)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Recommendation statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>In subjects with diabetes or stress hyperglycemia receiving artificial enteral nutritional support, the same goals of metabolic control than for the remaining people with diabetes should be applied</td>
<td>We suggest</td>
</tr>
<tr>
<td>Caloric intake provided by enteral nutrition in subjects with diabetes or stress hyperglycemia should be similar to that of patients without diabetes and with the same clinical condition</td>
<td>We suggest</td>
</tr>
<tr>
<td>The percentage of macronutrients for enteral nutrition in subjects with diabetes should be determined on the basis of an individualized assessment of metabolic goals and comorbidities</td>
<td>We suggest</td>
</tr>
<tr>
<td>Diabetes-specific enteral nutrition formulas specific should contain low glycemic index carbohydrates and a moderate or high percentage of monounsaturated fatty acids in relation to the total caloric value</td>
<td>We suggest</td>
</tr>
<tr>
<td>In natural or artificial (enteral) nutrition there is no evidence of benefits of supplementation with vitamins and minerals above requirements described for the general population</td>
<td>We cannot make a recommendation at this time</td>
</tr>
<tr>
<td>Formulas for diabetes should contain fiber, although its presence is not a determining factor for reducing of postprandial glycemia</td>
<td>We suggest</td>
</tr>
<tr>
<td>In mechanically-ventilated critically ill patients with diabetes or hyperglycemia, diabetes-specific hyperproteinic formulas rather than standard hyperproteinic formulas may be used, since these formulas besides improving metabolic control may reduce respiratory infectious complications</td>
<td>We suggest</td>
</tr>
<tr>
<td>In subjects with diabetes or stress hyperglycemia treated with enteral nutrition, the use of diabetes-specific formulas rather than standard formulas may be used because they facilitate the achievement of metabolic goals</td>
<td>We suggest</td>
</tr>
<tr>
<td>In patients with diabetic gastroparesis requiring enteral nutrition, the postpyloric route is the most adequate</td>
<td>We recommend</td>
</tr>
<tr>
<td>In hospitalized patients with hyperglycemia and enteral nutrition, insulin therapy with basal-bolus regimens may be used</td>
<td>We suggest</td>
</tr>
</tbody>
</table>

Sanz-Paris et al, Nutrition 2017 Sep; 41: 58-67

Only weak grade of recommendation was reached. Further research is needed to allow recommendations with higher levels of evidence. Despite the high incidence of DM and SH in patients who are candidates for enteral feeding, there are still many gaps of knowledge.
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.)

Question 3. Should diabetes-specific enteral formulas be used for hospitalized patients with hyperglycemia (Tables 6 and 7)?

Recommendation: We cannot make a recommendation at this time.

Grade: Further research needed

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.)

E1. Based on expert consensus, we suggest using a standard polymeric formula when initiating EN in the ICU setting. We suggest avoiding the routine use of all specialty formulas in critically ill patients in a MICU and disease-specific formulas in the SICU.
Evidence behind recommendations
Enteral Nutritional Support and Use of Diabetes-Specific Formulas for Patients With Diabetes

A systematic review and meta-analysis

Marinos Elia, MD, BSc (hons), FRCPEM	Meike Engler, PhD
Antonio Cerello, MD	Rebecca J. Stratton, BSc (hons), PhD.
Henor Laure, MD, PhD
Alan J. Sinclair, MD, PhD

OBJECTIVE — The aim of this systematic review was to determine the benefits of nutritional support in patients with type 1 or type 2 diabetes.

RESEARCH DESIGN AND METHODS — Studies utilizing an enteral nutritional support intervention (oral supplements or tube feeding) were identified using electronic databases and bibliographic searches. Comparisons of interest were nutritional support versus routine care and standard versus diabetes-specific formulas (containing high proportions of mono- or disaturated fatty acids, fructose, and fiber). Outcomes of interest were measures of glycemia and lipid status, medication requirements, nutritional status, quality of life, complications, and mortality. Meta-analyses were performed where possible.

RESULTS — A total of 23 studies (comprising 784 patients) of oral supplements (16 studies) and tube feeding (7 studies) were included in the review, and the majority compared diabetes-specific with standard formulas. Compared with standard formulas, diabetes-specific formulas significantly reduced postprandial rise in blood glucose (by 1.03 mmol/L [95% CI 0.58–1.47]; six randomized controlled trials [RCTs]); peak blood glucose concentration (by 1.59 mmol/L [86–2.32]; two RCTs), and glucose area under curve (by 7.96 mmol·l−1·min−1 [2.25–13.66]; four RCTs, i.e., by 35%) with no significant effect on HDL, total cholesterol, or triglyceride concentrations. In addition, individual studies reported a reduced requirement for insulin (26–71% lower) and fewer complications with diabetes-specific compared with standard nutritional formulas.

CONCLUSIONS — This systematic review shows that short- and long-term use of diabetes-specific formulas as oral supplements and tube feeds are associated with improved glycemic control compared with SF.

The impact of better glycemic control on long-term clinical outcome is well recognized in both type 1 (1) and type 2 (2) diabetes, where hyperglycemia may result in life-threatening complications and numerous comorbidities. In addition, many conditions, including accidental injury, stroke, and critical illness, show a worse outcome in the presence of hyperglycemia (3).

In the U.K., the costs associated with major hyperglycemic complications range from £372 (£1,256 or $1,607 for blindness in one eye) to £8,459 (£12,178 or $15,591 for amputation) per patient (4), and the U.S. has reported annual diabetes health care costs of $11,157 ($87,101 per patient) (5). This large economic burden is unsurprising given that patients with diabetes are known to be admitted to the hospital more often than other patient groups, accounting for up to 25% of intensive care admissions (3,6).

Many of these hospitalized patients will require nutritional support. In addition, an increasing number of patients receive long-term home enteral tube feeding (ETF), including those with diabetes (7).

Standard enteral (oral or tube) nutritional formulas are high in carbohydrate (mostly low-molecular weight sources), low in fat, and low in fiber. Standard formulas

Meta-analysis: 23 studies, 784 patients (19 RCTs, 3 CCTs, and 1 CT)
• 16: T2DM, 4: T1DM
• 16: Oral, 7: Tube
• 16: <24h, 7: 6 days – 3 months
Patients with T2DM on EN

3 studies compared DSF with SF

1 study compared slowly digested carbohydrate formula with DSF and standard formula

1 study compared DSF with 50% calories provided by fat and diabetes specific enteral formula with 34% calories provided by fat

DFs was more effective to patients with diabetes on enteral feed in controlling glucose profiles including postprandial glucose, HbA1c and insulimemic response.
Studies Limitations
Consist of small sample-size, high drop out rates.
Consist of single-meal investigations that did not examine clinical outcomes.
Conducted in outpatient settings, limiting their application to hospitalized patients.
The trials used glycemic or lipid control as their primary outcomes. They did not detect differences in morbidity and/or mortality.
The impact on glycemic and lipid control was inconclusive.
Studies Limitations

- Short-term duration
- Heterogeneous patient populations (combinations of DM1, DM2 versus stress induced hyperglycemia)
- Did not examine clinical outcomes (length of ICU stay, mechanical ventilation, mortality, infectious or digestive complications, or analytical data)
- Few studies of long-term EN treatment in diabetic patients and even fewer on hyperglycemic critically ill patients
Distinguish between:

- Patient groups: T1DM, T2DM, SH, Obesity/Metabolic syndrome
- Medical treatment: Oral antidiabetics and/or insulin
- Mode of feeding: Oral or tube, continuous or intermittent administration
- Setting: hospitalization, ICU setting, home

- Long term studies
- Other criteria: body weight (obesity, overweight, malnutrition, etc.), type of disease (neurological, oncological, critically ill disorders, etc.), presence or absence of gastroparesis.

Further research is needed in this area to allow recommendations with higher levels of evidence and grade of recommendation.
Although evidence of sufficient quality is not always available, most publications suggest the use of DFs, which facilitate the achievement of metabolic goals in the patient with hyperglycemia or DM.

More well designed and long term trials should be conducted.


Thank you very much!
Boat water reflection
Ithaca, Greece
*Shot: Nasos Kountourakis*